THE COMPLETE

DICTIONARY

OF

ARTS and SCIENCES.

IN WHICH THE WHOLE CIRCLE OF

HUMAN LEARNING

IS EXPLAINED.

And the DIFFICULTIES attending the Acquisition of EVERY ART, Whether LIBERAL or MECHANICAL, are Removed,

IN THE MOST EASY AND FAMILIAR MANNER.

Among the various Branches of LITERATURE explained in this WORK are the following, viz.

AGRICULTURE	ETHICS	HYDROGRAPHY	PAINTING
ALGEBRA	FLUXIONS	HYDROSTATICS	PERSPECTIVE
ANATOMY	FORTIFICATION	LAW	PHARMACY
ARCHITECTURE	GARDENING	LEVELLING	PHILOLOGY
ARITHMETIC	GAUGING	LOGIC	PHILOSOPHY
ASTRONOMY	GEOGRAPHY	MARITIME AND	PHYSIC
BOTANY	GEOMETRY	MILITARY AFFAIRS	PNEUMATICS
CATOPTRICS	GRAMMAR	MATHEMATICS	RHETORIC
CHEMISTRY	GUNNERY	MECHANICS	SCULPTURE
CHRONOLOGY	HANDICRAFTS	MERCHANDIZE	SERIES
COMMERCE	HERALDRY	METAPHYSICS	STATICS
CONICS	HISTORY	METEOROLOGY	STATUARY
COSMOGRAPHY	HORSEMANSHIP	MUSIC	SURGERY
DIALLING	HUSBANDRY	NAVIGATION	SURVEYING
DIOPTRICS	HYDRAULICS	OPTICS	THEOLOGY, &c.

The THEOLOGICAL, PHILOLOGICAL, and CRITICAL BRANCHES, by

The Rev. TEMPLE HENRY CROKER, A. M.

Chaplain to the Right Honourable the Earl of HILLSBOROUGH.

The MEDICINAL, ANATOMICAL, and CHEMICAL,

By THOMAS WILLIAMS, M. D.

The MATHEMATICAL

By SAMUEL CLARK,

Author of an Easy Introduction to the Theory and Practice of Mechanics.

AND THE OTHER PARTS BY

Several GENTLEMEN particularly conversant in the Arts or Sciences they have undertaken to explain.

VOL. II.

LONDON: Printed for the AUTHORS,

And Sold by J. WILSON & J. FELL, Pater-noster Row; J. FLETCHER & Co. St. Paul's Church-yard; J. COOTE, Pater-noster Row; Messr. FLETCHER & HODSON, Cambridge; and W. SMITH & Co. Dublin.

MDCCLXV.

BRITISH MUSEUM

THE COMPLETE DICTIONARY OF ARTS and SCIENCES.

EAG EAR

E, The ſecond vowel, and fifth letter of the alphabet. The letter E is moſt evidently derived from the old character ∃ in the ancient Hebrew and Phœnician alphabets, inverted by the Greeks to this poſition E, and not from the Hebrew He ה. From the ſame origin is alſo derived the Saxon *e*, which is the firſt letter in their alphabet that differs from the Latin one. It is formed by a narrower opening of the larynx than the letter A; but the other parts of the mouth are uſed nearly in the ſame manner as in that letter.

It has a long and ſhort ſound in moſt languages: the ſhort ſound is audible in *bed*, *fret*, *den*, and other words ending in conſonants: its long ſound is produced by a final *e*, or an *e* at the end of words, as in *glebe*, *here*, *hire*, *ſcene*, *ſphere*, *interfere*, *revere*, *ſincere*, &c. in moſt of which it ſounds like *ee*; as alſo in ſome others by coming after *i*, as in *believe*, *chief*, *grief*, *reprieve*, &c. and ſometimes this long ſound is expreſſed by *ee*, as in *bleed*, *beer*, *creed*, &c. Sometimes the final *e* is ſilent, and only ſerves to lengthen the ſound of the preceding vowel, as in *rag*, *rage*, *ſtag*, *ſtage*, *hug*, *huge*, &c. The ſound of *e* is obſcure in the following words, *oxen*, *heaven*, *bounden*, *fire*, *aire*, *maſſacre*, *maugre*, &c.

The Greeks have their long and ſhort *e*, which they call Epſilon and Eta. The French have at leaſt ſix kinds of *e*'s: the Latins have alſo a long and ſhort *e*; they alſo write *e* inſtead of *a*, as *dicem* for *dicam*, &c. and this is, no doubt, the reaſon why *a* is ſo often changed into *e*, in the præter tenſe, as, *ago*, *egi*; *facio*, *feci*, &c. E was alſo a numeral letter ſtanding for 250, according to the verſe,

E *quoque ducentos et quinquaginta tenebit.*

EAGLE, *Aquila*, in ornithology, the Engliſh name of ſeveral ſpecies of the falcon kind. See the article FALCON.

In heraldry, the eagle is accounted one of the moſt noble bearings in armoury, and according to the learned in this ſcience, ought to be given to none but ſuch as greatly excel in the virtues of generoſity and courage, or for having done ſingular ſervices to their ſovereigns; in which caſes they may be allowed a whole eagle, or an eagle naiſſant, or only the head or other parts thereof, as may be moſt agreeable to their exploits.

Among the ancients, the eagle was held ſacred to Jupiter, and on that account placed on his ſcepter. Philoſtratus, in his Themiſtocles, ſays, the Medes and Lacedæmonians took it for their enſign of royalty: and it is well known that the Romans had the greateſt reſpect for it, looking upon it as the taliſman of their ſtate, and taking it for their principal enſign. It was either of gold or ſilver, borne ſingle on the point of a pike, till the time of Conſtantine, when the empire being divided into the eaſtern and weſtern, the eagle was afterwards repreſented with two heads.

EAGLE, *Aquila*, in aſtronomy. See AQUILA.

EAGLE, in architecture, a figure of that bird anciently uſed as an attribute of Jupiter, in the capitals and friezes of the columns of the temples conſecrated to that god.

EAGLE-STONE, *Ætites*, in natural hiſtory. See the article ÆTITES.

Black EAGLE, an order of knighthood, inſtituted by the elector of Brandenburgh, in 1701, on his being crowned king of Pruſſia.

The knights of this order wear an orange-coloured ribbon, ſuſpending a black eagle.

White EAGLE, a like order in Poland, inſtituted in 1325, by Uladiſlaus V. on occaſion of the marriage of his ſon Caſimir to the daughter of the great duke of Lithuania.

The knights of this order wear a chain of gold, ſuſpending a ſilver eagle, crowned.

White EAGLE is alſo a term uſed by chemiſts for mercurius dulcis.

EAGLET, a diminutive of eagle, properly ſignifying a young eagle. In heraldry, when there are ſeveral eagles on the ſame eſcutcheon, they are termed eaglets.

EALDERMAN, or EALDORMAN, the ſame with alderman. See ALDERMAN.

EAR, *Auris*, in anatomy, the organ of hearing.

Anatomiſts generally diſtinguiſh the ear into external and internal; the greateſt part of the external ear conſiſts of

of a large cartilage, which is the baſis of all the other parts. There are two portions, the one large and ſolid, called pinna, which is the ſuperior part; the other ſmall and ſoft, called the lobe, which makes the lower part. We may likewiſe conſider two ſides in the outward ear, one turned obliquely forward, and irregularly concave; the other turned obliquely backward, and unequally convex; the foreſide is divided into four eminences and as many cavities; the firſt eminence is in the helix, which is the large folded border, or circumference of the great portion of the ear: the ſecond is the anthelix, which is the large oblong eminence ſurrounded by the helix: the third is the tragus, which is the ſmall anterior protuberance below the anterior extremity of the helix: the fourth is the antitragus, which is the poſterior tubercle below the inferior extremity of the anthelix.

The firſt cavity is the hollow of the helix; the ſecond is the depreſſion at the ſuperior extremity of the anthelix, called foſſa navicularis; the third is the concha, or great double cavity, that lies under the anthelix, the upper bottom of which is divided from the lower by a continuation of the helix, like a tranverſe criſta; and, laſtly, the meatus of the external ear at the bottom of the concha.

The backſide of the ear has only one conſiderable eminence, which is a portion of the convex ſide of the concha, the other portion being hid by the adheſion of the ear to the os temporis.

The external ear is fixed to the cranium by muſcles, or rather ligaments. The ſkin is a continuation of that which covers the neighbouring parts of the temporal region. The arteries of the external ear come anteriorly from the arteria temporalis, and poſteriorly from the occipitalis. The veins are branches of the jugularis externa. The portio dura of the auditory nerve gives off a branch which runs up behind the ear, to the backſide of which it ſends ſeveral filaments; and the trunk of the branch ſends likewiſe filaments to the meatus and foreſide of the ear. The ſecond vertebral pair ſends alſo a branch to the ear, the ramifications of which communicate with thoſe of the other.

The internal ear conſiſts chiefly of ſeveral bony pieces, which may be divided into four general parts; the external meatus auditorius; the tympanum, or barrel of the ear; the labyrinth; and the internal meatus auditorius; or it may be divided into immoveable or containing parts, which take in all the four already mentioned; and moveable or contained parts, which are four little bones lodged in the tympanum, called incus, malleus, ſtapes, and os orbiculare, or lenticulare.

The external auditory paſſage is about half an inch in length, running obliquely from behind forward: its cavity is almoſt oval, wider at the entry than at the middle, after which it widens again by degrees: it terminates inwardly by an even circular edge, the upper part being outward, and the lower part inward. The concave ſide of this edge is grooved quite round.

The tympanum is an irregularly hemiſpherical cavity, the bottom of it being turned inward, and the mouth joined to the circular groove. It has three remarkable eminences; the firſt is a large tuberoſity lying in the very bottom of the barrel; a ſmall irregular pyramid ſituated about the tuberoſity, the apex of which is perforated, and on one ſide of the baſis two ſmall bony filaments are often found parallel. In the third eminence is a cavity ſhaped like the mouth of a ſpoon, ſituated a little towards the anterior part of the bottom of the barrel; and at a very ſmall diſtance from its point is a little bony ridge. The principal cavities in the tympanum are the opening of the maſtoid cells, the opening of the Euſtachian tube, the bony half-canal, the feneſtra ovalis and rotunda, and the ſmall hole in the pyramid.

The incus or anvil may be divided into body and branches; the body is a large ſubſtance turned forward; the branches are two; one long turned downward, the other ſhort turned backward. The malleus is a long bone with a large head, a ſmall neck, and two apophyſes, one in the neck, the other in the handle. The ſtapes is a ſmall bone, ſo denominated from its reſemblance to a ſtirrup; it is divided into the head, legs, and baſis. The orbicular or lenticular bone lies between the head of the ſtapes and extremity of the long leg of the incus, being articulated with each of theſe.

The labyrinth is divided into three parts; the anterior, called cochlea; the middle, termed veſtibulum; and the poſterior; the labyrinth, in particular, comprehends the three ſemi-circular canals: the cochlea is a ſort of ſpiral ſhell, with two ducts, formed in the anterior part of the apophyſis petroſa, like the ſhell of a ſnail. The parts to be diſtinguiſhed in it are the baſis, the apex, the ſpiral lamina, or half-ſeptum, by which its cavity is divided into two half-canals, the ſpindle round which the cochlea turns, and, laſtly, the orifice and union of the two ducts. The veſtibulum is an irregularly round cavity, leſs than the tympanum, and ſituated more inward, and a little more forward. The ſemi-circular canals are three in number; one vertical and ſuperior; one vertical and poſterior; and one horizontal.

The internal auditory hole is the backſide of the apophyſis petroſa, in ſome meaſure behind the veſtibulum and baſis of the cochlea. It is a kind of blind hole, divided into two foſſulæ; one large, the other ſmall. The large one lies loweſt, and ſerves for the portio mollis of the auditory nerve: the ſmall one is uppermoſt, and is the opening of a ſmall duct, through which the portio dura of the ſame nerve paſſes. To this latter duct Fallopius gave the name of aqueduct.

The other parts of the ear are principally the membrana tympani, the perioſteum of the barrel, the membrana maſtoidæa interna, the muſcles of the officula, the parts which complete the formation of the Euſtachian tube, the arteries, veins, and nerves.

To begin with the Euſtachian tube, otherwiſe called ductus auris palatinus, and in France generally the aqueduct, which is not to be confounded with the aquæductus Fallopii: this duct reaches from the cavity of the barrel to the root of the internal ala of the apophyſis pterygoides; it is made up of two portions, one entirely bony, and the other partly bony, partly cartilaginous, and partly membranous. The Euſtachian tube is furniſhed with three muſcles, according to Valſalva; the pterygoſtaphylinus, the ſphenopterygopalatinus, and the palatoſalpingæus, ſince called by ſome, muſculus tubæ novus Valſalvæ; its uſe is to dilate and keep open this channel, as Valſalva firſt has moſt ingeniouſly obſerved.

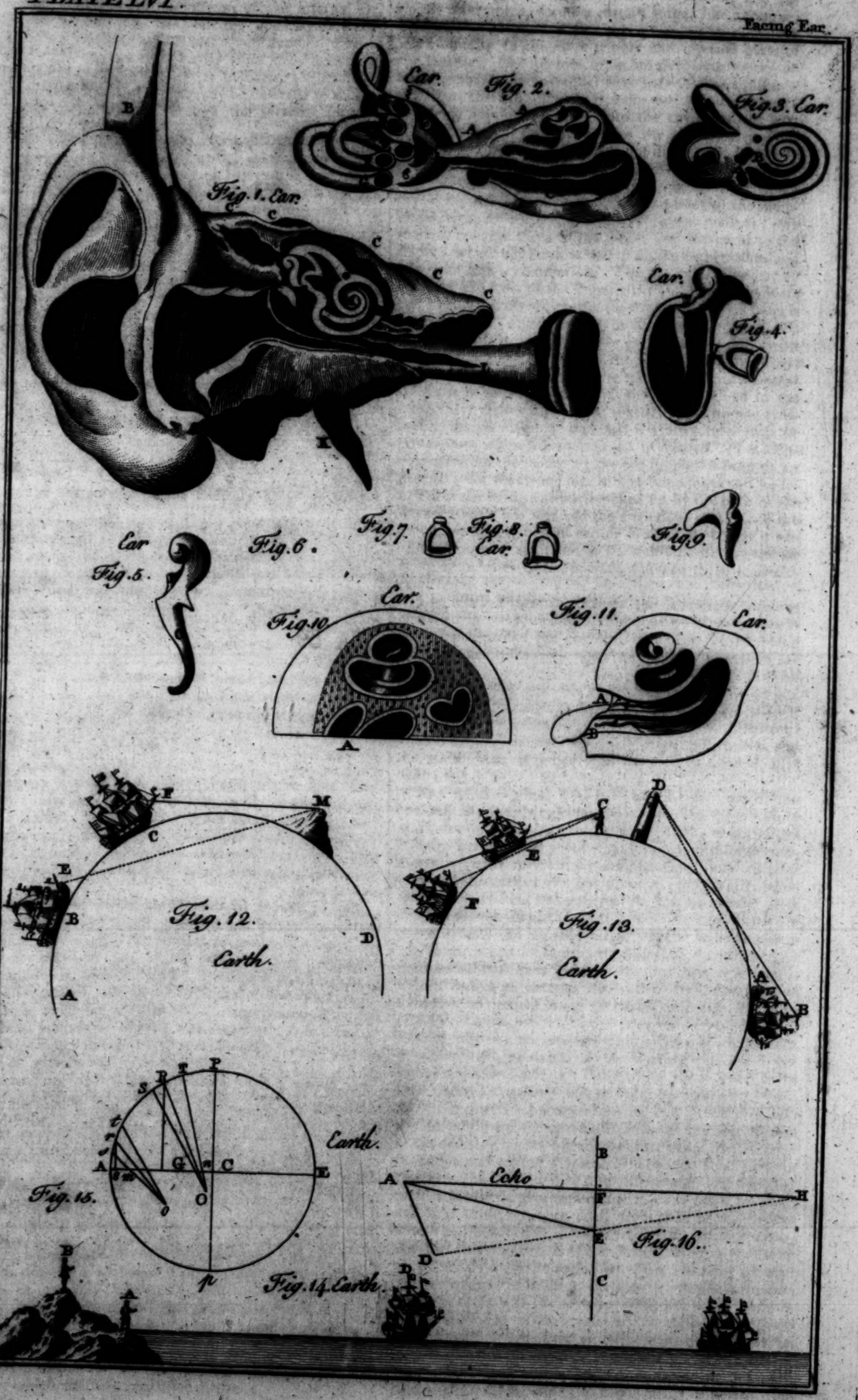
The membrana tympani is a thin, tranſparent, flattiſh pellicle, whoſe edge is round, and ſtrongly fixed in the orbicular tube. The perioſteum of the tympanum produces that of the ſmall bones; it is likewiſe continued over the two feneſtræ, and enters the Euſtachian tube. The cellulæ maſtoidææ are very irregular cavities in the ſubſtance of the maſtoid apophyſis, which communicate with each other, and have a common opening towards the inſide, and a little above the poſterior edge of the orbicular groove.

The ligaments of the officula come next in order: the incus is tied by a ſtrong ſhort ligament fixed in the point of the ſhort branch to the edge of the maſtoid opening. Between the incus and malleus we find a ſmall ſhort cartilage. The malleus is connected through the whole length of its handle, to the inſide of the membrana tympani. The malleus has three muſcles; one external, attributed to Caſſerius, and mentioned by Fabricius ab Aquapendente, is a thin faſciculus of fleſhy fibres, lying along the upper-part of the meatus auditorius, between the perioſteum and other integuments. The ſecond muſcle of the malleus is the anterior, called by Du Verney the external; it is fleſhy, long, and thin. It adheres very cloſely throughout to the Euſtachian tube; it is partly accompanied by a nerve which forms what is called the chorda tympani.

The third muſcle of the malleus is internal; it is very fleſhy and diſtinct, lying partly on the cartilaginous, and partly on the bony portion of the Euſtachian tube, and fixed by one extremity in the apophyſis petroſa; afterwards it runs along the cavity of the bony half-canal of the tympanum, where it is inveſted by a portion of the membranous or ligamentary vagina. The muſcle of the ſtapes is ſhort and thick, and lies concealed within the ſmall bony pyramid at the bottom of the tympanum. The three parts of the labyrinth are lined by a fine perioſteum, which is continued over all the ſides of their cavities,

PLATE LVI.

Facing Ear.



5 1A 59

and ſhuts the two feneſtræ of their tympanum. Through the whole extent of the perioſteum of the internal ear, eſpecially the officula, ſemi-circular canals, and half-canals of the cochlea, we diſcover a vaſt number of blood veſſels. The arteries come partly from the internal carotid, and partly from the arteria baſilaris, the ſmall capillary ramifications of which may be obſerved to accompany the auditory nerve through the internal foramen auditorium. *Winſlow.*

In order to render the foregoing deſcription of this organ the eaſier to be conceived, we have added a perſpective view of its ſeveral parts in plate LVI. where *fig.* 1. repreſents a general plan of the organ ſomewhat bigger than nature, from Le Cat. A, the external ear. B, the thin or ſquamous part of the temporal bone. C, C, C, &c. the os petroſum. D, ſemi-lunar canals. E, the maſtoid, or mamillary ſinus. F, the paſſage from the external to the internal ear. G, the ſmall bones, as the malleus, incus, and ſtapes. H, the tympanum. I, the extremity of the maſtoid proceſs. K, the ſtyloid proceſs. L, the Euſtachian tube. M, the cochlea. N, the canal of the hard portion of the auditory nerve.

Fig. 2. The labyrinth, &c. ſeveral times bigger than nature, from Du Verney. A, A, the cochlea. B, the cochlea opening into the veſtibulum. C, the cochlea opening into the tympanum. D, the veſtibulum. E, E, E, the poſterior three ſemilunar canals. F, the middle canal. G, the anterior canal. *e*, *e*, openings where the ſoft portion of the auditory nerve enters the veſtibulum.

Fig. 3. The cochlea, from Le Cat, almoſt as large again as the life. A, the ſpiral canal of the cochlea, leading to the tympanum. B, a ſpiral canal, leading to the veſtibulum.

Fig. 4. The ſmall bones of the ear, articulated with one another in their proper ſituation with the membrane of the tympanum.

Fig. 5. The malleus. A, its head. B, its neck. C, its handle.

Fig. 6. The os orbiculare.

Fig. 7. The inferior part of the ſtapes.

Fig. 8. The ſuperior back part of the ſtapes.

Fig. 9. The inner face of the incus.

Fig. 10. A ſection of the cochlea, comprehending the foramen of the auditory nerve. A, the double bottom of the internal auditory foramen.

Fig. 11. A ſection of the cochlea with the blood veſſels, the membraneous part of the ſpiral lamina being deſtroyed, except at the top; from Caſſebohm. A, the ſpiral winding of the cochlea, leading to the veſtibulum. B, the ſpiral canal, leading to the tympanum.

As to the uſes of the different parts of the ear, Du Verney tells us, that we may juſtly conſider the external ear as a kind of natural horn, the clean and ſmooth cavity of which ſerves to collect ſounds, and conſequently render their impreſſion on the other organs of hearing ſtronger. Some are of opinion that the direct lines of ſound, whilſt inſinuating themſelves into the ſinuſes of the ear, are there ſeveral times reflected, before they reach the concha; and that theſe ſinuſes and repeated reflections ſerve to augment the impreſſion. The motion of the muſcles of the external ear is a matter attended with a good deal of obſcurity; but yet it ſeems probable that the concha muſt, by their action, be either contracted or dilated, according to the impetus or faintneſs of the tremulous motions of the air. The meatus of the ear, by redoubling the reflexions, renders the vibrations more briſk; and the obliquity of its ſtructure not only guards the membrana tympani againſt the injuries of the air, but is alſo the reaſon why the ſurface of the meatus itſelf is larger than it would otherwiſe be. That ſpecies of wax, in the cartilaginous part of the meatus, retains any extraneous ſubſtances, or inſects, which might poſſibly convey themſelves into the ear, and injure the membrana tympani: but nevertheleſs it is often productive of great inconveniences; for, unleſs the ear were frequently cleanſed, this viſcid ſubſtance would be accumulated in too large a quantity, and at laſt hinder the tremulous motions of the air from reaching the membrana tympani; from which deafneſs very often happens.

The cartilaginous meatus, which is winding and variouſly interrupted, forms a certain ridge, like a tongue, before the concha. This ridge propels the reflexions more directly to the more remote and internal parts of the meatus. The nervous branches diſtributed upon the cartilaginous meatus render that part of ſo exquiſite a ſenſation, that we inſtantly feel the moſt minute extraneous body inſinuating itſelf into the cavity of the ear. The membrana tympani receives the various tremulous motions of the air, and, when not diſordered, faithfully conveys them to the other parts of the internal ear; but it performs theſe functions in conſequence of its being dry, thin, and diaphanous. The agitations of the membrana tympani are communicated to the malleus; the malleus conveys them to the incus, and the incus to the ſtapes; whoſe agitation at laſt puts the os petroſum and labyrinth into a commotion. The muſculus ſtapedis, by drawing the baſis of the ſtapes a little outwards, renders the pellicle, with which the ſuperior part of this baſis is covered, tenſe; and according as it renders it more or leſs ſo, it gives it a proportionably greater or leſs diſpoſition for receiving the tremulous motions of the membrana tympani. On the ſides of the tympanum are two meatuſes; it is not improbable that the air contained in the tympanum retires into theſe, when the membrana tympani is drawn inwards; and that it again returns into the tympanum, when this membrane is relaxed. The conveyance from the palate to the ear ſupplies a fund of air neceſſary for renewing that in the tympanum. The feneſtra ovalis being entirely blocked up by the baſis of the ſtapes, after it has received the tremulous motions of the other two bones, and of the air in the tympanum, it can eaſily communicate them to the veſtibulum, and the air in it, and thence to the cochlea and the three ſemi-circular ducts.

The feneſtra rotunda receives the tremulous motions of the air in the tympanum, and conveys them to that in the inferior part of the cochlea, in which the air being ſtrongly compreſſed, for want of an exit, is excellently calculated for putting the lamina ſpiralis into commotions; and thus the tremulous motions of the air are conveyed to the immediate organ of hearing itſelf; which is comprehended under the general name labyrinth, which conſiſts of two principal parts, the cochlea and the veſtibulum, together with their three ſemi-circular ducts.

The ſpiral lamina, which is a principal part of the cochlea, is not only calculated for receiving the vibratory motions of the air, but its ſtructure ought to be looked upon as a convincing proof, that it is qualified for accommodating itſelf to all their different modifications; for ſince it is broader at the beginning of its firſt circumvolution, than at the extremity of its laſt, its broader parts are adapted to languid vibrations, which are productive of grave tones; and *vice verſa*, that, when its narrow parts are ſtruck, their vibrations are lively, and conſequently produce acute ſounds: ſuch is the ſtructure of the veſtibulum and ſemi-circular ducts that the impreſſion of ſounds is heightened in their winding meanders, and conſequently better qualified for putting the nerves, diſperſed in theſe places, into a commotion. Each of theſe ducts reſembles two trumpets, whoſe narrow extremities are joined together; and the ſame thing holds good as to theſe ducts, as has been ſaid of the ſpiral lamina.

The connection between hearing and ſpeech is uſually accounted for by the communication of the ſoft portion of the auditory nerve, with thoſe branches of the fifth pair of nerves, which are diſtributed to the parts deſtined for the formation of the voice: for this reaſon it is ſaid that men and birds can mutually incite each other to ſing; and that thoſe who are deaf, from their birth, muſt of courſe be likewiſe dumb. Anatomiſts are alſo of opinion, that the communication of the ſecond vertebral pair with the external ear, is the reaſon why, upon hearing the leaſt noiſe, we turn our heads to the quarter whence it comes; and why the whole of the body is diſpoſed to various motions, according as the cauſes of the noiſe are imagined to be hurtful or beneficial to itſelf; and ſince theſe nerves communicate with thoſe of the lungs and heart, we become ſenſible of proportionable alterations in our pulſe and reſpiration, according to the diverſity of noiſes. But

all are not agreed, with regard to the effects of theſe different communications.

EAR, among gardeners, a name given to the leaves that firſt appear from the ſeed, which differ conſiderably from other leaves.

EAR-WIG, *Forficula*, in zoology. See the article FORFICULA.

EARL, a Britiſh title of nobility, next below a marquis, and above a viſcount. Earls were anciently called comites, becauſe they were wont *comitari regem*, to wait upon the king for counſel and advice.

EARL *Marſhal of England*, is a great officer who had anciently ſeveral courts under his juriſdiction, as the court of chivalry, and the court of honour. Under him is alſo the herald's office or college of arms. He hath ſome pre-eminence in the court of Marſhalſea, where he may ſit in judgment againſt thoſe who offend within the verge of the king's court. This office is of great antiquity in England, and anciently of greater power than now; and has been for ſeveral ages hereditary in the moſt noble family of Howard.

EARNEST, *Antiæ*, money advanced to bind the parties to the performance of a verbal bargain. By the civil law, he who recedes from his bargain loſes his earneſt; and if the perſon who received the earneſt give back, he is to return the earneſt double. But with us, the perſon who gave it is, in ſtrictneſs, obliged to abide by his bargain; and in caſe he decline it, is not diſcharged upon forfeiting his earneſt, but may be ſued for the whole money ſtipulated.

EARTH, in geography, this terraqueous globe whereon we live, conſiſting of land and water.

That the earth is nearly ſpherical may be ſhewn by the following obſervations. 1. When we are at ſea on board a ſhip, we may be out of ſight of land, when the land is near enough to be viſible, if it were not hid from our eye by the convexity of the water; thus let ABCD (plate LVI. *fig.* 12.) repreſent part of the globe of the earth; let M be the top of a mountain; this cannot be ſeen by a perſon on board a ſhip at B, becauſe a line drawn from M to his eye at E is intercepted by the convexity of the water: but let the ſhip come to C, and then the mountain will be viſible, becauſe a line may be drawn from M to his eye at F. 2. The higher the eye is, the farther will the view be extended: it is very common for ſailors from the top of the maſt of a ſhip to diſcover land or ſhips at a greater diſtance than they can do when they ſtand upon deck: thus (*fig.*13.) the top of the tower D may be ſeen from B, the top of the maſt, when it cannot be ſeen from A, by reaſon of its being hid by the convexity of the water. 3. When we ſtand upon the ſhore, the higheſt part of a ſhip is viſible at the greateſt diſtance: if a ſhip is going from us out to ſea, we ſhall continue to ſee the maſt, after the hull or body of the ſhip diſappears, and the top of the maſt will continue to be ſeen longeſt; if a ſhip be coming towards us, the top of the maſt comes firſt into view, and we ſee more and more of it, till at laſt the hull appears: thus let the eye be at C, when a ſhip is as far off as at F, only the top of the maſt is viſible, the hull is hid behind the water; when the ſhip is nearer, as at E, the hull may alſo then be ſeen. If the ſurface of the ſea were a flat, (*fig.*14.) a line might be drawn from any object ſituated upon it, as the ſhip D, to the eye, whether placed high or low, at A or B: in this caſe, any object upon the earth or ſea would be viſible at any diſtance which was not ſo great as to make the appearance of it too faint, or the angle under which it appears too ſmall, to be ſeen by us: an object would be viſible at the ſame diſtance, whether the eye were high or low: not the higheſt but the largeſt objects would be viſible to the greateſt diſtance, ſo that we ſhould be able to ſee the hull of a ſhip further off than the maſt: all which is contrary to experience. 4. The convexity of the water may be ſeen upon any ſtill water, as upon a river which is extended in a ſtraight line, a mile or two in length; a little boat upon the water may be ſeen, at a mile diſtance, by a man whoſe eye is any height above the water: but if he ſtoops down and lays his eye near the water, he will find the ſurface thereof riſing up in ſuch a manner as to cover the boat, and intercept his view of it. 5. Several navigators have ſailed quite round the globe; not in an exact circle, for this the winding of the ſhores, the land running out in many places into the ſea, would not admit of; but going in and out, as the ſhores happen to lie, they have held on the ſame courſe, and come home on a different ſide from that they firſt ſet out from: thus, Ferdinand Magellan, ſetting out on the weſt-ſide of Spain, continued ſailing weſtward till he returned home on the eaſt-ſide of Spain; our Sir Francis Drake, Capt. Dampier, Lord Anſon, and others, have done the like; the courſe they have ſome of them run is marked upon ſeveral maps and globes: theſe proofs are ſufficient to evince the roundneſs of the water. That the earth is alſo round is evident, if we conſider that the ocean is diffuſed all over the globe, ſo as to divide the earth as it were into large iſlands; and that the ſurface of the earth is not very much higher than the ſea, is evident from the courſe of rivers, which at a moderate eſtimate are computed to have not above one mile fall in running a thouſand miles, and have their ſhores pretty much of the ſame height; as alſo from the height of mountains, which are none of them found to be above three or four miles higher than the ſurface of the ſea: theſe experiments prove the earth and ſea to have a convex ſurface every-where. 6. All the appearances of the heaven, both at land and ſea, are the ſame as they would be if the earth were a globe, which proves it to be of that ſhape; and laſtly in eclipſes of the moon, which are cauſed by the ſhadow of the earth falling upon the moon, as will appear under the aricle ECLIPSE. This ſhadow is always circular, whatever ſituation the earth is in at that time: now a body can be no other than a globe, which in all ſituations caſts a circular ſhadow: it is true the ſurface of the earth is not an exact geometrical globe, becauſe it ſinks into vallies in ſome places, and riſes into mountains in others; but theſe inequalities upon its ſurface are as inconſiderable, when compared with the magnitude of the earth, as the little aſperities upon the rind of an orange are to the bulk of the orange; and accordingly we find that mountains and vallies upon the ſurface of the earth cauſe no irregularities in its ſhadow, in a lunar eclipſe, but the circumference thereof is even and regular, as if it were caſt by a body exactly globular: the diameter of the earth is about 8000 Engliſh miles; the higheſt mountain is not four miles higher than the ſurface of the ſea, which is about a 2000th part of the earth's diameter: thus it appears that the higheſt mountain bears no greater proportion to the bulk of the earth than a grain of duſt does to a common globe.

But, though the earth be ſpherical, yet it is not a true ſphere, but an oblate ſpheroid, flatted towards the poles; that is, the axis of the earth is not ſo long as the diameter of the equator. This was diſcovered by the following accident:

In 1672, M. Richer, going to Cayenne, in order to make aſtronomical obſervations, found, that his pendulum clock, which at Paris had been regulated to the mean motion of the ſun, when carried to this iſland, which is about five degrees diſtant from the equator, loſt every day two minutes and twenty-eight ſeconds. At his return he reported this experiment, and, as it ſeemed to be of ſome importance, it immediately engaged the attention of the greateſt mathematicans.

But they preſently preceived that the ſlowneſs of the pendulum muſt proceed from a diminution of the preſſure of gravity; and, conſequently, that the preſſure of gravity was leſs at Cayenne than at Paris: for, when a pendulum of a clock departs in its motion from the perpendicular, the force which cauſes it to return is gravity; whence it follows, that the greater the degree of gravity is, the quicker its motion will be, and *vice verſa*: and, as the motion of the pendulum was ſlower at Cayenne than at Paris, the preſſure of gravity muſt be leſs. Indeed, in warm climates all rods of metal will lengthen, whence the rod of the pendulum muſt be ſomewhat longer at Cayenne than at Paris; and, conſequently, its oſcillations ſlower. But as we know in what proportion heat will lengthen pendulums, and, conſequently, how much it retards their motion, we are ſatisfied that the heats of Cayenne are not ſufficient to ſolve this phænomenon; but it muſt, in general, flow from a diminution in the preſſure of gravity.

But from whence could proceed the cauſe of this diminution of gravity? Undoubtedly from this: every body, or particle of matter, that deſcribes a circle round a center, makes a continual effort to recede from that center. It is this force that ſtrains a ſling with a ſtone in it, while you whirl it round, and were its force ſtrong enough, would even break the ſling; this effort is called the centrifugal force; to this all revolving bodies are ſubject, and if they perform their revolution in the ſame time, it is proportional to the greatneſs of the circle they deſcribe.

Now, ſince the earth revolves round its own axis in twenty-four hours, all the bodies or particles of matter which compoſe it will deſcribe circles; and conſequently each will, more or leſs, partake of this centrifugal force, in proportion to the circle it deſcribes. And, becauſe the particles under the equator deſcribe the greateſt circle, therefore they will have the greateſt degree of centrifugal force; and the nearer the poles a particle is ſituated, the leſs will be its degree of centrifugal force; becauſe the circle it deſcribes will be ſmaller. The whole effect of this force tends to make bodies recede from the center of the circles they deſcribe, and a part of it is oppoſite to that of gravity, whoſe force every-where impels bodies towards the center of the earth. This part of the centrifugal force continually increaſes the nearer you approach to the equator, becauſe under the circle, not only the centrifugal force is directly contrary to that of gravity, but alſo the circles deſcribed by the revolving bodies are there the greateſt. The great Sir Iſaac Newton and M. Huygins carried their calculations ſo far as to compare the quantity of the centrifugal force with gravity, and found that under the equator it was $= \frac{1}{289}$ part of gravity; that is, a body under the equator loſt the 289th part of its weight: then, conſidering that the waters of the ſea are in æquilibrio all over the earth, and ſuppoſing the earth to be formed of a homogeneous and fluid matter, or that had originally been ſo, they undertook to determine its figure by the laws of hydroſtratics.

That this fluid matter might be at reſt, and the waters continue equal on each ſide, the weight of a column of water, continued from the center to the equator, muſt of conſequence be equal to that of a column of water continued from the center to the pole; for otherwiſe they would not continue in æquilibrio; but, as the matter which formed the column continued from the center to the equator, was rendered lighter by the centrifugal force than that which compoſed the column which was continued from the center of the pole; it follows that the column at the equator muſt be longer than at the poles, and conſequently the earth is flattened at the poles.

This theory was greatly confirmed by the figure of the planet Jupiter; for as this planet is much greater than the earth, his diameter being 81155 miles, whereas the earth's is only 7964 miles; and as the revolution of this planet about its own axis is performed in 9 hours, 56 min. it follows, that the equatorial parts of his ſurface muſt have a prodigious velocity, which muſt conſequently cauſe him to be a ſpheroidical figure. Accordingly the ingenious Mr. Pound diſcovered that the axis of the equator was to that of the poles, as 12 to 13.

Here the queſtion might have reſted, and had probably never been accurately ſolved, had it not been for the oppoſition it met with from M. Caſſini, though he afterwards ingeniouſly owned his miſtake. This gentleman, having meaſured the meridian of France from Dunkirk to Colliours, in Rouſſillon, declared, contrary to the opinion of all the mathematicians, that the earth, inſtead of being flattened, was lengthened towards the poles; that is, inſtead of being an oblate, it was a prolate ſpheroid, higher at the poles by about 95 miles. Sir Iſaac Newton remonſtrated, that, if this was the figure of the earth, bodies muſt be lighter, and a pendulum longer at the equator than in France, about half an inch; and that the diameter of the earth's ſhadow from ſouth to north muſt exceed its diameter from eaſt to weſt by 2 min. 46 ſec. a twelfth part of the moon's diameter; all which was manifeſtly contrary to fact and obſervation: but even this from ſo great a man could not intirely remove all the ſcruples of ſome mathematicians, as they were ſupported by the obſervations and experiments of ſo diligent an artiſt as M. Caſſini.

At length the king of France, at an expence becoming a monarch who delighted in cultivating the ſciences, ſent two companies of mathematicians, the one to the equator, and the other to the arctic circle, in order to decide this affair, and accurately determine the true figure of the earth.

Problem. Let APEpA (*fig.* 15.) be a meridian of the earth, Pp its axis and the height of the pole, in any two places on that meridian, as S and T at a given diſtance, but not very far from each other, to be truly determined; and the ſame thing to be done at two other places, s, t, a conſiderable diſtance from the former, either on the ſame or any other meridian: it is required from thence to find the ratio of the earth's equatorial and polar diameters, and the length of each of them, allowing the form of the earth to be ſpheroidical.

Solution. Let R and r be mean latitudes, between ST and st; RG, rg, ordinates to the axis AE; and RO, ro, the radius of curvature at R and r; then it is plain the angles AnR, Amr, expreſſing thoſe latitudes will be given; as alſo the little angles SOT, $ſot$, equal to the difference of latitudes at ST and st, exceeding near, becauſe the curvature in the elliptical arch ST, by reaſon of the ſmallneſs of the arch, can no where ſenſibly differ from the mean curvature at R; and the ſame may be ſaid in reſpect of the arch st. Therefore, putting AC$=b$, PC$=c$, GG$=u$, ST$=$D; angle TOS$=$E, ſine of AnR$=$S, radius $=1$, and $p=3{,}14159$, &c. we have $E : 180^\circ :: D : \frac{180\,D}{E}$, the length of a ſemi-circle, whoſe radius is equal to RO; $p : 1 : \frac{180\,D}{E} : \frac{180\,D}{Ep} =$ RO, which from hence is given. But it is proved by the writers on fluxions, that this radius RO is alſo equal to $\frac{\overline{b^4+u^2\times cc-bb}^{\frac{3}{2}}}{cb^4}$; wherefore, putting $\frac{180\,D}{pE}$, or RO$=$G$^{\frac{3}{2}}$, we have $b^4+u^2\times\overline{cc-bb}=c^{\frac{2}{3}}b^{\frac{8}{3}}\times$G: but now to exterminate u^2, from the nature of the curve, we have RG $=\frac{c\sqrt{bb-uu}}{b}$, and G$n=\frac{ccu}{bb}$; therefore as $\frac{c\sqrt{bb-uu}}{b}$ to $\frac{ccu}{bb}$:: S the ſine of GnR to $\sqrt{1-SS}$ its coſine; hence $u^2=\frac{\overline{1-SS}\times b^4}{\overline{1-SS}\times bb+SScc}$, which, ſubſtituted in the other equation, brings it to $\frac{b^4c^2}{\overline{1-SS}\times bb+SScc}=Gc^{\frac{2}{3}}b^{\frac{8}{3}}$, or $\overline{1-SS}\times bbG+ccSSG=\overline{c^4b^4}^{\frac{1}{3}}$. Therefore, if st be put $=d$, angle $tos=e$, ſine of the angle A$mr=s$, and $\frac{180\,d}{ep}=g^{\frac{1}{2}}=r$; it is manifeſt that $\overline{c^4b^4}^{\frac{1}{3}}$ will alſo be equal to $\overline{1-ss}\times bbg+ccssg$; hence by comparing theſe two values of $\overline{c^4b^4}^{\frac{1}{3}}$ we get $\frac{c}{b}=1-\frac{\overline{G-g}^{\frac{1}{2}}}{S^2G-s^2g}$ for the ratio required; which when E and e, the two differences of latitudes, are equal, will become $\frac{c}{b}=1-\frac{\overline{D^{\frac{2}{3}}-d^{\frac{2}{3}}}^{\frac{1}{2}}}{S^2d^{\frac{2}{3}}-s^2d^{\frac{2}{3}}}$ becauſe then G is to g, as $D^{\frac{2}{3}}$ is to $d^{\frac{2}{3}}$. But now, in order to find the values of b and c from hence, put f inſtead of $\frac{G-g}{S^2G-s^2g}$, or $\frac{D^{\frac{2}{3}}-d^{\frac{2}{3}}}{S^2D^{\frac{2}{3}}-s^2d^{\frac{2}{3}}}$, then will $\frac{c}{b}=\sqrt{1-f}$, and $cc=b^2\times\overline{1-f}$; whence, by ſubſtituting theſe values in the equation $\overline{1-ss}\times bbg+ccssg=\overline{c^4b^4}^{\frac{1}{3}}$ (above found) there comes out $b=\frac{g^{\frac{2}{3}}\times\overline{1-fss}^{\frac{2}{3}}}{1-f}=\frac{r\times\overline{1-fss}^{\frac{2}{3}}}{1-f}$, becauſe $g^{\frac{2}{3}}=r$: therefore $c=r\times\frac{\overline{1-fss}^{\frac{2}{3}}}{\overline{1-f}^{\frac{1}{2}}}$. Now if f be ſmall, in reſpect of unity, then $r\times\overline{\frac{1-fss}{1-f}}^{\frac{1}{2}}$ or b, will be nearly

nearly $= r + rf \times \frac{1-3ss}{2}$; but when this is ſo, it is evident, in caſe $E = e$, that $D^{\frac{2}{3}} - d^{\frac{2}{3}}$, muſt alſo be very ſmall; therefore, putting $\frac{D-d}{d} = m$, or $\frac{D}{d} = 1 + m$, we ſhall have $D^{\frac{2}{3}} - d^{\frac{2}{3}} = \frac{2md}{3}$ very nearly, and therefore (by ſubſtitution) $\frac{c}{b} = 1 - \frac{m}{3 \times SS - ss}$, $b = r + \frac{mr \times 2 - 3ss}{3 \times S^2 - s^2}$, and $b - c = \frac{mr}{3 \times SS - ss}$ very nearly.

By obſervations made under the artic circle, by Meſſrs. de Maupertuis, Clairaut, Camus, Le Monier, the Abbé Outhier, and M. Celſius of Upſal; the length of a degree in whoſe middle the pole was elevated 66° 31′ was found to be 57437 toiſes (a toiſe is = 6,408 Engliſh feet): but by thoſe of Mr. Picard, as corrected by the ſaid gentlemen, the length of one near Paris, where the mean latitude was 48° 50′ appears to be only 56925 toiſes, differing from the former by 512 toiſes. Now, to determine the earth's true dimenſions by the foregoing theorems applied to theſe obſervations, let S = Nat. ſine of 66° 31′ s = that of 48° 50′ D = 57437, d = 56925, and E = e = 1; then r = 3261600, $\frac{D-d}{d} = m = ,009$ $\frac{c}{b}$ $(= 1 - \frac{m}{3 \times SS - ss})$ = .9892, b = 3272300, c = 3236500, and $b - c$ = 35800 toiſes; wherefore it appears, that the length of the earth's axis, from pole to pole, is 6473000 toiſes, or 7863,2 Engliſh miles; and that the difference between it and the equatorial diameter is about $\frac{1}{572}$ part of the former, or 86,8 miles.

EARTH, in gardening and huſbandry, if good ſhould be of a blackiſh colour, gravelly, fat, pliant, or eaſy to be digged; it ſhould be neither cold nor light, it ought to have no ill ſmell or taſte, and it ſhould be of the ſame quality three or four feet deep for trees, which if they have not that depth, will languiſh and decay after they have been planted ſix years. Fruit trees will thrive in a leſs depth, and they generally produce the moſt generous fruits, when their roots ſpread near the ſurface of the earth.

Huſbandmen call that new earth which lying three or more feet deep, never ſerved to the nouriſhment of any plant; or earth that has been a long time built upon, though it had formerly bore; earth likewiſe of a ſandy loamy nature, where cattle have been a long time fed, may be accounted ſuch, and be of excellent uſe for moſt ſorts of plants, eſpecially if it has been thrown up in heaps to grow richer.

EARTH, in chemiſtry, the fourth of the chemical elements, or principles, into which bodies are reſolvable by fire.

Magnetiſm of the EARTH. Dr. Knight thinks the earth may be conſidered as a great load-ſtone, whoſe magnetical parts are diſpoſed in a very irregular manner, and that the ſouth-pole of the earth is analogous to the north-pole in magnets; that is, the pole by which the magnetical ſtream enters. He obſerves, that the earth might become magnetical by the iron-ores it contains; and notwithſtanding it might have remained unmagnetical, unleſs ſome cauſe had exiſted capable of making that excellent matter, producing magnetiſm, move in a ſtream thro' the earth; yet he thinks that ſuch a cauſe does really exiſt. For if the earth revolves round the ſun in an ellipſis, and the ſouth-pole of the earth is directed towards the ſun at the time of its deſcent, a ſtream of repellent matter will thereby be made to enter at the ſouth-pole, and come out at the north. And he ſuggeſts, that the earth's being in its perihelion in the winter, may be one reaſon why magnetiſm is ſtronger in this ſeaſon than in ſummer. Hence alſo the doctor imagines it probable, that the earth's magnetiſm has been improving ſince the creation, and that this may be one reaſon why the uſe of the compaſs was not diſcovered ſooner. See the article MAGNET.

Theory of the EARTH. The earth in its natural and original ſtate Des Cartes, Burnet, Woodward, and Whiſton, ſuppoſe to have been perfectly round, ſmooth, equable; and they account for its preſent rude and irregular form principally from the great deluge. See the article DELUGE.

Mr. de Buffon, arguing from the ſpheroidical figure of the earth, and the laws of hydroſtatics, ſuppoſes that the earth, as well as the other planets, are parts ſtruck off from the body of the ſun by the colliſion of comets, and conſequently, when the earth aſſumed its form, it was in a ſtate of liquefaction by fire. Of this, ſays he, we ſhall be the more eaſily convinced, when we conſider the nature of the matter contained in the body of the earth, the greateſt part of which, as ſand and clays, are vitrified, or vitrifiable ſubſtances; and, on the other hand, when we reflect upon the impoſſibility of the earth's being ever in a ſtate of fluidity produced by water, ſince there is infinitely more land than water; and beſides, water has not the power of diſſolving ſand, ſtones, and other ſubſtances, of which the earth is compoſed. How far the inequalities in the face of the earth, the beds of rivers, lakes, &c. and the various ſtrata in its internal parts, ſerve to confirm this hypotheſis, may be ſeen in Hiſtoire Naturelle, &c. tom. i. by M. de Buffon, and in the articles MOUNTAIN, RIVER, STRATA, &c.

EARTH-BANKS, in huſbandry, &c. are a very common fence about London, and in ſeveral other parts of England. Where ſtones are not to be had cheap, theſe are to be preferred to all other fences, both for ſoundneſs and laſting.

The beſt manner of making them is this: dig up ſome turf in a graſſy place, a ſpit deep, or nearly the breadth of the ſpade, and about four or five inches thick; lay theſe turfs, with the graſs outward, even by a line on one ſide, and on the back-ſide of theſe lay another row of turf, having a foot ſpace of ſolid ground on the outſide to prevent the bank from ſlipping in, if it ſhould be any ways faulty. On the outſide of this make a ditch, or elſe let the ſides be lowered both ways with a ſlope two feet deep. and there will be no paſture loſt by the fence, becauſe it will bear graſs on both ſides.

The earth that is dug out of the ditches, or from the ſlope, muſt be thrown in between the two rows of turf, till the middle is made level with the reſt: then lay on two more rows of turf in the ſame manner; and with more of the earth fill up and make level as before. Let this method be continued till the bank is raiſed four feet high, or more, if neceſſary, only obſerving, that the higher it is to be carried, the wider the foundation muſt be made. As the bank is carried up, the ſides muſt not be raiſed perpendicular, but ſloping, inward both ways, ſo that at the top it may be about two feet and a half wide. This ſort of fence, when made with leſs care, and faced with clay, is left naked, and ſerves very well in ſome places; but, when it is thus managed with the turf, the joinings of the ſeveral pieces are hid in a little time, by the growth of the graſſy part of the turf on each ſide, and it makes a beautiful fence, of as green and pleaſant a colour as the reſt of the field.

The great improvement upon this plan is the planting quickſets, or young white-thorn plants, in the middle of the top of the bank. The earth on each ſide of theſe may be raiſed up with a ſort of wall, and the rain that falls all preſerved for the plants. This plenty of water, and depth of fine earth, makes the young plants grow quicker and more vigorouſly than any other way; and the moſt beautiful of all hedges is propagated this way. When this ſort of hedge is young, there muſt be placed on each ſide of it a ſhort dry fence, of about a foot high, to keep the ſheep from cropping theſe young plants, but this may be taken away after a little time.

There is one caution neceſſary in regard to the making theſe banks, which is, that they muſt never be made in a very dry ſeaſon, becauſe, if much rain ſhould follow, the earth of the bank would ſwell aud burſt out, or ſpoil the ſhape of the bank; but, if this ſhould happen, it is eaſily repaired. This beautiful fence may be made at a ſmaller price than thoſe unaccuſtomed to theſe things may imagine. In good digging ground, where men work at about fourteen pence per day, it may be made and planted with quick for two ſhillings a pole. It may be made proper for the keeping in of deer, only by the ſmall addition of planting, at every eight or ten feet diſtance, a poſt a little ſlanting, with a mortiſe in it; let this ſtand about two feet above the bank, and into the mortiſes, all along, put a rail made of a bough of any tree; no deer

will ever go over this, nor can they creep under it, as they often do, when a pale tumbles down. The quick, on the top of this bank, may be kept clipped, and will grow very thick, and afford the beſt ſhelter for cattle of any fence in uſe with us.

EARTHING, in agriculture and gardening, ſignifies the covering of ſhrubs and plants, as vines, celery, &c. with earth.

EARTHQUAKE, in natural hiſtory, a violent agitation, or trembling of ſome conſiderable part of the earth, generally attended with a terrible noiſe like thunder, and ſometimes with an eruption of fire, water, winds, &c.

Earthquakes are allowed to be the greateſt and moſt terrible phœnomena of nature, there being no ſecurity againſt their effects, when they come with the laſt degree of violence.

There are two ſorts of earthquakes; the one cauſed by the action of ſubterraneous fires and the exploſion of the volcanos, which are not felt but at ſmall diſtances, and at the times that the volcanos are agitated, or before they begin to open: and the other from air. When the materials that form ſubterraneous fires come to be fermented, heated, and inflamed, the fire makes efforts on all ſides; and if it does not naturally find an outlet, it raiſes the earth, and makes a paſſage for itſelf by throwing it off, by which means a volcano is produced, the effects of which are repeated, and they laſt in proportion to the quantity of inflammable matter it contains: if this matter be inconſiderable, there may happen a raiſing of the ground, a commotion, and an earthquake, without any volcano being formed by that means: the air, produced and rarefied by the ſubterraneous fire, may likewiſe find ſmall outlets by which it may eſcape; and in this caſe there will only happen an earthquake without any eruption or volcano. But when there is a large quantity of inflammable matter, and when it is locked up and confined by ſolid and compact ſubſtances, there happens a commotion and a volcano too: but all theſe commotions cauſe no more than the firſt ſort of earthquakes, and can only ſhake a ſmall ſpace of ground. A very violent eruption, for inſtance, of Mount Ætna, will cauſe an earthquake over the whole iſland of Sicily; but it will never extend to three or four hundred leagues diſtance. When ſome new vents of fire have been formed in Mount Veſuvius, there are felt at the ſame time earthquakes at Naples, and in the neighbourhood of the volcano; but theſe concuſſions have never ſhaken the Alps, nor been communicated to France, or other countries remote from Veſuvius: in this manner earthquakes, produced by means of volcanos, are confined to a narrow ſpace; which is properly the effect of the re-action of the fire, and they ſhake the earth, juſt as the exploſion of a powder magazine cauſes a ſenſible concuſſion at ſeveral leagues diſtance.

But there is another ſort of earthquakes very different as to their effects, and, probably, as to their cauſes; and theſe are ſuch as are felt at conſiderable diſtances, and which ſhake a long tract or ſlip of ground without any volcano or eruption appearing. We have inſtances of earthquakes which are felt at the ſame time in England, France, Germany, and even in Hungary; and theſe always extend a great deal more in length than in breadth; they ſhake a tract of ground with more or leſs violence in different places; and they are almoſt always accompanied with a dull noiſe, much like that of a large carriage that rolls along ſwiftly.

In order to underſtand thoroughly what may be the cauſes of this kind of earthquake, we muſt remember that all inflammable matters capable of exploſion, ſuch as gun-powder, generate a large quantity of air; that this air, produced by the fire, is in a ſtate of very great rarefaction; and that by means of this compreſſion, in which it finds itſelf in the bowels of the earth, it muſt produce very violent effects. Let us, therefore, ſuppoſe that at a very conſiderable depth, as a hundred or two hundred fathoms, there be found pyrites and other ſulphureous ſubſtances, and that by the fermentation produced by the filtering of the waters, or other cauſes, theſe happen to take fire, let us ſee what will be the reſult; in the firſt place, theſe ſubſtances are not regularly diſpoſed in horizontal ſtrata; on the contrary, they are contained in the perpendicular fiſſures, in the caverns at the foot of theſe fiſſures, and in other places where the water can act, and into which they can penetrate: theſe ſubſtances, coming to take fire, will generate a large quantity of air, whoſe ſpring being compreſſed in a little room, as in that of a cavern, will not only ſhake the ſuperior ground, but ſeek for paſſages to eſcape by and to extricate itſelf. The paſſages that preſent themſelves, are the caverns and canals formed by the ſubterraneous waters and rivulets; the rarefied air will violently precipitate into all the paſſages that are open, and form a furious wind in theſe ſubterraneous cavities, the noiſe of which ſhall be heard at the ſurface of the earth, accompanied with concuſſions thereof; this ſubterraneous wind produced by the fire will extend as far as theſe cavities, and cauſe an earthquake more or leſs violent, in proportion as it is remote from the fire, and finds paſſages more or leſs narrow: this motion being performed lengthwiſe, the concuſſion will be in the ſame direction, and the earthquake felt in a long zone or tract of ground. This air will cauſe no eruption, or volcano, becauſe it will find ſufficient room to dilate itſelf, or, rather, becauſe it will find outlets, and iſſue out in form of wind or vapour: and even ſhould it be denied, that there are actually any ſubterraneous paſſages by which this air and theſe vapours can eſcape, we may eaſily conceive, that in the very place where the firſt exploſion happens, the ground being raiſed up to a conſiderable height, the adjoining place muſt be divided and rent aſunder horizontally, in order to correſpond with the primary motion, which is ſufficient to make paſſages that may communicate the motion to a very great diſtance. This explication agrees with all the phœnomena. An earthquake is not felt in the very ſame inſtant in two diſtant places, for inſtance, a hundred or two hundred leagues; there is no external eruption of fire cauſed by theſe earthquakes that reach to ſome diſtance, and the noiſe that accompanies them, almoſt always points out the progreſſive motion of the ſubterraneous fire.

What has been ſaid may be farther confirmed by connecting it with other facts. It is well known, that mines exhale vapours independently of the winds produced by the current of the waters, and that there are often obſerved in them currents of unwholeſome air and ſuffocating exhalations; and beſides, there are holes, abyſſes, and deep lakes on the earth, that produce winds, as the Lake of Boleſlaw, in Bohemia.

Earthquakes, it is true, are a great deal more frequent in places where volcanos are than elſewhere; as in Sicily and Naples; and it is well known from obſervations made at different times, that the moſt violent earthquakes happen at the time of the greateſt eruptions of volcanos. *Buffon's Hiſtoire Naturelle.*

Earthquakes may be produced artificially, by mixing equal quantities of ſulphur and the filings of iron, and beating them together, with an addition of water, into a kind of paſte; and burying the whole three or four feet under the ſurface of the earth; and in ſeven or eight hours time the earth will begin to tremble, crack, and ſmoke, and burſt out into flames.

EASEL-PIECES, a denomination given by painters to ſuch pieces as are contained in frames, in contradiſtinction from thoſe painted on cielings, &c.

EASEMENT, in law, a privilege or convenience which one neighbour has of another, whether by charter or preſcription, without profit: ſuch are paſſages thro' his lands, a ſink, or the like. Theſe, in many caſes, may be claimed.

EAST, one of the four cardinal points of the world; being that point of the horizon where the ſun is ſeen to riſe when in the equinoctial. See COMPASS, HORIZON, EQUINOCTIAL, &c.

EAST is alſo frequently compounded with other words, as Eaſt-Indies, eaſt-dial, eaſt-wind, &c. to ſignify their being ſituated towards the eaſt. See the articles INDIES, DIAL, WIND, &c.

EASTER is the great feſtival of the anniverſary commemoration of our Saviour's reſurrection; which, for its antiquity and excellence, challenges the precedence of all others.

The Greeks and Latins call it *paſcha*, originally an Hebrew word, ſignifying a paſſage, applied to the feaſt of

the paſſover held by the Jews much about the ſame time. In Engliſh it is called Eaſter, from a goddeſs of that name, worſhipped by the Saxons in the month of April.

It was in conformity to the cuſtom of the Jews, who were commanded by God himſelf to celebrate the paſſover in the firſt month, and on the fourteenth day of that month in the even, that the primitive fathers ordered that the fourteenth day of the moon from the calendar new moon, which immediately follows after the twenty-firſt of March, at which time the vernal equinox happened upon that day, ſhould be deemed the Paſchal full-moon, and that the Sunday after, becauſe our Saviour roſe on the day after the Jewiſh paſſover, ſhould be Eaſter-day; and it is upon this account that our Rubric has appointed it upon the firſt Sunday after the firſt full-moon immediately following the twenty-firſt day of March, upon which day, at that time, the vernal equinox happened: whence it appears that the true time of celebrating Eaſter, according to the original inſtitution of the feaſt of the paſſover, as well as according to the intent of the council of Nice, was to be the firſt Sunday after the firſt full-moon immediately following the vernal equinox, or when the ſun entered into the firſt point of Aries: and this was the principal view pope Gregory had, when he reformed the calendar, to celebrate Eaſter according to the intent of the Nicene council: and as the new-ſtyle has been ordered by act of parliament to be uſed in Great-Britain for the future, it will be neceſſary to ſhew the method of finding Eaſter, according to this method of computation, which may be performed by the following rule.

Find the epact for the year propoſed, and, if it be leſs then 24, ſubtract it from 74; but if it be 24, it muſt be taken from 73; alſo, if the epact be 25, and the golden number between 12 and 19, both numbers incluſive, the epact muſt be taken from 73, and the remainder will be Eaſter limit, or the day of the Paſchal full-moon. If the limit do not exceed 31, the day of the full-moon will be in March; but if it exceeds 31, it will be in April, the Sunday after which full-moon will be Eaſter-day.

But to ſave the trouble of calculation, we ſhall inſert the following table, by which Eaſter-day may be found by inſpection from the preſent time, till the year 1899 incluſive, according to the Gregorian method.

A TABLE to find EASTER till the year 1899 incluſive.

SUNDAY LETTERS.							
G.Numb.	A.	B.	C.	D.	E.	F.	G.
I.	April 16	17	18	19	20	14	15
II.	April 9	3	4	5	6	7	8
III.	March 26	27	28	29	23	24	25
IV.	April 16	17	11	12	13	14	15
V.	April 2	3	4	5	6	March 31	April 1
VI.	April 23	24	25	19	20	21	22
VII.	April 9	10	11	12	13	14	8
VIII.	April 2	3	March 28	29	30	31	April 1
IX.	April 16	17	18	19	20	21	22
X.	April 9	10	11	5	6	7	8
XI.	March 26	27	28	29	30	31	25
XII.	April 16	17	18	19	13	14	15
XIII.	April 2	3	4	5	6	7	8
XIV.	March 26	27	28	22	23	24	25
XV.	April 16	10	11	12	13	14	15
XVI.	April 2	3	4	5	March 30	31	April 1
XVII.	April 23	24	18	19	20	21	22
XVIII.	April 9	10	11	12	13	7	8
XIX.	April 2	March 27	28	29	30	31	April 1

To make uſe of the preceding table, find the Sunday letter for the year in the uppermoſt line, and the golden number, or prime, in the firſt column; and in the common angle of meeting, you have the day of the month on which Eaſter falleth that year. But note, that the name of the month is ſet on the left hand, or juſt with the figure, and followeth not, as in other tables, by deſcent, but collateral.

EASTERN, an appellation given to whatever relates to the eaſt: thus we ſay, eaſtern amplitude, eaſtern church, &c. See AMPLITUDE, CHURCH, &c.

EAVES, in architecture, the margin or edge of the roof of an houſe; being the loweſt tiles, ſlates, or the like, that hang over the walls, to throw off water to a diſtance from the wall. See the articles WALL and ROOF.

EAVES LATH, a thick feather-edged board, generally nailed round the eaves of a houſe for the lowermoſt tiles, ſlates, or ſhingles, to reſt on.

EBDOMARIUS, in eccleſiaſtical writers, an officer formerly appointed weekly to ſuperintend the performance of divine ſervice in cathedrals, and preſcribe the duties of each perſon attending in the choir, as to reading, ſinging, praying, &c.

EBENUS, the ebony-tree. See the article EBONY.

EBIONITES, in church hiſtory, heretics of the firſt century, ſo called from their leader Ebion.

They held the ſame errors with the Nazarenes, united the ceremonies of the Moſaic inſtitution with the precepts of the Goſpel, obſerved both the Jewiſh Sabbath and Chriſtian Sunday, and in celebrating the euchariſt, made uſe of unleavened bread. They abſtained from the fleſh of animals, and even from milk. In relation to Chriſt, ſome of them held that he was born, like other men, of Joſeph and Mary, and acquired ſanctification only by his good works. Others of them allowed, that he was born of a virgin, but denied he was the word of God, or had any exiſtence before his human generation. They ſaid he was, indeed, the only true prophet, but yet a mere man, who by his virtue had arrived at being called Chriſt, and the Son of God. They alſo ſuppoſed, that Chriſt and the devil were two principles, which God had oppoſed to each other. Of the New Teſtament, they only received the Goſpel of St. Matthew, which they called the Goſpel according to the Hebrews.

EBONY, *Ebenus*, in botany, a tree ſuppoſed to be of the palm-kind, the wood of which is imported from different countries of the Eaſt and Weſt-Indies.

Its wood is extremely ſolid, and capable of a fine poliſh; and, therefore, much uſed in toys and marquetry.

EBRBUHARITES, a kind of Mahometan monks, ſo called from their founder Ebrbuhar.

EBRILLADE, in the manege, a check of the bridle given to the horſe by a jerk of one rein, when he refuſes to turn. Some confound the ebrillade with the ſaccade.

EBULLITION, the ſame with boiling. See BOILING.

EBULLITION is alſo uſed in a ſynonymous ſenſe with effervеſcence. See the article EFFERVESCENCE.

ECCHYMOSIS, a livid, brown, or dark ſpot in the ſkin, cauſed by extravaſated fluids, when the capillaries are broken by a contuſion.

The word is formed from the Greek εκχυω, to pour out, and αιμα, blood; or perhaps from εξ, out, and χυμος, juice or humour.

ECCLESIA, in law, ſignifies a church or parſonage. See the articles CHURCH and PARSONAGE.

ECCLESIASTES, a canonical book of the Old Teſtament, the deſign of which is to ſhew the vanity of all ſublunary things.

It was compoſed by Solomon, who enumerates the ſeveral objects on which men place their happineſs, and then ſhews the inſufficiency of all worldly enjoyments.

The Talmudiſts make king Hezekiah to be the author of it; Grotius aſcribes it to Zorobabel, and others to Iſaiah; but the generality of commentators believe this book to be the produce of Solomon's repentance, after having experienced all the follies and pleaſures of life.

ECCLESIASTICAL, an appellation given to whatever belongs to the church: thus we ſay, eccleſiaſtical polity, juriſdiction, hiſtory, &c.

ECCLESIASTICUS, an apocryphal book, generally bound up with the Scriptures, ſo called from its being read in the church, *eccleſia*, as a book of piety and inſtruction, but not of infallible authority.

The author of this book was a Jew, called Jeſus the ſon of Sirach. The Greeks call it the wiſdom of the ſon of Sirach.

ECCOPE, in ſurgery, the ſame with amputation.

ECCOPROTICS, in pharmacy, the ſame with gentle cathartics and evacuants. See CATHARTICS and EVACUANTS.

ECHARPE, in the military art. See the article BATTERY.

ECHEVIN, *Scabinus*, in the French and Dutch polity, a magiſtrate elected by the inhabitants of a city or

town, to take care of their common concerns, and the decoration and cleanlineſs of the city.

ECHINITES, in natural hiſtory, the name by which authors call the foſſile centronia, frequently found in our chalk pits.

ECHINOPS, or ECHINOPUS, glove thiſtle, in botany, a genus of plants, the flower of which is compound; conſiſting of a great number of floſcules or ſmall flowers, divided into ſeveral acute ſegments: there is no pericarpium: the ſeed, which is ſingle, is of an ovato-oblong figure, narrower at the baſe, with an obtuſe hairy apex.

The roots and ſeeds of this plant are ſaid to be attenuant and diuretic.

ECHINUS, in zoology, a name frequently uſed for the erinaceus, or common hedge-hog. See ERINACEUS.

ECHINUS, in architecture, a member or ornament near the bottom of the Ionic, Corinthian, and Compoſite capitals.

ECHIUM, viper's bugloſs, in botany, a genus of plants, the flower of which conſiſts of a ſingle petal, the tube being very ſhort, and the limb erect, growing gradually wider at the extremity, where it is divided into five unequal ſegments; the two upper-ſegments are longer than the reſt, and the loweſt one is ſmall, acute, and reflex; there is no pericarpium, inſtead of which the cup becomes rigid, and contains in it four roundiſh and obliquely acuminated ſeeds.

A powder of the root of this plant is recommended againſt epilepſies: it is alſo a ſudorific, vulnerary, and preſcribed againſt the eryſepilas.

ECHO, a ſound reverberated, or reflected to the ear from ſome oppoſing body.

The word is formed from the Greek ηχεω, to ſound.

In order to account for the nature of echoes, we muſt conſider, that ſound is perceived as coming from that place, from which, as a center, the pulſes are propagated. This is well known by experience: but to illuſtrate this matter, let A (plate LVI. *fig.* 16.) be the center from whence any ſound is directly propagated, and ſtrikes againſt any plain obſtacle C B, ſufficiently large; draw A F perpendicular to B C, and produce it to H, ſo that it may be A F = F H; the ſound reflected will be perceived as coming from the point H.

For let A E be the incident ray impinging againſt the obſtacle B C in the point E; from E draw the ray E D, in ſuch a manner that the angle C E D may be equal to the angle F E A, or that the angle of incidence may be equal to the angle of reflection; then will E D be the reflected ray of ſound; and, if produced, will paſs thro' the point H; for the angle F E H = C E D = F E A: therefore in the triangles A F E and E F H, ſince the angles of one are reſpectively equal to the ſides of the other, and the ſide F E is common to both, the ſides of one triangle will be reſpectively equal to the ſides of the other; and therefore H F = A F; wherefore the reflex ſound will be heard by a perſon at D, as coming from the point H.

As the place of the auditor, or point D, approaches towards A, the caſe will conſtantly be the ſame with reſpect to the center of ſound H; the triangles will ſtill be equal, and all their angles and ſides reſpectively; therefore, when D coincides with A, the reflex ſound, or echo, will be heard from the point H, which was to be demonſtrated.

The ſame ſound therefore is heard twice by an auditor at D; firſt by the direct ray at A D; and ſecondly by the reflex ray A E D; provided the difference between A D and A E D be ſufficiently great, that the direct and reflex ſound do not in the ſame ſenſible moment of time affect the ear: for if the reflex ſound arrive at the ear before the impreſſion of the direct ſound ceaſes, the ſound will not be double, only rendered more intenſe.

We know by experience, if more than 9 or 10 ſyllables be produced in a ſecond, the ſounds will not be diſtinct and articulate; therefore, that the reflex ſound may not be confounded with the direct ſound, there ought to be at leaſt the ninth part of a ſecond between the times of their appulſe to the ear. But in the ninth part of a ſecond the ſound runs through the ſpace of $\frac{1142}{9} = 127$ feet; the difference therefore between A D and A E D muſt not be leſs than 127 feet, for the echo to be diſtinctly heard at D.

Hence alſo it follows, that a perſon ſpeaking or uttering a ſentence in A aloud, in order to obſerve the echo by reflection from the obſtacle B C, ought to ſtand at leaſt 73 or 74 feet from it, that is, A F = 74; and ſince, at the common rate of ſpeaking, we pronounce not above 3 and $\frac{1}{2}$ ſyllables per ſecond, or read more than twenty lines of Engliſh poetry per minute; therefore, that the echo may return juſt as ſoon as the three ſyllables are expreſſed, we muſt have twice A F equal to about 1000 feet; or the ſpeaker muſt ſtand about 500 feet from the obſtacle B C; and ſo in proportion for any other number of ſyllables.

ECHO, in architecture, is applied to certain vaults and arches, generally of elliptical or parabolical figures, erected to produce artificial echoes.

ECHO, in poetry, a kind of compoſition, wherein the laſt words or ſyllables of each verſe contain ſome meaning, which, being repeated apart, anſwer to ſome queſtion or other matter contained in the verſe, as in this beautiful one from Virgil:

Crudelis mater magis, an puer improbus ille?
Improbus ille puer, crudelis tu quoque mater.

The elegance of an echo conſiſts in giving a new ſenſe to the laſt words; which reverberate, as it were, the motions of the mind, and by that means affect it with ſurprize and admiration.

ECHOMETER, in muſic, a kind of ſcale, having ſeveral lines divided on it, to find the intervals and ratios of ſounds.

The word is derived from the Greek ηχω, ſound, and μετρεω, to meaſure.

ECLECTICS, *Eclectici*, ancient philoſophers, who, without attaching themſelves to any particular ſect, ſelected whatever appeared to them the beſt and moſt rational.

Potamon of Alexandria was the firſt of the eclectics: he lived in the reigns of Auguſtus and Tiberius; and being tired with the ſcepticiſm of the Pyrrhonians, he reſolved upon a ſcheme that would allow him to believe ſomething, but without being ſo implicit as to ſwallow any entire hypotheſis.

ECLECTOS, the ſame with what is more uſually called linctus. See LINCTUS.

ECLIPSE, in aſtronomy, a privation of the light of ſome luminary, by the interpoſition of an opaque body, either between it and the eye, or between it and the ſun.

The word is derived from the Greek εκλειπω, to leave or forſake.

All dark bodies, expoſed to the direct light of the ſun, caſt a ſhadow behind them; which is nothing but the privation of light in the ſpace oppoſite to the ſun, by reaſon of the ſun's rays being intercepted by the opaque body: and as the globes of the earth and moon are both opaque bodies, which borrow all their light from the ſun, when either interpoſes, the other muſt in ſome meaſure be obſcured, as the earth (plate LVII. *fig.* 1.) at A, and the moon in B.

Hence it appears, that a ſolar eclipſe is cauſed by the interpoſition of the moon betwixt the ſun and the earth; and a lunar one, by that of the earth betwixt the ſun and moon.

Let S repreſent the ſun, D the earth, M the moon, and E her ſhadow, by which it is evident there can be no line drawn from any part of the ſun to any point in the ſpace I H, upon the earth's ſurface, but will fall upon the globe of the moon; and, ſince the moon is a dark body, it will not ſuffer any ray to paſs through or illuminate the ſpace I H; therefore that part of the earth muſt be deprived of the ſun's light. It is to be noted, that this can never happen but when the moon is in conjunction with the ſun; for at no other time is her ſhadow caſt upon the earth.

The moon being leſs than the earth, her ſhadow can never cover the whole globe, only a part of it, ſuch as I H; and a total darkneſs happens only to thoſe inhabitants on whom the ſhadow falls. The circumjacent places will be illuminated with ſome of the ſun's beams, called

called the penumbra, or a lucid partial ſhadow; which will have different degrees of illumination, according to the diſtance from the center of the real ſhadow. The inhabitants where this penumbra falls will only ſee a part of the ſun's diſk obſcure, which will appear to be more or leſs, in proportion as they are ſituated nearer or farther remote from the center: without this penumbra all the ſun's body will be ſeen at the ſame time, and no eclipſe perceived at all.

Let S (*fig.* 2.) repreſent the ſun in the equinoctial, and E the earth; then will A be the moon conjoined with the ſun to the ſouth pole; B a true conjunction at the earth's center, or in the equator; and C the moon conjoined with the ſun at the north pole.

Now it is manifeſt, when the moon is at B, her ſhadow falls in the torrid zone; and conſequently muſt take away the ſun's light from that part of the globe; when at the ſame time to the north and ſouth poles only part of the ſun's body will be darkened: and when the moon is centrally conjoined at C, the ſun may be totally eclipſed at the north pole, when at the ſame time to the ſouth part of the world he is free from the leaſt obſcuration. Hence the penumbral cone is determined in this manner:

Let A (*fig.* 3.) repreſent the ſun, E the moon, D the earth, C the moon's opaque ſhadow, and AED a right line joining the three centers; draw the line FG, from the ſuperior limb of the ſun to the earth's ſurface, touching the inferior limb of the moon; and the line HI from the inferior limb of the ſun, touching the ſuperior limb of the moon; and they will interſect each other in the point K; which point will be the vertex, and the line KN the axis of the penumbral cone. About which, if the line KG or KI be made to revolve, it will deſcribe the limits of the penumbra upon the earth's ſurface, and is here repreſented by the faint ſhadow LM.

To know how much of the earth's ſurface can be involved in this penumbra, firſt, let us ſuppoſe the angle of the cone, as demonſtrated by Dr. Keill in his Aſtronomical Lectures, page 116, without ſenſible error, equal to the apparent diameter of the ſun; then in the triangle KOE, right-angled at O, is given the ſemi-diameter of the moon OE, and the ſemiangle of the cone OKE, to find the diſtance of the moon's center from the vertex K; which when known, added to the moon's diſtance from the earth, will give the whole height of the ſaid cone from the earth's center: then in the oblique triangle DKI are given the ſides DK and DI, together with the angle DKI; hence will be found the angle NDI, whoſe meaſure is the arch IN, the ſemi-diameter of the penumbra upon the earth.

After the ſame manner may be found the quantity of the earth involved in the real ſhadow. But if the apparent diameter of the ſun exceed that of the moon, the real ſhadow will not reach the earth: in this caſe there may be a central eclipſe of the ſun, but not a total one. This is called an annular eclipſe; the moon's body appears in the ſun's diſk, ſurrounded by a bright luminous circle. Such a one was obſerved by Clavius at Rome, April the 9th, 1567; and ſuch another paſſed over the city of Edinburgh on February 18, 1736-7, in the evening.

As it is evident there can be no eclipſe of the ſun, but when the moon is in the change; for then only the moon is in oppoſition to the ſun, and near the earth's ſhadow: ſo there can be no eclipſe of the moon but at the time of the full. And ſince there is a new and a full moon every month, it will be proper to give a reaſon, why there is not alſo an eclipſe at thoſe times every month. If the moon's orbit lay in the plane of the earth's orbit, that is, if thoſe two planes were to coincide in a plane paſſing through the ſun, there would be a total eclipſe of the moon at every full, and conſequently a central eclipſe of the ſun at every change. This is improperly attributed to the ſun, becauſe it is really an eclipſe of the earth; for all the time the ſun retains his own light without the leaſt diminution, and only thoſe inhabitants of the earth that are under the ſhadow of the moon, or of the penumbra, are truly eclipſed.

But the orbs of the earth and moon, being placed obliquely, and not both in the ſame plane, interſect each other in two points, called nodes, where the moon's orbit is found to be inclined to the ecliptic in an angle of about five degrees; therefore the moon may be in ſuch a poſition from the nodes, as to paſs the oppoſition or conjunction, either too high or too low to fall into the earth's ſhadow, or to have her ſhadow or penumbra fall upon the earth. Hence it is very poſſible every full and new moon may not be eclipſed. And it will farther appear, that no eclipſe can happen but when the moon is near one of her nodes; conſequently the quantity of the eclipſe depends upon the diſtance from it: and of both kinds it may be either total, partial, or central.

Let E (*fig.* 4.) repreſent the earth, S, S, S, three different poſitions of the ſun, and M, M, M, M, M, M, various places of the moon in her orbit; let us now ſuppoſe a conjunction or an oppoſition to be made at B or C, at both which places the moon happens to be exactly in the nodes; conſequently, in either of them there will be a central eclipſe. Again, let us imagine the true ſyzigy at D or E; in both thoſe points the moon has conſiderable latitude, and can only produce a partial eclipſe. Farther, if the moon be removed to G or H, there will be no eclipſe at all. Thus, in any part of the moon's orbit, by knowing the moon's diſtance from either node, the limits of eclipſes, both ſolar and lunar, may be eaſily determined; that of the ſun will be found nearly 18°, and that of the moon 12°. Hence it is that eclipſes of the ſun, in general, are more frequent than thoſe of the moon; although in any particular place they are much fewer.

Now from the horizontal parallaxes of the ſun and moon, and their apparent ſemi-diameters, the poſſibility of a ſolar eclipſe is thus determined:

Let A *fig.* 5. repreſent the ſun, B the earth, and C the moon; then the angle HEG will be the apparent diameter of the ſun, ſeen from the earth's center; and QER the apparent diameter of the moon ſeen from the ſame place; and conſequently her ſhadow: hence, LKM will be the penumbral cone, limiting the utmoſt extent of ſuch an eclipſe, and WZ the quantity of the earth's ſurface involved in the real ſhadow at the ſame time. Now to find the apparent diameter of the penumbra in the moon's orbit, we have given the points L and M, upon the earth's ſuperficies; in which, when the moon is at C, the circles XQ and RT will repreſent the ſun's apparent diſk free from obſcuration.

To the inhabitants at L the moon's north limb will juſt touch the ſun's ſouth one, and may here repreſent the beginning of an eclipſe; when, at the ſame time, to the people at M the moon's upper limb will juſt go off the ſun's lower limb, repreſenting to them the end of an eclipſe.

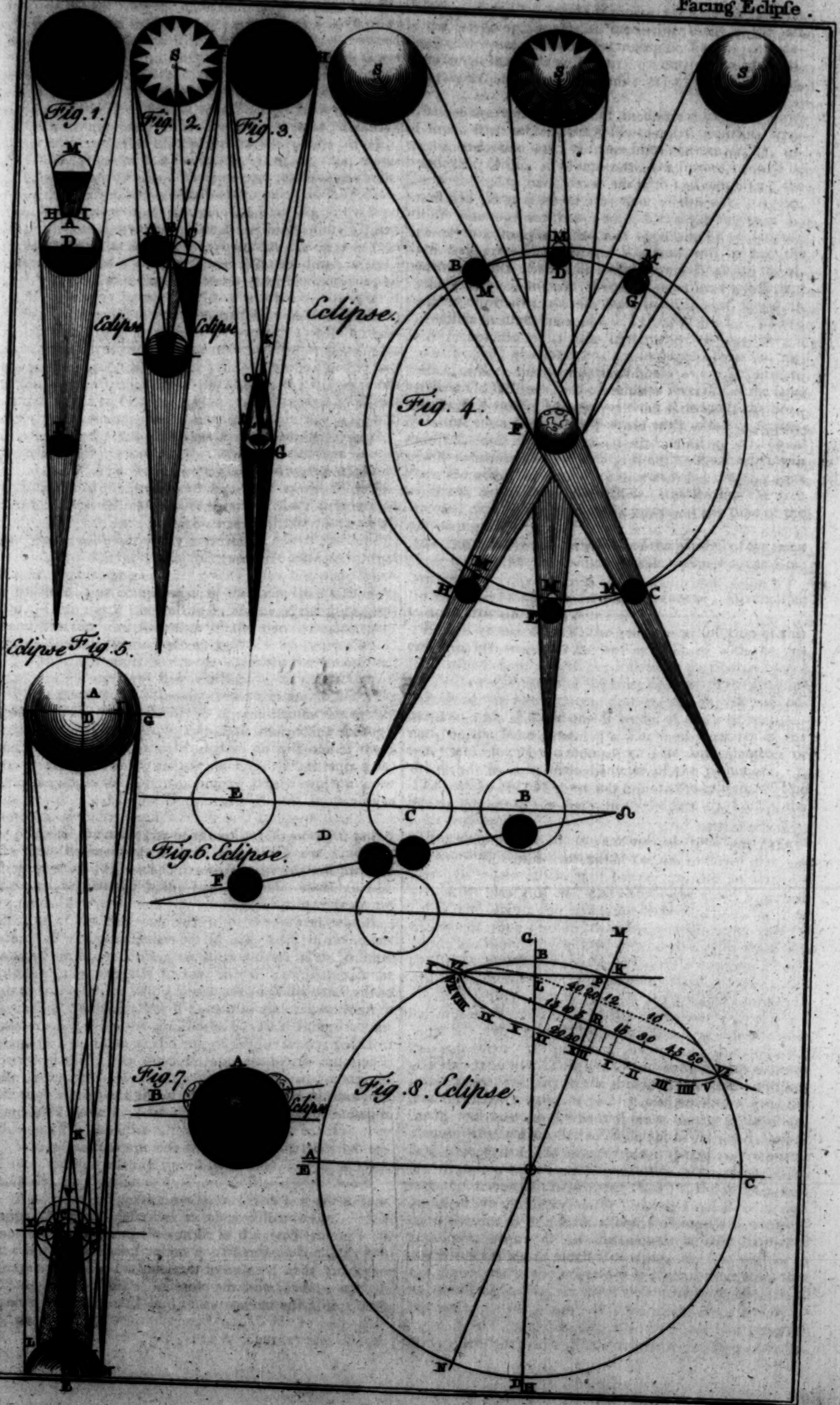
Thus it appears, that the diſtance of the two centers, S and Y, is equal to the apparent diameter of the penumbra; wherefore upon F, with the ſum of the ſemi-diameters of the ſun and moon, equal to the angle FMY, deſcribe the circle SYP, and it will repreſent the penumbra in the moon's orb.

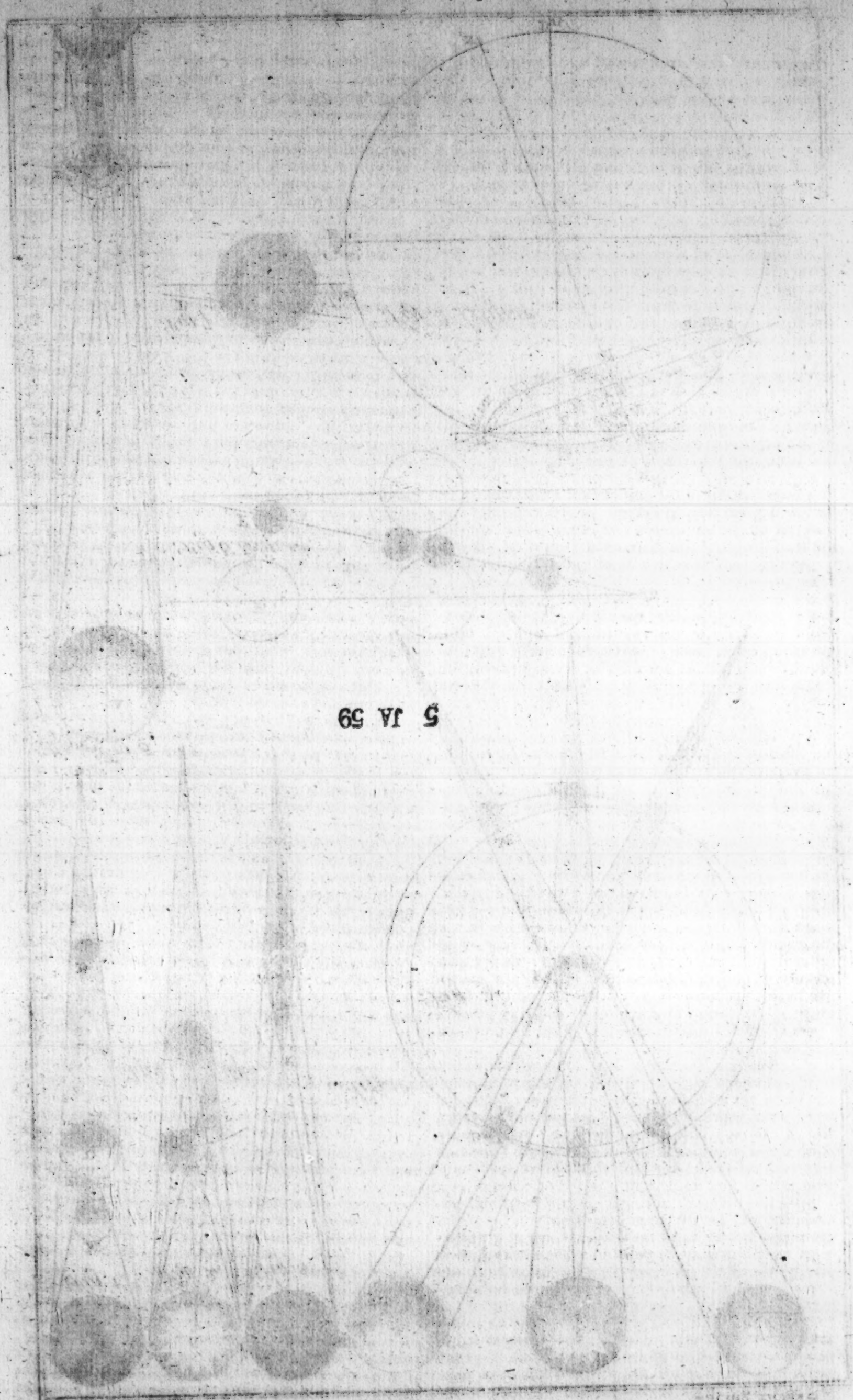
It is to be obſerved, if in the above figure C repreſents the moon perpendicular to the equator, and N the north pole, M will be the north limit, and L the ſouth limit of the ſaid eclipſe. Again, to find the apparent diameter of the earth's diſk in the moon's orb, you have given the horizontal parallax of the ſun NDE, and EFN, the horizontal parallax of the moon; draw the line IO parallel to DKE, then will the angles EDN and DNI be equal. Therefore out of the angle FNO, equal to the moon's horizontal parallax, take the angle TNO, that of the ſun, and there will remain the angle ENT equal to the apparent ſemi-diameter of the earth's diſk in the moon's orb. Hence upon the center F, with the difference of the horizontal parallaxes of the ſun and moon ENT, deſcribe XVT, and it will repreſent the ſame.

Now, as was ſaid before, if none of this penumbra fall within the ſaid diſk, there can be no eclipſe: for let E (*fig.* 6.) be the diſk in the ecliptic, and F the penumbra in the moon's orbit, F & is the diſtance of the luminaries from the node: here it is plain that the moon's latitude is greater than the ſum of the ſemi-diameters of the diſk and penumbra, and therefore no eclipſe can happen to that part of the moon's orbit: but if the ſum of the ſemi-diameters of the diſk and penumbra be greater than the moon's true latitude, as at C, then an eclipſe muſt unavoidably

PLATE LVII.

Facing Eclipse.





5 JA 59

avoidably happen to ſome place: and if the moon's latitude be leſs than the ſemi-diameter of the diſk; as at B, the eclipſe will be central, and ſomewhere may be total. And further, if all the penumbra fall within the diſk, as at A, *fig.* 7. the ſame for ſome time may be general. It is to be noted that in partial eclipſes the center of the penumbra falls without the diſk.

The geometrical conſtruction of ſolar eclipſes for particular places of the earth.

Lemma I. To an obſerver in the ſun the earth's enlightened hemiſphere would appear a ſuperficial diſk: to him the ſeveral parts of land and water would directly appear as if projected on a plane; conſequently, if circular lines, ſuch as the meridians, parallels, &c. were drawn or imagined upon it, there may be conceived an orthographical projection of the ſphere.

II. Every place upon the earth's ſurface, to the eye as above, in each diurnal revolution, apparently deſcribes an elliptical path, or otherwiſe a right line, parallel to the equator; the axis of which, at different times of the year, is variouſly inclined to the right, or to the left, from the axis of the ecliptic; that is,

III. During the ſun's progreſs through the ſummer and autumn ſigns, to wit ♋, ♌, ♍, ♎, ♏, and ♐, the axis of the earth projected on the above plane lies to the left of the axis of the zodiac; but if the ſun be in any of the other oppoſite ſigns, it will on the contrary be thrown to the right. If the ſun's place be in any of the north ſigns, that is, ♈, ♉, ♊, &c. the north pole will be enlightened; but if otherwiſe, to the ſouth, it will be obſcure.

Corollary. The conjugate diameter of every elliptical path apparently increaſes and decreaſes, as the ſun's declination doth increaſe or decreaſe. If the ſun is in the equinoctial, the path of each vertex will then be a right line, but at all other times orbicular.

It is to be obſerved, that the tranſverſe diameter of the ellipſis, repreſenting the path of any place, is always equal to twice the ſine complement of the reſpective latitude; and the conjugate one to the difference of the ſines, betwixt the ſum and difference of the two complements, latitude and the ſun's declination.

Prob. I. To repreſent the path of any vertex on the earth's diſk, as viewed from the ſun.

The general rule.—Having drawn a circle as ABCD, (plate LVII. *fig.* 8.) let it be ſuppoſed to be the earth's enlightened diſk; then, by two right lines paſſing through the center, croſs it at right angles; ſo will one of them repreſent a part of the ecliptic, as EC; the other its axis, as GH; ⊙ is the vertex point, or where the ſun is in the zenith; and B and D the ecliptic pole in the ſolar horizon.

Now, as the obliquity of the ecliptic is nearly 23° 30′, ſet this diſtance from B both ways to I and K; then draw the line IK, and ſomewhere in it you will find the elevated pole thus: Make half this line, namely, IL, equal to the radius of a line of ſines, and upon it ſet off the ſine of the ſun's diſtance from the ſolſtitial colures; which is here repreſented by the axis BD, from L, towards I or K, according to what quarter of the ecliptic the ſun is in; that is to ſay, if the ſun's longitude be given in ♑, ♒, ♓, ♈, ♉, or ♊, the ſaid diſtance will be from L towards K; but if in any of the others, from L towards I. Thus let the ſun be ſuppoſed in the beginning of Taurus, or at the end of Aquarius, the pole will be found at P; if in the former, it will be viſible; if in the latter, inviſible, being then remote and obſcure; through which, and the center of the diſk, if you draw the line MN, it will repreſent the axis of the world; and in this caſe P will be the north pole.

When the ſouth pole is elevated, it may eaſily be conceived, every plane lying in oppoſition, that the above rule will be reverſed.

Again, to delineate the ellipſis which any given place upon the earth deſcribes in twenty-four hours; if in north latitude, and the ſun be in the northern ſigns (or the latitude and declination be of the ſame kind) or if in ſouthern (or the latitude and declination be of a different kind) the difference of the ſun's declination and the pole's elevation will be the diurnal interſection, or the ſign of the ſun's meridional diſtance that day from the path of the ſaid place; and for the nocturnal interſection of the ſame, the direct contrary, that is, if their ſum be that, their difference will be this.

Thus, ſuppoſe I would repreſent the path of London in the foregoing figure, the ſun being then in the laſt ſcruple of Aries, or at the beginning of Taurus: his declination at that time will be 11° 30′ north; this added to, and ſubtracted from, the latitude 51° 32′ north, the ſum is 63° 2′, and the difference 40° 2′.

Make the ſemi-diameter of the diſk the radius of a line of ſines, from which take thoſe two laſt numbers ſeparately, and place upon the axis from the center, ⊙, towards the pole P, if illuminated, the former 12 will be the nocturnal interſection of the arch and meridian; the later XII the viſible one, or that of the day. Again, biſect that part of the axis 12 XII at right angles in R, and on this line place the ſine complement of latitude both ways from R to VI and VI, thus will be had the extreme points of each diameter, through which the ellipſis or curve is to paſs. Now to determine a ſufficient number of other points, in order to be as near the truth as poſſible in protracting the ſaid ellipſis, make R VI and R XII each the radius of a different line of ſines: then if from the firſt, you take the ſines in degrees from the meridian, of ſuch hours or parts of hours as are required to be ſhewn in the path, and place them ſeverally in the ſame tranſverſe diameter both ways, from R towards the horizon, and from the points ſo made erect as many perpendiculars, ſuch as 20, 5, 40, 40, 10, 20, 1, 15, &c. equal to the coſines of the ſaid arches, to each reſpectively taken from the other, or ſecond ſcale, you will have 24 points or hours, with other ſubdiviſions, repreſenting the true way and exact place of the ſaid vertex, at any time of the day or night.

In like manner may be projected the parallel of the ſame place at any other time, and of various places at the ſame time, &c.

Prob. II. To conſtruct the appearance of a ſolar eclipſe to any particular place, &c.

Before we can come at the geometrical ſolution of this problem, we ought to be well acquainted with the general calculation, at leaſt the following particulars.

1. The middle time of the eclipſe, or of the neareſt approach of the two centers, that is, of the disk and penumbra. 2°. The moon's latitude, at the true conjunction, at the ſame time. 3°. The ſemi-diameter of the ſun. 4. That of the moon. 5. The ſemi-diameter of the diſk. 6. The ſemi-diameter of the penumbra. 7. The inclination of the moon's orbit to the ecliptic. 8. The hourly motion of the moon from the ſun. 9. Laſtly, the ſun's declination.

For example, in the ſun's eclipſe of April 21, 1715, in the morning, the ſun in ♉ 12° 14′ 41″.

The 1		21h 42′ 18″ P. M.
2		44. 12 N. D.
3		15. 58
4		16. 46
5	was	61. 30
6		32. 45
7		5° 34. 52
8		35. 35
9		15° 34. 12

Theſe requiſites being accurately known from aſtronomical tables, we may in the next place proceed to repreſent the moon's way, or path of the penumbra over the earth, and how to divide the ſame to any given place. Having deſcribed the circle ABCD (pl. LVIII. *fig.* 1.) as before, to repreſent the disk, and upon it the path of the place, &c. draw a perpendicular line to the radius of the disk, take the inclination of the moon's orb to the ecliptic, and lay it on the perimeter of the disk, as from B to E, and draw the line E ⊙; ſuch a one will repreſent the perpendicular required. If the moon's latitude be either north deſcending or ſouth aſcending, this line will lie to the right hand of the ecliptic pole; but if otherwiſe, that is, north aſcending, or ſouth deſcending, to the left of the ſame.

Again, from a ſcale in proportion to the diſk, take the moon's latitude, and place it on this line, as from ☉ to H; through H draw a line, ſuch as I K, at right angles to ☉ E, now ſuppoſed the axis of the moon's way, and it will repreſent the path of the penumbra, or the center of the general eclipſe. Now to divide the ſaid path properly to the time, at any given place; firſt, fix the time at or near the middle, according as it happens, by making proportionable allowances, as the minutes more or leſs require; then, from that point, by the hourly motion of the moon from the ſun, the motion of the whole duration may be divided into time, which, if marked reſpectively, will ſhew the place of the penumbra in its paſſage over the diſk, at every hour and minute of the ſaid continuation.

Thus, according to the hourly motions of the ☾ from the ☉, ſuppoſing the middle of an eclipſe, at London, to be 42′ paſt 9 o'clock in the morning, the path muſt be divided, &c. as in the *fig*.

As one hour of time is to the hourly motion in minutes and ſeconds of the moon from the ſun, ſo is any number of minutes in time to minutes of motion: hence, by the foregoing calculation, 60′ : 30′ 35″ :: 42′ 18″ : 25′ 6″, which, placed in the path from *a* to *b*, gives the place of the center (penumbra) at 22 hours or X of the clock.

In the above-mentioned eclipſe, proceeding as above directed, the points for 11 o'clock, and 9, by opening your compaſſes to 35′ 35″, will be found at *c* and *d*; the reſt as is repreſented in the *fig*. from which you may learn to divide, ſubdivide, and mark the ſame accordingly.

In like manner, if regard be had to the difference of meridians, any path may be divided to different places.

1. To determine the apparent time of the beginning, middle, and end of an eclipſe.

Take between your compaſſes, in proportion to that of the diſk, the ſemi-diameter of the penumbra; and, with one foot in the moon's way, moving it from the left hand towards the right, find ſuch a point, that the compaſſes ſo placed, as at *e*, the other foot may fall upon the ſame hour and minute in the path of any given vertex, as at *g*; thus will each leg point to the beginning of the eclipſe at that place.

Again, your compaſſes remaining at the ſame extent, find another point in the ſaid path, on which, if one foot be placed, the other, as before, may cut the ſame hour and minute in the path of the place, then will either point ſhew the end of the eclipſe.

To determine the requiſites at London.—From any ſcale of equal parts = 61′ 30″, the radius of the diſk, take the extent of 32′ 45″, the ſemi-diameter of the penumbra in the ſame *fig*. and that diſtance applied from one path to the other, as is taught above, you will find both pointing to 8^h 7′, the time ſought.

Likewiſe, at the end (ſee the ſame *fig*.) upon K and I, there ſhewing the hour 24′ paſt 10. Again, at M and N, the equal times in a perpendicular to the moon's way, you will find 9^h 24′, the greateſt obſcuration, or the neareſt approach of the two apparent centers (☉ and ☾), upon which, if two circles be drawn, that is, one upon M = 13′ 58″, the ſemi-diameter of the ſun; and another upon N = 16′ 46″, that of the moon, from the ſame ſcale; the latter will cut off from the former juſt ſo much as the viſible obſcuration will be.

In this manner you will find the preceding eclipſe at London will be total, and exactly 12 digits. It is to be noted, that, the air happening to be very clear when this eclipſe was obſerved, ſeveral of the planets and fixed ſtars, during the time of total darkneſs, became viſible to the naked eye.

2. To find the middle.—Apply the one ſide of a ſquare to the moon's way; ſo placed, move it backward, or forwards, until the other ſide cut equal time in each path; that is, the ſame hour and minute in one as in the other; the time ſo found will be that of the greateſt obſcuration.

3. To find the number of digits, the ſun's diameter being divided into twelve, that are eclipſed.

This is known by deſcribing two circles upon the two laſt points, which determine the middle of the eclipſe, that is, one upon the point in the path of the vertex, with the ſemi-diameter of the ſun; the other in the moon's way, with the ſemi-diameter of the moon. Thus will the quantity obſcured be ſhewn in the ſun's diameter, cut by the moon's limb.

4. How to project the viſible appearance of the eclipſe. Let M repreſent the ſun, and N the moon, at the middle of the eclipſe; draw the line ☉ M V (*fig*. 1.) as alſo M N; then will ☉ V repreſent the vertic circle, and V N M the angle of obliquity, as made by the line of connexion M N: conſequently, O being the vertic point of the ſun's limb, if the ſaid lines be reverſed, as in the above *fig*. the poſition of the viſible eclipſe, with reſpect to a perpendicular paſſing through the ſun, may be naturally ſhewn, not only at the middle, but, if required, at both the beginning and end.

In eclipſes that continue for ſome time total, or annular, if, inſtead of the ſum of the ſemi-penumbra of the ſun and moon, you make uſe of their difference, that is, if inſtead of the penumbra for total darkneſs, you make uſe of the umbra, you may eaſily find the beginning and ending of the ſame.

Prob. 3. To find at any time, and in any part upon the earth's ſurface, the ſpecies of the total ſhadow, or of the annular ſection of the penumbra.

The general rule.—Upon the center point, as at A, (*fig*. 2.) deſcribe a circle equal to the difference betwixt the apparent diameter of the ſun and moon; this circle ſhall project upon the globe the true quantity of the ſaid ſhadow or penumbral ſection; therefore, if you take the dimenſion of it from a ſcale of ſines, in proportion to the radius of the diſk, and transfer it upon a plane, you will have the true poſition, figure, and direction, upon the earth; which in all parts of the world, but where the ſun is vertical, will be an ellipſis, and more or leſs irregular, according to its diſtance from the ſolar horizon. The direction of the middle, it is to be noted, is various, according to the ſeaſon of the year and time of the day.

The obliquity of the figure entirely depends upon the ſun's altitude; and, in eclipſes that happen near the horizon, is very much diſtorted during its ſtay on the illuminated hemiſphere; upon every different country it is continually changing its ſhape, and putting on a new form, ſuch as A, B, or C (*fig*. 3.)

It is to be noted, that the ſection of every cone, &c. made by a ſpherical ſurface, is not eaſily determined any other way but by conſtruction; in the vaſt penumbra it is beſt underſtood by throwing a diſtinct ſhadow upon a round ball or globe.

The longer or tranverſe diameter always coincides with the line of the ſun's azimuth; the conjugate is at right angles with it.

Let E (*fig* 2.) be the earth's diſk, A the moon's center in the line of her paſſage over it, N O, and the circle B C D E, the ſpace or portion of the earth's ſurface to be delineated. Draw the diameter G A H, and at right angles to this the line I K paſſing through the center of the penumbra; alſo a perpendicular to the path, as L M. Now, if to theſe be drawn other lines parallel, ſuch as *a b*, *c d*, *e f*, *g h*, *i k*, *l m*, *n o*, and *p q*, equal to the radius A B; then will *a* N *c*, *f* M *h*, and *i m*, be the true dimenſions of the ſaid ſhadow or penumbra, in all its parts from the center; that is, *i m* will be the ſhorteſt diameter, and *o q* the longeſt; *a c* will be the perpendicular breadth, and *f h* the obliquity; which, if meaſured in degrees, and reduced into geographical miles, you may eaſily know both its limits and direction.

That narrow compaſs, called the umbra, or the ſmall annular ſpace of the penumbra, approaches nearly to a plane, being the ſection of a cone cut by a ſpherical ſurface: whence it will appear (Eu. lib. iii. p. 6.) that the center of the baſe of the cone is not the real center of the eclipſe.

Scholia. The duration of total darkneſs, and conſequently the extent of the umbra, penumbra, or entire eclipſe to different places, along or near the path of the moon's center, is vaſtly various upon account of the un-

equal elevation of the luminaries above the horizon: for the moon is much nearer to a ſpectator upon the earth, when ſhe is in the meridian, than when ſhe is riſing or ſetting; and when ſhe is in the zenith of any place, ſhe is nearer by a ſixtieth part of her diſtance from us, than when ſhe is in the rational horizon; and, in conjunctions which happen near the zenith, this is therefore conſiderable, for which a particular allowance muſt be made.

The duration of a ſolar eclipſe, in any particular place, is more or leſs, according as it happens nearer to or farther from noon; by reaſon that, near ſix o'clock, the diurnal motion conſpires with the ecliptic one leſs than at 12 o'clock at noon. The velocity of the ſhadow is very unequal, ariſing not only from the inequality of the moon's proper motion, but alſo from the oblique variation of every horizon; but as the latitude and the longitude of any point, in its direction, may be eaſily known, there can be no great difficulty in finding it.

Of the general Tranſit of an ECLIPSE, &c. and how to find the time and particular place of the beginning, &c. of the general eclipſe.

Let BRCN (*fig.* 4.) repreſent the earth's diſk in the ecliptic, BC and FK, &c. the moon's way or paſſage of the penumbra over it, P the north pole. Now the time when the moon's center will be at FDIHME and R is required. In the firſt place, here is given FO = KO, the ſum of the ſemi-diameters of the diſk and penumbra; ſecondly, DO = OE, the ſemi-diameter of the diſk; and laſtly, MO, the neareſt approach of the luminaries to the center of the diſk, to find FOH and DOH, the two angles of incidence. By the ſolution of a right angled triangle, having found the reduction MH, ſay, As OP or DO is to the radius, ſo is HO to the ſine complement of the angle HOF or DOH: then to find the ſemi-duration FH or HK, the analogy is, As the radius is to FO; ſo is the angle of incidence FOH to FH: or by Eucl. i. 47. $FH = \sqrt{FO^2 - HO^2}$. In like manner may be found DH = HE; which, if divided by the hourly motion of the moon from the ſun, will give each reſpective arch in time; this added to, or ſubtracted from, the time of the greateſt obſcuration, will give the beginning and ending of the general eclipſe, &c.

Now, to find the latitude and longitude of thoſe places upon the earth, over which the center of the penumbra paſſes, O will be that place to which the ſun is vertical; its latitude is always equal to the ſun's declination; and its longitude, from the place to which the tables are accommodated, is equal to the time from noon in that place reduced into degrees and minutes: hence the poſition of the center is known; and conſequently, by the doctrine of ſpherics, the latitude and longitude of any given point, ſuch as G, D, I, H, M, E, or L, may be found. G is the place where the ſhadow firſt touched the earth; D the place where the center firſt comes on, I the point where the ſun is eclipſed in the univerſal meridian; H the place where the center falls; M the nonageſimal degree; E the place where the center goes off from the earth; L the place where the penumbra leaves it.

The mean velocity of the ſhadow over the earth is always equal to the hourly motion of the moon from the ſun in the moon's orbit, reduced into geographical miles.

Lunar ECLIPSES are occaſioned by the interpoſition of the earth betwixt the ſun and the moon, whereby the moon is deprived of her luſtre by falling into the earth's ſhadow; and for the ſame reaſon as to quantity and duration, is both general and univerſal. A lunar eclipſe can never happen but at the full, and when the moon is leſs than half a ſign from one of the nodes. Now the moon, although deprived of the direct ſolar beams, is not abſolutely hid from us at the ſame time, as at the change; becauſe the rays of light paſſing through our atmoſphere are refracted, and thrown obliquely into the real ſhadow, and thereby faintly illuminate the whole cone: hence it is that the moon's body remains viſible to us, though it be totally eclipſed.

The beginning and ending, &c. of a lunar eclipſe are found in the ſame manner by the angles of incidence, &c. as has been before ſhewn of the ſun's eclipſe, only with this difference, that, whereas in the latter it is underſtood of the diſk and penumbra, here the ſame is to be underſtood of the moon and the earth's ſhadow.

To find when there will be an eclipſe of the moon, and when not.—Let AE (*fig.* 5.) repreſent the path of the earth's ſhadow at the diſtance of the moon near the node ☊, and FH a part of the lunar orbit, and the ſection of the earth's ſhadow be delineated at ☊, B, C, D, and the full moon at ☊, I, N, G; then it is evident, where the leaſt diſtance of the centers of the moon and ſhadow exceeds the ſum of their ſemi-diameter, there can be no eclipſe of the moon, as at D; but, where that diſtance is leſs, the moon muſt be partly or wholly involved in the ſhadow, and ſo ſuffer an eclipſe, as at B and ☊; in which latter caſe the moon paſſes over the diameter of the ſhadow.

But in a certain poſition of the ſhadow, as at C, the leaſt diſtance of the centers NC is equal to the ſum of the ſemi-diameters; and therefore ☊C is the ecliptic limit for lunar eclipſes: to find which we have NC = 63′ 12″ nearly when greateſt, and the angle N☊C = 5° 00′. Therefore, as the ſine of the angle N☊C, is to radius; ſo is the ſide NC, to the ſide ☊C = 725′ 2″ = 12° 5′. Hence, if the moon be at a leſs diſtance from the node ☊ than 12° 5′, there will be an eclipſe, otherwiſe none can happen.

ECLIPTIC, in aſtronomy, is that circle which the plane of the earth's orbit would mark out, were it ſuppoſed to be extended to the heavens. This therefore is that which the ſun ſeems to deſcribe in his annual courſe.

The axis of the ecliptic is a right line ſuppoſed to paſs through the center of the ſun, and to be perpendicular to the plane of the ecliptic; and the points in the heavens, to which this axis is directed, are called its poles; and the great circles paſſing through theſe poles will be perpendicular to the ecliptic, and therefore called its ſecondaries, and ſometimes circles of longitude.

By means of theſe the place of any ſtar is referred to the ecliptic, and its longitude and latitude eſtimated: for the longitude of a ſtar is an arch of the ecliptic intercepted between the firſt point of Aries, and that where one of theſe ſecondaries that paſſes through the ſtar cuts the ecliptic; and the latitude of a ſtar is the arch of the ſame ſecondary intercepted between the ſtar and the ecliptic. Upon this account all circles conceived to be drawn parallel to the ecliptic, that is, parallels of the ecliptic, are ſometimes called parallels of latitude. The latitude of a ſtar is either northern or ſouthern, as the ſtar is placed on this or that ſide of the ecliptic.

The ecliptic is divided into twelve parts, called ſigns. They begin at that point in which the ſun appears to be at the vernal equinox, and are reckoned from weſt to eaſt. The names of the ſaid ſigns, together with the characters whereby they are commonly expreſſed, are theſe that follow.

Aries.	Taurus.	Gemini.	Cancer.	Leo.	Virgo.
♈	♉	♊	♋	♌	♍
Libra.	Scorpio.	Sagittarius.	Capricornus.	Aquarius.	Piſces.
♎	♏	♐	♑	♒	♓

The firſt ſix of theſe are called the northern ſigns, as poſſeſſing that half of the ecliptic which lies neareſt the north pole of the earth; the latter, the ſouthern, as being in that which is neareſt the ſouth pole. The ſun is always ſeen in ſome part of this circle; but the planets, by reaſon of the inclination of the plane of their orbits to that of the ecliptic, appear ſometimes above it, and ſometimes below it, but never deviate from it above 7 or 8 degrees on either ſide: ſo that if we imagine a ſpace ſurrounding the heavens 16 degrees in breadth, and extended equally above and below the ecliptic, this will include all their ecliptics, ſo to ſpeak; that is, all the circles they would appear to move in when ſeen from the ſun, and is called the zodiac.

The ſigns of the ecliptic took their names from 12 conſtellations ſituated in the heavens near thoſe places. But it muſt be remembered, that the ſigns are different from the conſtellations which bear the ſame name: for the ſign Aries is not, for inſtance, in the ſame part of the heavens with the conſtellation Aries; the former is only

30 degrees of the ecliptic, counted from one of the equinoctial points; whereas the conſtellation is a ſyſtem of ſtars, the moſt of which are now ſituated between the firſt and laſt degree of Taurus: and ſo of the other ſigns. Theſe conſtellations were, in the infancy of aſtronomy, ſituated within the ſigns which now bear their names: but, by a ſlow retrograde motion of the equinoctial points, called the preceſſion of the equinoxes, the conſtellation Aries has got into the ſign Taurus, and that of Piſces into the ſign Aries; and ſo of the reſt.

It has been a ſubject of controverſy amongſt aſtronomers, whether the obliquity of the ecliptic be variable or not; that is, whether the angle between the planes of the ecliptic and equator, continues always unchangeably the ſame, or is ſubject to alteration: it is alſo diſputed among theſe writers who hold it liable to change, whether that change be regular or irregular. It is certain that the obliquity of the ecliptic is at preſent found to be above a third part of a degree leſs than Ptolemy has given it us. From Ptolemy's time down to Tycho, ſome obſervations have made it leſs, and others more, by a few minutes. They who will have the obliquity to have been always the ſame as it is at preſent, ſurmount all theſe difficulties, by throwing upon the inaccuracy of the obſervations of the ancients, and the imperfection of their inſtruments, all the differences found between them and the moderns: others think this is treating the ancients with too little reſpect; for though it appears by Ptolemy, that they did not pretend to obſerve more nicely than to a ſixth part of a degree, and their inſtruments fell far ſhort of thoſe made uſe of by the moderns; yet it can hardly be imagined they could be ſo greatly miſtaken in a matter ſo eaſy to be known, and ſo well deſerving their attention. As for thoſe who ſuppoſe that the obliquity is ſubject to a ſort of libration, increaſing in ſome ages, and decreaſing in others, they attribute a greater degree of exactneſs to the obſervations on which they ground this fancy, than they ought. Some have imagined that the obliquity has been always gradually decreaſing, the planes of the ecliptic and equator growing continually nearer to a coincidence. This opinion, beſides its being founded upon a compariſon of ancient and modern obſervations, receives a good deal of ſupport from the conſideration of the figure of the earth.

The obliquity of the ecliptic is equal to the diſtance of either tropic from the equator; the beſt way of finding it, becauſe leaſt liable to error from refraction, is to take the ſun's height when in the ſummer tropic, the height of the pole, and conſequently its complement, the height of the equator, being firſt known in the place of obſervation. There is another way of finding this, the only one made uſe of by the ancients, namely, to obſerve the ſun's meridian height in each tropic; but then refraction muſt be taken into the account, which increaſes the ſun's meridian altitude, when he is low in the winter ſolſtice, more than when he is high in the ſummer: ſo that the tropics are brought nearer to one another by refraction. For want of being aware of this, the ancients meaſured the diſtance of the tropics leſs than it really was: they all ſuppoſed the ſun's parallax too great, which in like manner diminiſhed the diſtance between the tropics, and that about twice as much as they leſſened it by not conſidering refraction. Theſe errors are no hinderance to our making uſe of their obſervations in this diſquiſition; becauſe we know what allowance to make for the conſequences they draw after them. Now, after proper allowances, the obliquity of the ecliptic comes out from the obſervations of the ancients above a third part of a degree greater than the modern aſtronomers have found it. Louville, after comparing all the ancient obſervations, was of opinion, that the obliquity of the ecliptic decreaſed at the rate of 1′ in a hundred years, and, from a great number of obſervations of his own about the year 1711, ſet it down 23° 28′ ½, which is ½ a minute leſs than Flamſtead and De la Hire made it: he goes farther, and thinks he diſcovered it to be five ſeconds leſs in the year 1720, than he obſerved it in 1714. But, notwithſtanding the great care with which his obſervations appear to have been made, ſuch a degree of exactneſs, as is here pretended, is hardly credible.

A TABLE of the OBLIQUITY of the ECLIPTIC.

	Authors Names.	Yrs. before Chriſt.	Obliquity.
L.	Pytheas — — — —	320	23° 49′ 23″
	Eratoſthenes — — —	230	23 51 20
		After Chriſt.	
	Ptolemy — — — —	140	23 48 45
F	Almamon — — — —	832	23 35
	Albatennius — — —	890	23 35
F.	Thebet — — — —	911	23 33 30
F.	Abul Wafi and Abu Hamed	999	23 35
F.	Perſian Tables in Chryſococcea	1004	23 35
F	Albatrunius — — — —	1007	23 35
F.	Arzakel — — — —	1104	23 33 30
F	Almeon — — — —	1140	23 33 30
F.	Chojah Naſſir Oddin — —	1290	23 30
F.	Prophatius the Jew — —	1300	23 32
F.	Ebn Shatir — — — —	1363	23 31
	Ulug Beigh — — —	1437	23 30 17
R.	Purbachius and Regiomontanus	1460	23 28
R.	Waltherus — — — —	1476	23 30
R.	Wernerus — — — —	1510	23 28 30
	Copernicus — — —	1525	23 28 24
R.	Egnatio Danti — — —	1570	23 29
	Prince of Heſſe — — —	1570	23 30
	Tycho Brahe — — —	1584	23 31 30
	Wright — — — —	1594	23 30
	Ricciolus — — — —	1646	23 30 20
F.	Hevelius — — — —	1653	23 30 20
L.	Caſſini — — — —	1655	23 29 15
	Richer — — — —	1672	23 28 54
	De la Hire — — —	1686	23 29
	Flamſtead — — — —	1690	23 29
L.	Bianchini — — — —	1703	23 28 25
	Roemer — — — —	1706	23 28 41
	Louville — — — —	1715	23 28 24
	Godin — — — —	1730	23 28 20
	Caſſini's Elements d'Aſtronomie	1738	23 28 20

The letter F on the ſide of the tables intimates the obſervation to be taken from Flamſtead; R from Ricciolus's Almageſt; L from Louville; and thoſe without a letter are from the authors themſelves.

If there be any change in the obliquity of the ecliptic, which it is very probable, it may be cauſed either 1. by a change in the inclination of the earth's axis, the plane of the earth's orbit continuing immoveable; or, 2. by a change in the plane of the earth's orbit, the axis of the earth continuing parallel to itſelf; or, 3. by a change both in the inclination of the axis and in the ſituation of the earth's orbit. The firſt of theſe ſeems moſt likely to be the caſe; for if we conſider the ſhape of the earth, that it is an oblate ſpheroid, or a globe a little flatted like a turnep, having its diameter at the poles a little ſhorter than at the equator; and that, by reaſon of this figure of the earth, the attraction of the heavenly bodies will act upon it in the ſame manner as if it had a ring round the equator; and that the ſun, being in the plane of the ecliptic, is perpetually pulling this ring, or the protuberant parts about the equator of the earth, towards a coincidence with the plane of the ecliptic; which action of the ſun, together with the like attraction of the moon, is the cauſe of the preceſſion of the equinoxes; and if this be conſidered, it will not appear improbable, that theſe actions of the ſun and moon, which have a continual tendency to bring the plane of the earth's equator nearer to the plane of the ecliptic, ſhould gradually diminiſh the angle between theſe planes. The moon indeed, being nearer to the earth, contributes more than the ſun towards this effect, by her attraction; for though ſhe be but twice a month in the ecliptic, yet ſince ſhe is always near it, never deviating much above five degrees from that circle; and theſe deviations are as much towards the north in one half of her period round the earth as they are towards the ſouth in the other; they will ſo balance one another, that the effect of the whole attraction of the moon will be pretty much the ſame, as if ſhe were carried round the earth exactly in the plane of the ecliptic.

However,

However, all changes in the poſition of the ecliptic are not to be abſolutely excluded; for, as the planets move round the ſun in different planes, their mutual attractions muſt have a tendency to change the ſituation of all their planes, and bring them nearer to a coincidence with one another: but then the diſtance of the planets from each other is ſo great, that the change here mentioned may be ſo exceedingly ſmall as not to become ſenſible in many ages.

ECLOGUE, in poetry, a little elegant compoſition in a ſimple natural ſtyle.

The word is derived from the Greek, ἐκλέγω, to ſelect.

The eclogue, in its primary intention, is the ſame thing with the idyllium; but cuſtom has likewiſe made ſome difference between them, and appropriated the name eclogue to pieces wherein ſhepherds are introduced; and idyllium to thoſe written like eclogues, but without any ſhepherds in them.

The eclogue then is properly an image of the paſtoral life; therefore the matter is low, and its genius humble. Its buſineſs is to deſcribe the loves, ſports, piques, jealouſies, intrigues, and other adventures of ſhepherds; ſo that its character muſt be ſimple, the wit eaſy, and the expreſſion familiar. The true character then of the eclogue is ſimplicity and modeſty: its figures are neat, the paſſions tender, the motions eaſy; and though ſometimes it may have little tranſports and deſpairs, yet it never riſes ſo high as to be fierce or violent. Its narrations are ſhort, deſcriptions little, the thoughts ingenious, the manners innocent, the language pure, the verſe flowing, the expreſſions plain, and all the diſcourſe natural.

The models in this ſort of poetry are Theocritus and Virgil, who both have ſome eclogues of a lofty character: the eclogue, therefore, occaſionally raiſes its voice. Yet M. Fontenelle eſteems it a fault in ſome modern poets to have put matter of high concern in their eclogues, and made their ſhepherds ſing the praiſes of kings and heroes.

Some imagine the name eclogue to have been originally applied to ſuch poems as were written in imitation of others; ſuch are the eclogues of Virgil, which are only imitations of Theocritus.

ECLOGUE is alſo applied to certain compoſitions in proſe: ſuch are thoſe of Strabo, Diodorus, &c. in which ſenſe the word ſignifies only an extract, or collection.

ECOUTE, in the manege, a pace or motion of a horſe, when he rides well upon the hands and the heels, is compactly put upon his haunches, and hears or liſtens to the heels or ſpurs, and continues duly ballanced between the heels, without throwing to either ſide. This happens when a horſe has a fine ſenſe of the aids of the hand and heel.

ECPHORA, in architecture, commonly ſignifies the diſtance between the extremity of a member or moulding, and the naked of the column, or any other part it projects from. Some authors, however, account for the ecphora from the axis of the column, and define it to be the right line intercepted between the axis and the outermoſt ſurface of a member or moulding.

ECPHRACTICS, in medicine, remedies which attenuate and remove obſtructions.

ECPIESMA, in ſurgery, a ſort of fracture of the cranium, when the bones are much ſhattered, and, preſſing inwardly, affect the membranes of the brain.

ECPIESMA, in pharmacy, ſignifies the maſs remaining after the juices of vegetables have been preſſed out; and, in this ſenſe, is the ſame as magna. It ſometimes further imports the juice preſſed out.

ECTASIS, in grammar, the ſame with diaſtole. See the article DIASTOLE.

ECTHESIS, in church hiſtory, a confeſſion of faith, in the form of an edict, publiſhed in the year 639, by the emperor Heraclius, with a view to pacify the troubles occaſioned by the Eutychian hereſy in the Eaſtern church.

ECTHLIPSIS, ἐκθλῖψις, among Latin grammarians, a figure of proſody, whereby the *m* at the end of a word, when the following word begins with a vowel, is elided, or cut off, together with the vowel preceding it, for the ſake of the meaſure of the verſe: thus they read *mult' ille*, for *multum ille*.

ECTROPIUM, in ſurgery, is an inverſion of the eye-lids, when they are ſo retracted that their interior red ſkin becomes prominent, and the eye cannot be ſufficiently covered by them.

The word is derived from the Greek, ἐκτρέπω, to invert.

ECTYLOTICS, in pharmacy, remedies proper for conſuming calloſities. See the article CALLUS.

ECTYPE, in antiquity, is an impreſſion of a medal, ſeal, or ring; or a figured copy of an inſcription, or other ancient monument.

The word is derived from the Greek, ἐκ and τύπος, reſemblance; becauſe it reſembles the original.

ECU, or ESCU, a French crown; for the value of which ſee the article EXCHANGE.

ECUSSON, in heraldry, a little eſcutcheon.

EDDISH, or EADISH, the latter paſture or graſs that comes after mowing, or reaping; otherwiſe called eagraſs, earſh, and etch.

EDGINGS, in gardening, the ſeries of ſmall, but durable, plants, ſet round the edges or borders of flower-beds, &c. The beſt and moſt durable of all plants for this uſe is box, which, if well planted, and rightly managed, will continue in ſtrength and beauty for many years. The ſeaſons for planting this are the autumn, and very early in the ſpring: and the beſt ſpecies for this purpoſe is the dwarf Dutch box. The edgings of box are now only planted on the ſides of borders, next walls, and not, as was ſome time ſince the faſhion, all round borders or fruit beds, in the middle of gardens, unleſs they have a gravel walk between them, in which caſe it ſerves to keep the earth of the borders from waſhing down on the walks in hard rains, and fouling the gravel.

In the laſt age it was alſo a very common practice to plant borders, or edgings, of aromatic herbs, as thyme, ſavory, hyſſop, lavender, and the like: but theſe are all apt to grow woody, and to be in part, or wholly deſtroyed in hard winters. Daiſies, thrift, or ſea july-flower, and chamomile, are alſo uſed by ſome for this purpoſe; but they require yearly tranſplanting, and a great deal of trouble, elſe they grow out of form; and theſe are alſo ſubject to periſh in very hard ſeaſons.

EDHELING, *Edhelingus*, the ſame with Atheling. See the article ATHELING.

EDICT, *Edictum*, in matters of polity, an order or inſtrument, ſigned and ſealed by a prince, to ſerve as a law to his ſubjects.

EDIFICE, the ſame with building. See BUILDING.

EDILE, or ÆDILE. See ÆDILE.

EDINBURGH, the capital city of Scotland, ſituated about one mile ſouth of Leith, and of the Firth of Forth, eighty-two miles north-weſt of Newcaſtle, and about three hundred north-weſt of London: weſt long. three degrees, and fifty-ſix north lat.

Here the parliament of that ancient kingdom uſed to aſſemble, before its union with England; and here the ſupreme courts of juſtice for North-Britain are ſtill held. It has likewiſe a celebrated univerſity, and exceeds all the cities of the world for the loftineſs of its buildings, which are all of hewn ſtone, faſhed, and ten, eleven, or more ſtories high: it is alſo remarkable for the ſpaciouſneſs of its High-ſtreet, its Caſtle, the palace of Holyrood-houſe, &c.

EDITOR, a perſon of learning, who has the care of an impreſſion of any work, particularly that of an ancient author.

EDUCATION is the bringing up and forming the minds of children, either in point of learning or good manners.

The word is formed from the Latin, *educo*, to bring up.

EDULCORATION, in pharmacy, the ſame with dulciſying. See the article DULCIFYING.

EDULCORATION, in chemiſtry, is the ſweetening or clearing of any matter from impurities, eſpecially the ſalts it may be impregnated with, by waſhing it thoroughly in common water; ſo that it is the ſame with ablution.

The word is derived from the Latin *edulcoro*, to ſweeten, and that from *dulcis*, ſweet.

EEL, *Anguilla*, in ichthyology, a ſpecies of muræna. See the article MURÆNA.

EEL-BACKED, an appellation given to ſuch horſes as have black liſts along their back.

EEL-SPEAR, a forked inſtrument with three or four jagged teeth, uſed for catching of eels: that with the four teeth is beſt, which they ſtrike into the mud at the bottom of the river, and if it ſtrike againſt any eels, it never fails to bring them up.

EFFECT is that which reſults from, or is produced by, any cauſe. See CAUSE.

EFFECTIONS, in geometry, are uſed in the ſame ſenſe with the geometrical conſtruction of propoſitions, and often of problems and practices, which, when they are deducible from, or founded upon, ſome general propoſition, are called the geometrical effections thereunto belonging.

EFFERVESCENCE, in a general ſenſe, ſignifies a ſlight degree of ebullition in liquors expoſed to a due degree of heat. But the chemiſts apply it to that ebullition which is excited when two ſubſtances of different natures, an alcali, for example, and an acid, are mixed together. If the efferveſcence produces a heat in the ſubſtance ſo mixed, it is called a hot efferveſcence; but, if no heat is excited, it is a cold efferveſcence.

The chemiſts formerly confounded efferveſcence with fermentation; but the learned Boerhaave has very judiciouſly limited the ſignification of fermentation to that inteſtine motion of vegetable juices, which produces either a vinous ſpirit or vinegar; and calls all other ebullitions, produced by the mixture of bodies, efferveſcences.

The word is derived from the Latin, *effervco*, to boil over.

EFFICACIOUS, a term uſed by divines, in ſpeaking of grace; importing ſuch grace, as never fails to produce its effect. See GRACE.

EFFLORESCENCE, among phyſicians, the ſame with exanthema. See the article EXANTHEMA.

EFFLUENT FEVER, the ſame with an inflammatory one. See the article INFLAMMATORY.

EFFLUVIA, minute particles which exhale from bodies.

The word is derived from the Latin *ex*, from, and *fluo*, to flow.

EFFUSION, in a general ſenſe, the pouring out of any thing liquid, and that with ſome violence.

EFT, in zoology, the Engliſh name of the common lizard, *lacertus vulgaris*, called alſo, in ſeveral parts of the kingdom, the newt and ſwift. See the article LIZARD.

EGG, *Ovum*, in natural hiſtory, a body formed in certain females, in which is contained an embryo, or fœtus, of the ſame ſpecies, under a cortical ſurface or ſhell.

An egg conſiſts of the albumen or white, and of the vitellus or yolk. The albumen is a cold, viſcous, white liquor in the egg, differing in conſiſtence in its different parts. Dr. Harvey not only obſerved this difference, but alſo that there are two diſtinct albumens, both of which are involved in their proper membranes: of theſe one is very thin and liquid, the other more denſe and viſcous, and of a ſomewhat whiter colour; but in old and ſtale eggs, after ſome days incubation, inclining to a yellow. As this ſecond albumen covers the yolk on all ſides, ſo it is itſelf ſurrounded by the other external liquid.

As the eggs of hens conſiſt of two liquors ſeparated from one another, and diſtinguiſhed by two branches of umbilical veins, one of which goes to the vitellus, and the other to the albumen; ſo it is very probable they are of different natures, and conſequently appointed for different purpoſes. Ariſtotle ſays, "That the vitellus is condenſed by cold, the albumen rather liquefied. On the contrary, the albumen is condenſed by fire; the vitellus retains its ſoftneſs, if it be not burnt; and concretes more in boiling than in roaſting." When the vitellus grows warm with incubation, it becomes more humid, and like melted wax or fat, whence it takes up more ſpace: for as the fœtus increaſes, the albumen inſenſibly waſtes away and condenſes; the vitellus, on the contrary, ſeems to have loſt little or nothing of its bulk; when the fœtus is perfected, and only appears more liquid and humid, when the abdomen of the fœtus begins to be formed.

The chick in the egg is firſt nouriſhed by the albumen; and, when this is conſumed, by the vitellus, as with milk. The albumen waſtes in keeping, and that through the ſhell, eſpecially if it be expoſed to a gentle heat: and it is ſpecifically lighter than the vitellus.

By incubation the albumen becomes thinner and more turbid, eſpecially on its upper part, near the obtuſe end, where it is alſo firſt conſumed; and it is afterwards diminiſhed towards the ſharp end of the egg, till at laſt nothing of it is left, except a white cretaceous ſubſtance at the lower part of the ſhell. In the Edinburgh Medical Eſſays, we are told that the albumen of a fœcundated egg is as ſweet and free from corruption, during all the time of incubation, as it is in a new-laid egg.

As the white of an egg has all the requiſites to the formation of an animal body, that is, to nutrition, when properly applied by the vital actions to the parts which require it, and this without any previous digeſtion by the ſtomach, it muſt neceſſarily be one of the moſt proper aliments in the world, in morbid caſes, where the d geſtive organs are relaxed and weak, where the fibres of the whole body want a due tenſion and elaſticity, and where conſequently reſtoratives are indicated. But in order to anſwer any good purpoſe in this view, it muſt be given freſh, raw, and without the application of the leaſt heat: for heat, as Boerhaave found by his experiments, renders it unfit for nutrition. It is to be given in a little milk and water, or broth, or may be taken alone, well ſeparated from the yolk.

The white of an egg has a refrigerating, aſtringent, and agglutinating quality.

The yolk is endued with an anodyne, maturating, digeſting, and relaxing virtue. Hence it is very often an ingredient in clyſters, and mixed with a little ſalt, is commonly applied, in a walnut ſhell, to the navels of infants, in order to looſen the belly.

EGG, in architecture, is an ornament in that form, cut in the echinus or quarter round of the Ionic and Compoſite capitals. The profile or contour of an echinus is enriched with eggs and anchors placed alternately.

EGLANTINE, in botany, a name frequently given to the ſweet-briar, a ſpecies of roſe. See the article ROSE.

EGYPT, an extenſive country of Africa, lying between the thirtieth and thirty-ſixth deg. of eaſt long. and between the twenty-firſt and thirty-firſt of north latitude. It is bounded by the Mediterranean on the north; by the Red-ſea and Iſthmus of Suez, which divide it from Arabia, on the eaſt; by Abyſſinia or Ethiopia, on the ſouth; and by the deſarts of Barca and Nubia, on the weſt; being ſix hundred miles in length from north to ſouth; and from one hundred to two hundred in breadth from eaſt to weſt.

Egypt is ſubject to the grand ſignior, and governed by a baſhaw, or viceroy. It owes its fertility to the annual over-flowing of the Nile, which it begins to do in the months of May and June, and is uſually at its height in September, from which time the waters decreaſe till May or June again. By this ſupply of water, Egypt is rendered ſo fruitful, as to ſerve Conſtantinople and other places with corn, as it did Rome and Italy of old. They only harrow their grain into the mud, on the retiring of the water; and in March following, uſually have a plentiful harveſt: and the lands, not ſown, yield good crops of graſs for the uſe of the cattle. According to Mr. Sandys, no country in the world is better furniſhed with grain, fleſh, fiſh, ſugar, fruits, melons, roots, and other garden ſtuff, than the Lower Egypt.

EJACULATOR, a muſcle of the penis, otherwiſe called the elevator.

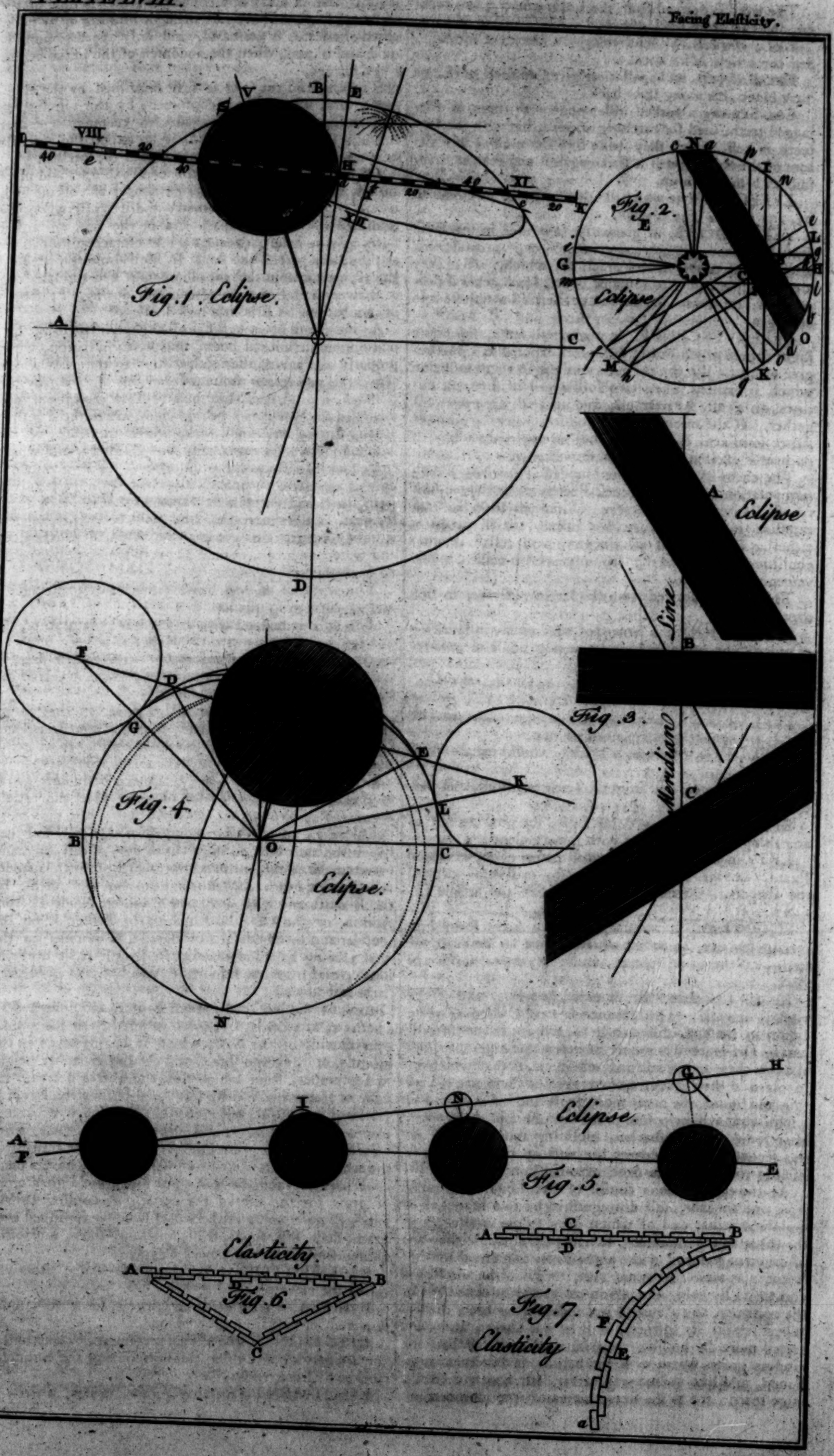
EJECTA, a term uſed, by lawyers, for a woman deflowered, or caſt from the virtuous.

EJECTION, in the animal œconomy, evacuation, or the diſcharging any thing through ſome of the emunctories, as by ſtool, vomit, &c.

EJECTMENT, *Ejectione Firmæ*, in law, a writ, or action,

PLATE LVIII.

Facing Elasticity.



5 1A 59

action, which lies for the leſſee for years, on his being ejected, or put out of his land before the expiration of his term, either by the leſſor, or a ſtranger. It may alſo be brought by the leſſor againſt the leſſee, for rent in arrears; or holding over his term, &c.

EIGHT, or PIECE OF EIGHT. See the article EXCHANGE.

ELABORATORY, the place where chemical proceſſes are performed. See CHEMICAL *Laboratory*.

ELÆAGNUS, dutch myrtle, in botany, a genus of trees, the characters of which are, that it has no flower petals; the fruit is an oval, obtuſe, and ſmooth drupe, including an oblong kernel or nut.

ELÆOSACCHARUM, in pharmacy, a preparation of ſome eſſential oil with ſugar, thus performed: grind an ounce of dry loaf-ſugar to an impalpable powder, in a glaſs mortar, and with a glaſs peſtle, and by degrees add thereto a dram of any eſſential oil, or only half a dram, if the oil be very tenacious; and continue rubbing them together, till all the oil be thoroughly mixed, and drank in by the ſugar. If a little freſh white of an egg be added in the grinding, the oil becomes thereby more eaſily miſcible; but the mixture will not keep ſo long, without turning rancid.

If theſe elæoſaccharums be well prepared, dried, and put into clean glaſſes, exactly cloſed with glaſs ſtoppers, they may be preſerved a long time perfect. By this method, therefore, you may prepare an excellent medicine, rich in virtue: for if the elæoſaccharum of mint be diſſolved in diſtilled mint-water, then ſtrengthened with the addition of ſpirit of mint, and the mixture ſweetened with the ſyrup of the ſame plant, the whole virtues of mint may be thus obtained.

ELAPHOCAMELUS, in zoology, the ſame with the glama, or Peruvian camel. See GLAMA.

ELASTIC, in natural philoſophy, an appellation given to all bodies endowed with the property of elaſticity.

ELASTICITY, that power or property in natural bodies, by which they reſtore themſelves ſpontaneouſly to the figure and dimenſions which they had loſt by the action of ſome other body applied to them.

Thus a ſpring or bow, when bent, reſtore themſelves, by their elaſticity, to the form they obtained before any external force was applied to them. And thus the arteries of an animal body, after being diſtended by the impulſe of the blood, contract and reſtore themſelves, by their elaſticity, to the ſame form and dimenſions they had before they were thus diſtended. Some have endeavoured to ſolve elaſticity by attraction only; as for example, if the ſtring AB (plate LVIII. *fig.* 6.) be conſidered as made up of particles lying over one another in the manner repreſented at ADB; it is plain that, if the point D be forcibly brought to C, the parts will be pulled from each other; and when the force that ſtretched the ſpring ceaſes to act, the attraction of coheſion, which was hindered before, will take place, and bring back the ſtring to its former length and ſituation, after ſeveral vibrations. Now, tho' this ſeems to agree pretty well with the phœnomena of a ſtring in motion, it will by no means ſolve the elaſticity of a ſpring faſtened to one end, and bent either way at the other, like a knife or ſword-blade. For if ſuch a ſpring be bent from A to *a*, (*fig.* 7.) the particles on the ſide C, which now become convex, will be farther aſunder at F, while the particles at D, carried to the concave part E, will come cloſer together: ſo that the attraction, inſtead of making the ſpring reſtore itſelf, will keep it in the ſituation in which it is, as it happens in bodies that have no elaſticity, where, perhaps, only attraction obtains. Thus a plate of lead, a plate of copper, and a plate of ſoft iron ſtand bent.

But the moſt probable way of ſolving the elaſticity of ſprings, is to conſider both a repulſive, and an attractive property in the particles, after the manner of the black ſand, which is attracted by the load-ſtone, and has been ſhewn by the learned and ingenious profeſſor Petrus Van Muſchenbroeck to be nothing elſe but a great number of little load-ſtones.

The great law of perfectly elaſtic bodies is, that their relative velocity will remain the ſame before and after colliſion; that is, perfectly elaſtic bodies will recede from one another after the ſtroke, with the ſame velocity that they came together. Many curious phænomena may be explained from this property in bodies.

If the ivory ball A, (plate LIX. *fig.* 1.) weighing two ounces, ſtrike with the velocity 16 againſt B at reſt, weighing alſo two ounces; the body B will move forward after this ſtroke with the velocity 16, A remaining at reſt in its place: the reaſon of this is, that the body A loſes one half of its motion by ſtriking the equal body B, and the other half by the elaſticity of B, recovering its former figure. From this experiment, ſeveral pretty odd phœnomena ariſe: thus, if a row of ſhovel-board pieces, that is, metalline cylinders of about half an inch in height, and two inches diameter, be laid upon a ſmooth table, and you take a ſingle piece, and drive it againſt the row, the laſt piece off the row will fly off; for if A (plate LIX. *fig.* 2.) ſtrike the row of pieces B, C, D, E, F, G, H, I, in the direction A *a*, then will the laſt piece I fly off to *i*, with the ſame velocity that A ſtruck B: and whatever be the velocity of A, no other piece but the laſt piece I will fly off. But if you take two pieces, as A and B, (*fig.* 3.) and ſtrike them together againſt the row C, D, E, F, G, H, I, the two laſt pieces H and I, will fly off from the other end of the row with the ſame velocity that A and B made the ſtroke.

If three or more pieces are made uſe of to make the ſtroke, the very ſame number will fly off from the other end of the row; and it is to be obſerved, that the ſame will happen with equal elaſtic balls, ſuſpended in a row by ſtrings of the ſame length.

Again, if the elaſtic body A, (*fig.* 4.) weighing four ounces, ſtrike the quieſcent body B, weighing only two ounces, with a velocity equal to 12; then will the velocity of A, after the ſtroke, be 4, and that of B 16. Juſt the reverſe of this happens, when a leſſer body ſtrikes againſt a greater; in which caſe, the ſtriking or leſſer body will be reflected with one fourth of its firſt motion, and the greater be carried forward with a motion which is as 16.

The magnitude and motions of ſpherical bodies perfectly elaſtic, and moving in the ſame right line, and meeting each other, being given, their motion after reflection may be determined thus: Let the bodies be called A and B, and the reſpective velocities *a* and *b*; then, if the bodies tend the ſame way, and A, moving ſwifter than B, follows it, the velocity of the body A, after the reflection, will be $\frac{aA-aB+2bB}{A+B}$, and that of the body $B=\frac{2aA-bA+bB}{A+B}$; but if the bodies meet, then, changing the ſine of *b*, the velocity of A will be $\frac{aA-aB-2bB}{A+B}$, and that of $B=\frac{2aA+bA-bB}{A+B}$: and if either of theſe happen to come out negatives, the motion after the ſtroke tends the contrary way to that of A before it; which is alſo to be underſtood of the motion of the body A in the firſt caſe.

ELATERIUM, in pharmacy, imports in general any purging medicine; but is particularly applied to thoſe which operate with violence; hence the word was tranſferred to the wild cucumber and the preparations thereof. See the article *Wild* CUCUMBER.

ELATINE FLUELLIN, in botany, a genus of plants, the corolla of which conſiſts of four ovated, obtuſe, ſeſſile, patent petals: the fruit is an orbiculated great capſule, compreſſed globeways, containing four cells, and conſiſting of four valves; the ſeeds are numerous, lunulated, erect, and ſurrounding the receptacle in the manner of a wheel. This plant is an aperient, reſolvent, and vulnerary.

ELBOW, in anatomy, the juncture of the cubitus and radius; or the outer angle made by the flexure, or bend of the arm. See CUBITUS and RADIUS.

ELBOW, in architecture, a term uſed for an obtuſe angle of a wall, building, road, &c. which divides it from its right line.

ELCESAITES, in church hiſtory, ancient heretics, who made their appearance in the reign of the emperor Trajan, and took their name from their leader Elceſai.

The Elceſaites kept a mean between the Jews, Chriſtians,

tians, and Pagans; they worſhipped but one God, obſerved the Jewiſh ſabbath, circumciſion, and the other ceremonies of the law. They rejected the Pentateuch, and the prophets; nor had they more reſpect for the writings of the apoſtles, particularly thoſe of St. Paul. They deteſted chaſtity and continence, and obliged their diſciples to marry. They acknowledged a Meſſiah, whom they called their great king; but we do not know whether they meant Jeſus Chriſt, or ſome pretended Meſſiah. They gave him a human form, but inviſible; the dimenſions of which were thirty-eight leagues in height, and ſo in proportion. They pretended that the Holy Ghoſt was a woman, and of the ſame ſize with the Meſſiah. They were much addicted to judicial aſtrology, magic, and enchantments: they held that it was lawful to renounce the faith with the lips, provided a man kept it in his heart.

ELDER, or SENIORS, in Jewiſh hiſtory, were perſons the moſt conſiderable for age, experience, and wiſdom.

ELDER is alſo a denomination ſtill preſerved in the Presbyterian diſcipline. See the article PRESBYTERIAN.

ELDER, in botany. See SAMBUCUS.

ELEATICS, a ſect of philoſophers of Elea, founded by Xenophanes, a Colophonian. He held all things to be incomprehenſible, but withal, maintained many dogmatical aſſertions. He held that God is one, incorporeal, eternal, all ſight, and all hearing, no way reſembling man: that this God is all things; that whatever is, is eternal; that there are infinite worlds, and thoſe immutable and eternal; that there are four elements; that the ſtars are certain clouds, ſet on fire when they riſe, and extinguiſhed when they ſet; that all comets, falling ſtars, and the like, are clouds, kindled by motion; that the ſun is a fiery cloud, extinguiſhed in its eclipſes; that the moon is a cloſe, compact, and habitable cloud; that there are many ſuns and moons in the ſeveral climates of the earth; that the ſun promotes generation, but the moon contributes nothing to it; that the ſun goes forward in infinitum, but to us ſeems to move circularly by reaſon of the great diſtance; that the clouds are a vapour drawn up by the ſun; that the earth was firſt founded and rooted, as it were, in an infinite depth; that the ſoul is a ſpirit; and that all divination is falſe, &c.

ELECAMPANE, in botany, a large plant, with long, wrinkled, oval, acuminated leaves, ſerrated about the edges, pale green above, and hoary underneath, joined cloſe to the ſtalk, which divides towards the top into ſeveral branches, bearing large yellow flowers of the radiated diſcous kind, followed by oblong ſeeds, winged with down: the roots are ſhort and thick, ſomewhat unctuous to the touch, brown, or blackiſh on the outſide, and whitiſh within. It is perennial, grows wild in moiſt rich ſoils, and flowers in June.

The freſh roots of elecampane have a weak, not very grateful ſmell; which, on thoroughly drying, and keeping them for ſome time, is greatly improved, and approaches to that of Florence orris. Chewed, they diſcover at firſt a kind of rancid glutinous taſte, quickly ſucceeded by an aromatic bitterneſs, which by degrees becomes conſiderably pungent.

This root ſtands recommended as a diaphoretic, ſtomachic, for promoting expectoration in humoural aſthmas and coughs, and for attenuating viſcid juices in general, and diſpoſing them to excretion: taken freely, it is ſaid to gently looſen the belly, and increaſe the urinary diſcharge. The doſe of the dry root in ſubſtance is from a ſcruple to a dram or two.

ELECT, *Electus*, among eccleſiaſtical writers, thoſe whom God has choſen, or predeſtinated to be ſaved. See the article PREDESTINATION.

ELECTION, the choice that is made of a perſon, or thing, in preference of any other; as, in the election of an emperor, of a pope, of a biſhop, of members of parliament, &c.

ELECTION is alſo the ſtate of a perſon who is left to his own free will, to take or do one thing or another, which he pleaſes.

ELECTION, in theology, ſignifies the choice which God, of his good pleaſure, makes of angels and men for the objects of his grace and mercy.

ELECTOR, a perſon who has a right to elect or chooſe another to an office, honour, &c.

Elector is particularly, and by way of eminence, applied to thoſe princes of Germany, in whom lies the right of electing the emperor; being all ſovereign princes, and the principal members of the empire.

ELECTORAL CROWN, or CORONET. See the article CROWN.

ELECTORATE, a term uſed as well to ſignify the dignity of, as the territories belonging to, any of the electors of Germany.

ELECTRICITY, a power or property in ſome bodies, as amber, ſealing-wax, &c. whereby they attract light bodies.

The ancients have obſerved that amber, when it is rubbed, attracts bits of ſtraw, down, and other light bodies. They called amber *electrum*; ſo that the name of electricity has been given to that property of attracting light bodies, which at firſt was thought peculiar to amber; but it has ſince been found to be in a vaſt many other kinds of ſubſtances, ſuch as Spaniſh wax, gum copal, all the reſins, and tranſparent bodies. It is to be remarked, that bodies ſuſceptible of electricity are divided into two claſſes: the one are electrical of themſelves, or *per ſe*, that is, they contain that quality in themſelves, and they need only be rubbed, to excite it: ſuch are thoſe already mentioned; and a large catalogue of them may be ſeen in Muſchenbroek. The others do not contain that virtue in themſelves, or they have ſo little of it, as to be reckoned to have none at all; yet they acquire it by communication, or by emanation derived to them from a body that is electrical *per ſe*. This ſecond claſs of non-electrical bodies *per ſe*, are all thoſe in general that are not compriſed in the firſt claſs. Mr. Dufay has found, that the greateſt part of the bodies of this ſecond claſs may be raiſed to the condition of electrical bodies *per ſe*, by means of heating them briſkly, or by uſing ſome other preparations; but by reaſon of theſe difficulties they are left in the number of non-electrical bodies *per ſe*.

There is ſcarce any ſubject in natural philoſophy that has given occaſion to more experiments and diſcoveries than electricity has done; for, about thirty-ſix years paſt, the learned in Holland, Germany, Italy, France, and England, have ſtrove to diſtinguiſh themſelves upon this head. Mr. Gray, of the Royal Society at London, and M. Dufay, of the Academy of Sciences at Paris, have, in particular, carried this matter very far, by communicating the reſult of their labours to each other, and verifying them reſpectively, by a kind of concurrence of friendſhip and emulation, whoſe polite and uncommon unanimity has done as much honour to theſe learned men, as it has been of ſervice to promote this part of philoſophy.

M. Boze in Germany, and the Abbé Nollet in France, ſeem to have ſucceeded to theſe two great men; and they have already left them pretty far behind, by the ſingularity and number of their diſcoveries.

We ſhall confine ourſelves to the principal circumſtances of electricity, and pitch upon ſuch experiments as are moſt proper to confirm theſe circumſtances, and to diſcover their cauſes; and laſtly, endeavour to account for this phænomenon.

We are not only certain, that a great number of ſubſtances, which the antients did not ſuſpect to be electrical, as amber is, attract, like it, light bodies; but farther we have diſcovered, that all theſe ſubſtances, after they have attracted theſe bodies, do likewiſe repel them. So that hence alone we have in the phænomenon of electricity two contrary effects, attraction and repulſion.

Afterwards, by rubbing electrical ſubſtances in a dark room, it has been found, that they emitted ſome ſparks of light, and that thus the electrical body was a kind of phoſphorus. Upon bringing the finger within a line or two of the electrical body, the finger not only drew a ſpark out of this body, but farther, this ſpark made a little noiſe, and cauſed a pretty lively pricking in the finger.

At laſt, curioſity led philoſophers to examine, whether theſe effects of electricity might not be communicated to other bodies that were not naturally electrical, and they found that they were communicated to all bodies

PLATE LIX.

- Facing Electricity.

Fig. 1.

Elasticity

Fig. 2.

Fig. 3

Fig. 4.

Fig. 5.

Electricity

A

Fig. 8.

Electricity.

Fig. 7 Electricity.

Fig. 6. Electricity.

Fig. 11.

Electricity.

Fig. 9.

Fig. 10. Electricity.

Fig. 13. Electrometer.

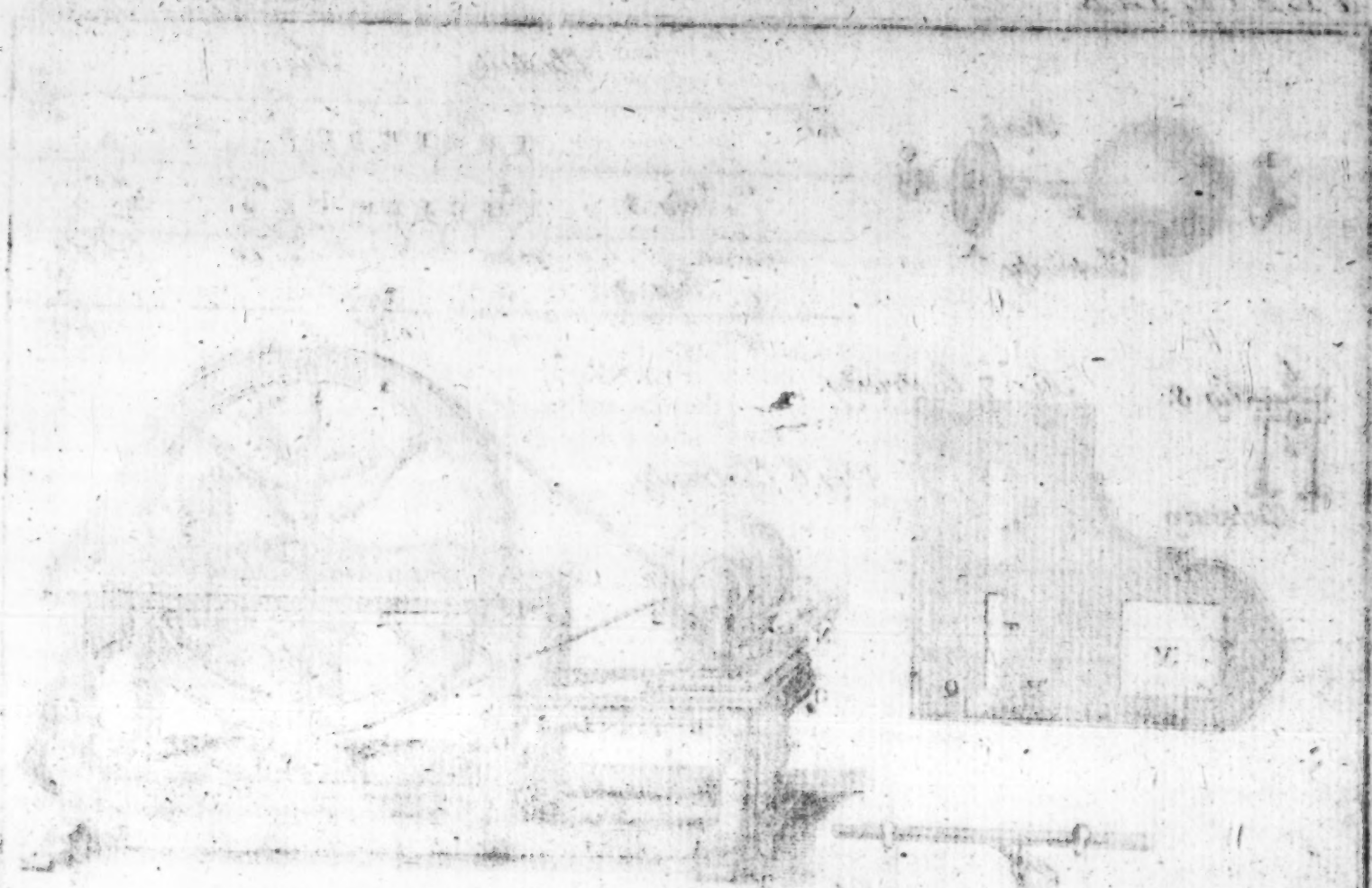
Fig. 12.

Electricity.

Electrometer.

Fig. 14.

5 JA 59



in general, except flame, and that at very great diſtances; and that it was almoſt the ſame cauſe with electricity as with ſound and light.

Theſe are the chief effects, which, till the year 1745, were allowed to be in the phœnomenon of electricity; namely, attraction, repulſion, the emanation of ſparks, and the communication or propagation of all thoſe effects.

Of Attraction, the firſt Effect of ELECTRICITY.—The firſt and moſt ſimple phœnomenon of electricity is the attraction of light bodies by electrical or electrified bodies. This firſt property of electrical bodies is, to ſpeak the language of the ancients, the only phœnomenon to which the term electricity correſponds. This is electricity itſelf, ſince this word ſignified formerly the attraction produced by amber and other bodies of the ſame nature: however, modern philoſophy having diſcovered in theſe very ſubſtances the quality of repelling light bodies, as alſo that of producing light; and all theſe effects being naturally produced by the ſame cauſe; it is natural to call this general cauſe by the name of electricity, and to give theſe different effects the names of attraction, repulſion, &c. by joining thereto the epithet of electrical. The manner in which this phœnomenon of electricity is excited is as follows:

Get a tube of about three feet and a half in length, an inch and a half in diameter, and its ſides a line thick; let this tube be very ſmooth and dry; rub it with a piece of ſtuff, paper, or, which is better ſtill, with the hand, provided it be very dry. You will ſucceed ſtill better, if your hands be rubbed with a little chalk or white lead; afterwards bring this rubbed tube near light bodies, ſuch as gold-leaf, down, &c. laid upon a glaſs ſtand a foot high, and three or four inches broad at top, or hung upon linen or ſilk threads, ſituated perpendicularly in the open air. It is to be obſerved that theſe threads are called proof threads, becauſe they obey the leaſt electricity, and becauſe they are made uſe of to examine if any matter be electrical. If it is a thread of linen or ſilk moiſtened, the down will be always attracted; but if it be a dry ſilk thread, it will be attracted and repelled alternately. But to return; the aforeſaid bodies, as they approach the tube, will be thrown even upon it with rapidity. Chooſe for making theſe experiments a cold and dry ſeaſon; for hot weather and a moiſt air are not favourable for them.

Of Repulſion, the ſecond Effect of ELECTRICITY.—After having rubbed the tube more violently than before, if you bring gold-leaf, down, or a peacock's feather near it, it will not only attract theſe light bodies, but afterwards repel them a great way off; and if you do this in ſuch a manner that the gold-leaf, for example, be perpendicularly repelled above the tube, and that it meet with no other body, it will ſuſtain itſelf in the air, always at the ſame diſtance from the tube, and you may convey it in this ſituation quite round the room; but if it touch any other body, it will come back and adhere to the tube; then it will be repelled anew, as at the firſt. It often happens that the gold-leaf adheres to the tube, and is not repelled, eſpecially if it fall flat upon it; and then you aſſiſt the repulſion by blowing upon it a little.

During the time that the gold-leaf is ſuſpended in the circumference of the tube's atmoſphere, if you preſent to it another non-electrified light body, it attracts it in the ſame manner as the tube itſelf would do; but if it be a heavy fixed body, it ſhall be attracted by that; and if two gold-leaves, having been repelled at the ſame time by the tube, come to meet, they will reciprocally repel each other in the ſame manner as the tube repels them.

M. Boze, profeſſor of philoſophy at Wittemburg, obſerving ſome inconveniencies in the uſe of the tube, introduced a globe of glaſs or of roſin.

The globe muſt be made of the ſame ſort of glaſs as the tube, not leſs than a foot diameter; but not too large, about two lines thick, and as equal in thickneſs as poſſible; for a thick glaſs performs the beſt.

It is not neceſſary that this ball or globe ſhould be exactly ſpherical; and the Abbé Nollet aſſures us, that after fifteen years practice, he found a chemiſt's receiver makes the beſt inſtrument, after its neck is cut down to about three or four inches, and this he capped on one pole with a pulley like that uſed by pack-thread ſpinners or cutlers, and armed at the other pole with a piece of hard wood, having at the ends two needles or broaches of iron or ſteel, that it may turn round very briſkly in a horizontal poſition. Of which apparatus you have an exact repreſentation in plate LIX. *fig.* 5. where A is the pulley; B the neck of the ball, to which the pulley is faſtened with a paſte made of pitch, bees-wax, and fine ſifted aſhes; C is the ſtopper that ſcrews into the hole made in the center of the pulley: the axis on which the ball turns is fixed to the center of this ſtopper; and beſides, there ſhould be two or three ſlant holes in this ſtopper for the better communication of the air. D is the calot or cup of about four inches diameter, made of hard wood, with a hollow or concave ſide juſt to receive and exactly fit the pole of the globe oppoſite to the pulley. This cup muſt be carefully faſtened to the glaſs with the ſame cement, but ſo carefully, that when the cement cools, the glaſs may not move; for if it do, it will certainly break.

The next thing is to provide a wheel-band, of the thickneſs of a pinion gooſe-quill, which ſhall run in the pulley; and a wheel of about four feet in diameter, by which the ball ſhall be made to turn regularly and briſkly on its axis.

You are to take care that this wheel be framed upon a ſtrong and ſecure foot; and let it have two handles, that two perſons may turn it together; which, ſays the Abbé, is the beſt method of operation.

The axis muſt be fixed about three feet and a half above the plank or foot on which the wheel, and the perſons who turn it, ſtand. The cord ſhould be made of gut, and to run very freely in the pulley; and the ball, as much as poſſible, clear of every thing; for if the ſphere of attraction be interrupted on any part, it deſtroys the efficacy of the whole.

A B (*fig.* 6.) is the foot-frame of a machine which the Abbé had made uſe of above ten years, made of ſound oak, of about three inches ſquare, in which are mortiſed the uprights of the frame C, D, E, *c*, *d*, *e*, at the diſtance of nine inches from each other, but of unequal heights. F, G, project about five inches from the bottom of the ends of the uprights, for the more ſolid retention of the machine. H, I, *b*, *i*, are the croſs parts of the frame, four feet eight inches long, which hold the longer uprights C, D, *c*, *d*; and theſe complete a frame of four feet two inches long, and nine inches broad within. E, *e*, are the two ſhorter uprights, and both of a height; over which runs a bar marked M, N, and are ſtrengthened with the pieces K, L, mortiſed in the uprights D, *d*. Upon the wood, M, N, which projects beyond the uprights, and is ſupported at that end by a bracket O, is placed the table repreſented in *fig.* 7. Y, Z, are the poſts on which the wheel hangs; and H, I, *b*, *i*, contain two ſockets for the reception of the axis of the wheel, which axis is ſecured by two braſs claſps *k l*, (*fig.* 8.) one of which is let quite into the wood, and the other is faſtened to the outſide by long iron ſcrews, which run through both the ſocket and the bar H, I, and are faſtened on the other ſide with a nut. The outer claſp ſhould have a hole in the middle to receive a little oil. The end of the axis, to which the handles are fixed, ſhould be an exact ſquare of nine or ten lines each ſide with the corners very ſharp, and the crank of each handle ought to be ten inches long.

The globe (*fig.* 9.) is placed on the table (*fig.* 7.) whoſe frame by means of two rules, P, *p*, Q, *q*, enters the grooves R, *r*, (*fig.* 9.) and is ſecured by the ſcrews S, X, which paſs through the openings T, V. And if you would paſs two balls on this table at a time, the other muſt be mounted in the ſame manner as that deſcribed in *fig.* 10. and ſo placed, as that the ſcrew S may go through the opening *t*.—Having thus deſcribed the apparatus, we ſhall relate ſome of the capital experiments which have been made therewith, and are as follow:

1. A long, pointed, piece of iron being laid on a frame of ſilken ſtrings, with one end about a quarter of an inch from the globe, will at the other end, which terminates in a conical point, emit a purple flame of electrical fire, diverging each way from the point, like the rays of the ſun from the focus of a burning-glaſs in a darkened room. This pencil of electric rays is viſible, even in the day-light,

but is extremely ſo in the room made dark; and if the finger be held within a quarter of an inch, it cauſes the fire to iſſue out in a greater quantity, and to appear much more luminous than before. See plate LIX. *fig.* 11.

2. The finger, being placed as above directed, within a quarter of an inch of the ſaid flame, will be ſenſible of a gentle blaſt of wind from the end of the iron; that is, the electrical fire will iſſue out of the point in ſuch a manner, as to blow againſt the finger very ſenſibly; and if the finger be held ſtill nearer, the large pencil of rays will be condenſed in ſuch a manner as to run out of the point upon the finger in a ſtream, or body, of denſe yellow fire, and ſtrike the finger like a gentle jet d'eau; and indeed the phœnomenon may be truly called a jet de feu. This electric flame is ſenſible alſo to the ſmell, and much reſembles, in that reſpect, the fire of phoſphorus.

3. While the flame continues to appear from the point of the iron, the finger being placed any where upon the iron, the flame at the end diſappears immediately; if the finger be taken off, it again inſtantly appears; and ſo, by putting the finger off and on ſucceſſively, the electric flame will appear and diſappear alternately. The reaſon whereof is, that when the finger is applied, the electric virtue all runs off upon the finger, as a non-electric body, and therefore cannot go to the pointed end to produce the flame, as it does when the finger is taken off.

4. If a muſket barrel, &c. be ſuſpended, and the finger applied near it, as within $\frac{1}{5}$ of an inch, the fire will forcibly iſſue out, and ſtrike it, and in ſtriking it will give a very ſenſible ſnap; and ſeveral fingers being ſucceſſively applied to the barrel, will cauſe ſeveral ſuch eruptions and ſnappings of the fire, which will be all very ſenſible to the feeling, to the eye, and to the ear; and produce a moſt extraordinary and entertaining phœnomenon.

5. If a chain, or hempen cord, be ſuſpended by ſilken ſtrings, all round the room, of any length you pleaſe, and one end thereof be hung by a loop acroſs the barrel, the electrical fire will inſtantly be tranſmitted through the whole length of the chain, and appear upon every part at the approach of the finger, and be heard to ſnap, and ſtrike with as great if not greater force, than from the gun-barrel itſelf. In this particular the electric fire ſeems to reſemble that of lightning.

6. If a ſponge, thorough dry, be hung on to the electrified barrel, it gives no appearance of fire, which ſhews it be an electric ſubſtance: but if, when the ſponge has been immerſed in water, it be ſuſpended to the barrel as before, and the finger or hand be applied near it, the fire iſſues out with conſiderable force and ſnapping, and the drops which, before the ſponge was electrified, fell very ſlowly, will now fall very faſt; if the room be darkened, theſe drops will appear to be drops of fire, and illuminate the baſon into which they fall.

7. If a capillary ſyphon be hung on to the ſmall cup of water, at the end of the barrel, and the finger laid acroſs the barrel to prevent the electric virtue going to the water, then, before the water is electrized, you obſerve the ſyphon to drop only, and that very gently; but when the finger is taken off, and the water becomes electrized, the ſyphon runs a ſtream; and if the room be dark, it iſſues from the ſyphon in the appearance of fire. See plate LIX. *fig.* 12.

8. If a phial of water be provided, and well corked, and a wire bended on the top be pierced through the cork, and thruſt down near the bottom of the phial, leaving the upper part ſtanding about two or three inches above the bottle; then laying this wire on the globe in motion, the wire receives the electricity from the globe, and the water will be impregnated therewith, the more as the wire is kept longer on the globe; then the perſon thus holding the phial in one hand is to approach a finger of his other hand near the middle part of the globe, and he will receive the electric eruption of fire with a very conſiderable ſnap and force, greater by much than what proceeds from the barrel alone; the reaſon is, becauſe all the electricity, running through the wire into the water, is there condenſed, as it were, and confined by the electric ſubſtance of glaſs, and ſo acts in a greater quantity, and therefore with a greater force, than when it iſſues from the barrel unconfined.

9. A perſon ſtanding on a large cake of roſin, at leaſt three inches thick, holding a chain faſtened to the gun-barrel, will be electrized; that is, he will be all over poſſeſſed with the electric virtue, and at the ſame time feel nothing of it, unleſs ſome perſon ſtanding by put his finger near to any part, and then the virtue will be emitted in form of fire from any part, and ſnap, and become very ſenſible to both the parties, but in a very innocent manner. See plate LIX. *fig.* 12.

10. The phial being electrified, as above, the whole company join hands, or communicate with each other by wires; then the operator, or perſon who ſtands firſt, at one extremity of the line, hangs the electrical phial on the barrel, when the perſon at the other extremity draws off the ſpark from the barrel; and at that inſtant all the company receive the ſhock, which they feel to their elbows, and in both their arms.

11. A perſon, ſtanding on roſin, holding the chain from the barrel, points his finger to the warm ſpirits of wine, and by communicating the electric fire thereto, kindles the riſing flame, and ſo ſets the whole on fire. In this manner any ſort of matter, which when warmed will ſend forth an inflammable vapour, may be ſoon and very eaſily ſet on fire.

12. If a load-ſtone, armed with iron, be hung on to the gun-barrel by an iron wire, the electric virtue will ruſh out from every part, but more forcibly from the iron than from the ſtone itſelf; from the ſtone it ſeems to be emitted in a more lax manner, and diffuſed in a ſort of ſtream or fiery vapour; whereas from the iron it iſſues in a more impetuous, denſe, and penetrating ſtream. By this experiment we ſee that the two moſt conſiderable powers of nature, electricity and magnetiſm, do no ways interfere, or impede each other's action.

13. If the globe be exhauſted of all its air, and then whirled about, the electricity will be obſerved to act wholly within the globe, where it will appear, in a darkened room, in form of a cloud, or flame of reddiſh or purple coloured light, filling the whole capacity of the globe. This voluble flame will be diminiſhed and diſappear by degrees, as the air is gradually admitted into the globe: the reaſon why the action of the electric virtue does not ſhew itſelf outwardly, is the ſtrong repulſive power of the electric effluvium, and cauſing it to tend inwards, where it meets with no reſiſtance in a vacuous ſphere.

The above are the principal experiments uſually performed; to which we ſhall add the following, as it is not generally known, and at the ſame time exhibits a very curious and uncommon phœnomenon. Let two perſons ſupport a ſword between them on the top of their fingers; that is, let both perſons claſp all their fingers except the index, or fore-finger, and on the top of theſe place the guard of the blade, or that plate that ſeparates the blade from the hilt; ſo that the point of the ſword may hang down in a perpendicular direction towards the floor: then let one of the above perſons rub, with his other hand, the cryſtal of his watch, or a ſmall glaſs globe, bottle, &c. up and down his breaſt; and in a very ſhort time the ſword will begin to move in a circular direction on the two fingers that ſupport it; and continue that motion as long as the perſon continues to rub the glaſs globe, cryſtal, &c.

From the above experiments it appears that the force of the electric matter is very great; but nothing when compared with what may be called the celeſtial electricity; for it has been found, that the effects of lightning and thoſe of electricity are ſimilar. Lightning has been known to ſtrike people blind, the electrical ſhock has had the ſame effect on animals. Animals have been killed by both. The mariner's compaſs has ſometimes loſt its virtue by lightning; and by Mr. Franklin's experiments it appears, that polarity may be given and reverſed by electricity. The late Mr. Stephen Gray obſerved ſeveral years ago, that the electrical fire ſeemed to be of the ſame nature with that of thunder and lightning: others have ſince been of the ſame opinion. And indeed it appears, from various experiments, that the flame of electricity has been juſtly called by Mr. Franklin, a mimic lightning, ſince it blinds and kills animals, and melts metals, &c. like natural lightning.

This analogy is now farther confirmed by the diſcovery

made in France, in conſequence of Mr. Franklin's hypotheſis, of being able, by a proper apparatus, to collect the electricity from the atmoſphere during a thunder-ſtorm. For a pointed bar of iron, forty feet high, having been placed upon an electrical body, and a ſtormy cloud having paſſed over the place where the bar ſtood, thoſe that were appointed to obſerve it drew near, and attracted from it ſparks of fire, perceiving the ſame kind of commotions as in the common electrical experiments. The like effect followed, when a bar of iron ninety-nine feet high was placed upon a cake of roſin, two feet ſquare, and two inches thick: for a ſtormy cloud having paſſed over the bar, where it remained half an hour, ſparks were drawn from the bar. Theſe were the firſt experiments made in France, and they have been ſufficiently varied and verified ſince; ſo that it ſeems now certain, 1. That a bar of iron, pointed or not, is electriſed during a ſtorm. 2. That a vertical or horizontal ſituation is equally fitting for theſe experiments. 3. That even wood is electriſed. 4. That by theſe means a man may be ſufficiently electriſed to ſet fire to ſpirit of wine with his finger, and repeat almoſt all the uſual experiments of artificial electricity; for ſuch may that which is excited by friction be denominated.

It is, however, to be remarked, that theſe phœnomena are attended with irregularities, and do not always ſucceed perfectly. Sometimes ſimple clouds, without thunder or lightning, produce more electricity than when there is loud thunder. Sometimes the electricity does not ſhew itſelf but where there is lightning: in other caſes, the electricity, which ſeemed diſſipated during the rain, began again as ſoon as the rain ceaſed, although the thunder was very diſtant.

Mr. Franklin has contrived a very ingenious and eaſy way of trying experiments of this kind by means of an electrical kite, made of a large thin ſilk handkerchief, extended and faſtened at the four corners to two ſlight ſtrips of cedar, of ſufficient length for this purpoſe. This kite, being accommodated with a tail, loop, and ſtring, will riſe in the air like thoſe of paper. To the top of the upright ſtick of the croſs is to be fixed a very ſharp-pointed wire, riſing a foot or more above the wood. To the end of the twine, next the hand, is to be tied a ſilk ribbon; and where the twine and ſilk join, a key may be faſtened. The kite is to be raiſed when a thunder-guſt appears to be coming on, and as ſoon as the thunder clouds come over the kite, the pointed wire will draw the electric fire from them, and the kite with all the twine will be electrified; and the looſe filaments of the twine will ſtand out every way, and be attracted by an approaching finger. When the rain has wet the kite and twine, ſo that it can conduct the electric fire freely, it will ſtream out plentifully from the key on the approach of a man's knuckle. At this key the phial may be charged; and from electric fire thus obtained ſpirits may be kindled, and all the other electrical experiments be performed, which are uſually done by the help of a rubbed glaſs globe or tube, and the ſameneſs of the electric matter with that of lightning may thereby be completely demonſtrated.

Laws, &c. of ELECTRICITY.—Mr. Ellicott, from carefully obſerving the various phœnomena of electricity, thinks that the following concluſions, or general laws, may be juſtly deduced from the phœnomena.

1. That theſe remarkable phœnomena are produced by means of effluvia; which, in exciting the electrical body, are put into motion, and ſeparated from it.

2. That the particles compoſing theſe effluvia ſtrongly repel each other.

3. That there is a mutual attraction between theſe particles and all bodies whatſoever.

Mr. Watſon has endeavoured to prove, that electricity is not furniſhed from the glaſſes employed in the experiments, nor from the circumambient air. He thinks that electricity is the effect of a very ſubtile and elaſtic fluid, occupying all bodies in contact with the terraqueous globe, and that every where in its natural ſtate it is of the ſame degree of denſity; and that glaſs, and other bodies which are called electrics *per ſe*, have the power of taking this fluid from one body, and conveying it to another, in a quantity ſufficient to be obvious to all our ſenſes; and that under certain circumſtances, it is poſſible to render the electricity in ſome bodies more rare than it naturally is; and, by communicating this to other bodies, to give them an additional quantity, and make their electricity more denſe; and that theſe bodies will thus continue until their natural quantity is reſtored to each; that is, by thoſe which have loſt part of theirs, acquiring what they have loſt, and by thoſe to which more has been communicated, parting with their additional quantity. Both the one and the other of theſe is, from the elaſticity of the electric matter, attempted to be done from the neareſt non-electric; and when the air is moiſt, this is ſoon accompliſhed by the circumambient vapours, which here may be conſidered as preventing, in a very great degree, our attempts to inſulate non-electric bodies.

Mr. Watſon's ſyſtem naturally leads him to aſk, by what denomination ſhall we call this extraordinary power? From its effects in theſe operations, ſhall we call it electricity? From its being a principle neither generated nor deſtroyed; from its being every-where and always preſent, and in readineſs to ſhew itſelf in its effects, though latent and unobſerved, till by ſome proceſs it is produced into action, and rendered viſible; from its penetrating the denſeſt and hardeſt bodies, and its uniting itſelf to them; and from its immenſe velocity; ſhall we, with Theophraſtus, Boerhaave, Niewentiit, s'Graveſande, and other philoſophers, call it elementary fire? Or ſhall we, from its containing the ſubſtance of light and fire, and from the extreme ſmallneſs of its parts, as paſſing through moſt bodies we are acquainted with, denominate it, with Homberg and the chemiſts, the chemical ſulphureous principle, which, according to the doctrines of theſe gentlemen, is univerſally diſſeminated? Whatever we call it, it ſeems certain, that this power has many ſurpriſing properties, and cannot but be of great moment in the ſyſtem of the univerſe.

ELECTROMETER, an inſtrument contrived to meaſure the force of electricity.

M. d'Arcy, in the Memoirs of the Royal Academy of Sciences at Paris, has given us the following curious electrometer.

Plate LIX. *fig.* 13. is a large veſſel A B, containing a glaſs bottle C D, called the philoſophical egg; at the extremity of the neck of this bottle is fitted on the rod V, perfectly cylindrical, one line in diameter and twelve inches long. The veſſel A B is covered again at the top with a plate of braſs H, which fits cloſe upon it; this plate has a large perforation at its center, and ſo has the veſſel, that the rod may paſs through at liberty. At the upper extremity of the rod is the ſmall circular plate of braſs L, fourteen lines one ſixth diameter. The veſſel A B being full of water, the egg is immerſed to a certain depth, which ought to be ſuch, that the inſtrument being at reſt, that is, not electrified, the lower extremity of the egg may be as near as poſſible to the bottom of the veſſel without touching it. That the egg and rod may always be in a vertical ſituation, the egg is ballaſted with mercury, by which means, the center of gravity being very low, the whole keeps itſelf perpendicular to the horizon, and proves by the leaſt poſſible motion of the egg, from its balance, that if it were not confined, it would go towards the ſides of the veſſel, and ſwim ſometimes on one ſide and ſometimes on the other; wherefore it was neceſſary to determine it to a center in the following manner: on the plate H are fixed fine ſilver wires in the form of a croſs, like thoſe in micrometers; this croſs is formed by double wires, having a ſmall ſquare ſpace in the center of the plate, which, being larger than the diameter of the rod, permits it to aſcend and deſcend between the wires without any ſenſible friction, and yet reſtrains it from erring from its center: and this ſingular phœnomenon ariſes, when the whole machine is ſtrongly electrified, namely, the rod keeps in the middle of the wires almoſt without touching them, becauſe, being electrified as well as they, it avoids them continually.

After this deſcription of the inſtrument, it is eaſy to conceive its uſe, eſpecially if we attend to this known principle in hydroſtatics, that a body immerſed in water ſwims on the ſurface or ſinks in it, in proportion as a volume of water, equal to that it poſſeſſes, is lighter or heavier than the body itſelf; from this principle it follows, that a volume of water equal to that of the egg,

and

and that part of the rod immerſed in the water when the whole is at reſt, was equal to the egg, the little plate, and all the rod: conſequently, if the whole be elevated one inch, the power which will ſuſtain it at this height, will ſuſtain a weight equal to a volume of water of the thickneſs of the rod, and an inch in height; becauſe the volume of water which the egg and rod then poſſeſs, is leſſened by this quantity. If, therefore, different powers ſuſpend it at 1, 2, 3, 4 inches, &c. in height, above the point of reſt, theſe powers will be, with regard to each other, as theſe numbers, double, triple, quadruple, &c. You will ſee in a moment that electricity produces the ſame effect upon the electrometer; that is, it performs the function of a power which would ſuſpend it at 1, 2, 3, 4 inches, &c. above its point of reſt; and, conſequently, that by means of this inſtrument we may eſtimate all its different degrees of force. Let us ſuppoſe, for example, the whole machine compoſed of the veſſel A B, the egg, &c. placed like that in *fig.* 14. on a recipient of glaſs or any other electric *per ſe*. Electrify the veſſel A B, the rod V and plate L will become electrified alſo. Now it is admitted that all electrical bodies repel each other: thus the little plate L and the rod V, being repelled by the great plate H, will neceſſarily riſe more or leſs in proportion to the ſtrength or weakneſs of the electricity. Electricity therefore will, as has been already obſerved, perform the function of a power that will ſuſpend the inſtrument to a certain elevation; but as theſe powers are proportional to the elevations of the inſtrument above its equilibrium, or point of reſt, theſe elevations alſo will be in proportion to the different degrees of the force of electricity: this is therefore a true electrometer. But this inſtrument is of much more extenſiveneſs than barely this; for it may be employed in a great number of electrical experiments to determine the laws of attraction, repulſion, tranſmiſſion, &c. in electrical bodies: diſcoveries equally important with that of menſurating electrical force.

Method of uſing the ELECTROMETER.—As electrical bodies have this inconvenience, that they cannot be approached without deſtroying their electricity, it is evident that, if we come ſo near the electrometer as to judge of its motions with exactneſs, we ſhould deſtroy its electricity. This reaſon determined M. d'Arcy, after a number of attempts, to make his obſervations in the following manner: he placed a capacious lantern with a large wax candle, in a part of the room which projected its light through a hole on the electrometers I, K (we have not drawn the lantern in the plate, for fear it might have cauſed ſome confuſion, and have therefore only exhibited the ray of light); behind theſe electrometers is a very ſolid frame Q, all the part X is wood, but it may conſiſt of any opaque matter. In this frame are cut two rectangular apertures or windows filled with glaſſes, on which are marked very exact diviſions with ſtrong Indian ink.

This frame is ſo diſpoſed that the projection of the electrometers may fall upon the glaſſes, and the extremity of the rod D, being made in the form of a cone, projects a very nice ſhadow. Now, as theſe glaſſes are tranſparent, the obſervator, placed behind in F, ſees, in the moſt diſtinct manner, all the different elevations of the electrometer, and can therefore judge of all its variations with the utmoſt exactneſs; for the plane of the ſquare being perpendicular to the horizon, and the electrometer riſing and falling in a parallel plane, the elevations and depreſſions of the ſhadows are always correſpondent to thoſe of the electrometers. The chains M ſerve to conduct the electricity from the bar of iron or any other electrified body to the electrometers: the ſquare Q, inſtead of two windows, may have but one, that being ſufficient for the electrometer: but M. d'Arcy thought it adviſeable to make his obſervations on the inſtrument with which he made his experiments, and the electrometer too, in order to be aſſured that the electricity is always equal, which cannot be done without comparing their ſhadows very accurately. The conſtruction of the electrometer ſhews, it has all the eſſentials of an inſtrument of this kind.

1. As the electrical force is very weak, the inſtrument muſt be very nice and ſenſible of the leaſt impreſſion: therefore the weight of eight grains laid on the little plate L makes it ſink above four inches.

2. As the electrical force is very ſubject to alterations, the inſtrument muſt be ſo contrived as to exhibit all its variations; and a thouſand experiments have ſhewn that the leaſt alteration in the force of electricity, immediately affects this electrometer. It is in ſhort univerſal, for the true electrometer is the cylindrical rod V, which determines the quantity of electrical power by the number of its parts raiſed above the point of reſt: now it is not difficult to procure a cylindrical rod of a line diameter. It is true the diameter of the little plate L, and its diſtance to H, the point of reſt, may cauſe ſome difference in the repulſion; but it is eaſy to obſerve all theſe proportions, ſo that any one may conſtruct an electrometer, which will be equally operated upon, by the ſame power of electricity: this property ſeems to be one of the moſt remarkable in his inſtrument, like that of M. Reaumur's thermometer, which all Europe has admired. As this electrometer may be uſed as an inſtrument, it may be neceſſary to give ſome account of the experiments that have been made. In order to diſcover whether electricity is in proportion to the bulk or ſurface of bodies, M. d'Arcy proceeded in the following manner: the inſtrument E ſerved for an electrometer, the other I was deſigned to make the experiment on; above this laſt was ſuſpended perpendicularly, at the diſtance of ten inches, a cap or portion of the ſphere P S; this cap was of hammered iron, very thin, and of a very regular figure; it received its electricity from the electrical bar by a braſs wire, and, being ſuſpended on ſilk, preſerved it. The chain in *fig.* 14. extends to both inſtruments, but in this experiment it only communicated with the electrometer, ſo that the inſtrument was not electrified. M. d'Arcy ſays one perſon made his obſervation on the ſquare of the height of the electrometer cauſed by the electricity, while another obſerved the elevation of the inſtrument; and ſeveral repeated experiments confirmed them in the opinion that the elevation of the inſtrument was in proportion to the force of the electricity; and this they found to anſwer exactly, after having repeated the experiment above fifty times. He afterwards poured mercury into this cap till it increaſed the weight ſixty times, and found no ſenſible alteration in the experiment: this ſeems to ſhew that the attraction of electrical bodies is in proportion to their ſurfaces; but this is a matter of doubt, for the fire and ſparks drawn from an electrical body may obſerve ſome other law. Certain it is, that a piece of any metal muſt be of a certain thickneſs to extract ſhining ſparks from it, otherwiſe you only procure ſuch a kind of fire as is extracted from electrified wood of any thickneſs; yet the ſparks extracted from the middle of a plate of iron are very ſtrong; and thoſe extracted from the cap, either with or without mercury, ſeemed to have no difference. In ſhort, by a multitude of experiments M. d'Arcy found that the gravity or levity of a body neither increaſe nor diminiſh its electricity.

We ſhall add another experiment made by M. d'Arcy, in order to know whether an electrical body always tranſmitted the ſame quantity of electricity, of whatever volume it was. Every thing being diſpoſed, as in *fig.* 14. except that the inſtrument with which he made his experiment, inſtead of communicating with the iron bar by a chain, had a communication with it by a very fine iron wire; he electrified the bar of iron, and made his obſervations on the electrometer and the inſtrument: he afterwards ſubſtituted a much thicker wire in the room of the fine one, and repeated the experiment, but did not find the leaſt difference in the reſult, though it was performed ſeveral times with wires of all the different ſizes that could be procured.

The objections to M. d'Arcy's electrometer are of three kinds, its certainty, univerſality, and the method of making uſe of it. It may be aſked in the firſt place, whether the egg immerſed in water be not more or leſs repelled by the bottom of the veſſel, which would affect the electrometer, without any alteration in the electricity? In anſwer to this, a body totally immerſed in a fluid, receives no motion from electricity; and this is a fact confirmed by experiments. 2. It may be aſked whether the bodies which tranſmit the electricity to the electrometer, may not act differently on the electrometer? The experiment already produced of wires of different magnitudes tranſmitting the ſame quantity of electricity, ſufficiently

proves electricity to have the property of fluids, which always endeavour to preſerve a plain ſurface, whatever are the canals of their communication. Beſides, it follows from this property, that the leaſt change of electricity, in a body compoſing the maſs of thoſe which are electrical, equally influences the whole maſs; which ſolves another objection that might be made againſt the veſſels of glaſs on which the electrometer is ſupported: it may be ſaid, that, being more or leſs dry, they might loſe their electricity, and the electrometer ſink, though there was no alteration in the electrical bodies themſelves: but the laſt property already mentioned, proves, that electricity, like a fluid, endeavours to preſerve an even ſurface, and is therefore acted upon equally; and this is ſupported by a number of experiments.

It may in the laſt place be objected, that the inſtrument, notwithſtanding all that has been ſaid about it, is too coarſe to be affected ſo nicely, and that we ſhall be apt to draw falſe conſequences from it; but the following experiment will ſhew this objection entirely groundleſs.

The iron bar which receives the electricity of the globe was placed at the diſtance of about twenty inches from it; a communication was made afterwards between this bar and the electrometer; and, the chamber being made very dark, M. d'Arcy began to electrify. The electricity which the bar received by this method was ſo weak, that he could ſcarce be ſenſible whether it was electrified or not, by trying to draw ſparks from it; and what were drawn, were ſo weak, they ſcarce deſerved the name; notwithſtanding which, the electrometer which had a communication with the iron bar roſe above a degree. This ſufficiently demonſtrates the nicety of the inſtrument, and how eaſily it is acted upon; this too might, if there was occaſion, be ſtill increaſed by leſſening the diameter of the rod.

But the ſtrongeſt objection againſt the univerſality of M. d'Arcy's inſtrument is the different denſity of water in different climates: but in anſwer to this he ſays, if a rod be made which will deſcend four inches with the weight of eight grains, the electrometer will be as correct as his. It may be objected, that in a hot country ſuch a rod might be more repelled, becauſe it would be bigger than the former; but, as the rod is only repelled in proportion to its circumference, the difference can ſcarce be perceivable.

ELECTRUM, amber, in natural hiſtory. See the article AMBER.

ELECTUARY, in pharmacy, a form in which both officinal and extemporaneous medicines are frequently made. It may be conſidered as a number of boluſes united together, but made a little ſofter by the addition of a due proportion of ſyrups, &c.

ELEGANCE, or ELEGANCY, an ornament of politeneſs and agreeableneſs, ſhewn in any diſcourſe, with ſuch a choice of rich and happy expreſſions, as to riſe politely above the common manners, ſo as to ſtrike people of a delicate taſte, and diffuſe a reliſh which affects every body.

It is obſerved that elegance, though irregular, is preferable to regularity without elegance; that is, by being too ſcrupulous of grammatical conſtruction, we loſe certain licenſes wherein the elegance of language conſiſts.

ELEGANCE, in painting, a certain manner which embelliſhes and heightens objects, either as to their form, colour, or both, without deſtroying or perverting the truth. It is not ſeen in the correctneſs of the deſign, as appears from Raphael, and the antique. It is moſt ſenſibly perceived in works otherwiſe careleſs and inaccurate, as in Corregio, where, notwithſtanding all the defects as to juſtneſs of deſign, there is an elegance even in the manner of the deſign itſelf, as well as in the turn of the attitudes, &c.

ELEGIT, in law, a writ of execution, which lies for a perſon who has recovered debt or damages; or upon a recognizance in any court, againſt a defendant that is not able to ſatisfy the ſame in his goods.

ELEGY, in poetry, primarily and generally implies a mournful poem.

The word is derived, according to Didymus, from ε, a particle of grief, and λεγω, to ſay, and according to others from ελεος, ſomething moving, and λεγω.

As elegy, at its firſt inſtitution, was intended for tears; it expreſſed no other ſentiments, it breathed no other accents, but thoſe of ſorrow. With the negligence natural to affliction, it ſought leſs to pleaſe than to move. By degrees, however, elegy degenerated from its original intention, and was employed upon all ſorts of ſubjects, gay or ſad, and eſpecially upon love.

Ovid's books of love, the poems of Tibullus and Propertius, are intitled elegies; and yet ſo far are they from being ſad, that they are ſometimes ſcarce ſerious: ſo that one and the ſame title was indiſcriminately given to poems on different ſubjects, but which agreed in their verſe and manner of writing. The chief ſubjects then to which elegy owes its riſe, are Death and Love: ſo that elegy ought to be eſteemed the moſt perfect, which has ſomewhat of both at once; namely, where the poet bewails the loſs of ſome youth, or damſel, falling a martyr to love. The next are thoſe elegies full of that melancholy complaint which lovers ſeldom want matter for: the thoughts of elegy ſhould be always natural, far from the affectation of wit; its ſentiments tender and delicate; its expreſſion ſimple and eaſy, always retaining that alternate inequality of meaſure which Ovid extols ſo much; and which gives the elegiac poetry of the ancients ſo much the advantage over the moderns. Elegy ſhould flow in one even current, ſmooth, humble, and unaffected; and yet ſhe is not abject in her humility, but becoming, elegant, and attractive.

Some early writers in this way, among the Greeks, were Callimachus, Philetas, Mimnermus, Callinus, and others, of whoſe writings only fragments have been ſaved. Quintilian gives the preference to Callimachus; but Horace ranks Mimnermus above him. Mimnermus is by ſome reckoned the inventor of elegiac verſe; he at leaſt gave it its perfection, and was perhaps the firſt who transferred it from funerals to love.

Among the Latins, Ovid, Tibullus, and Propertius, bear the firſt rank: there is ſcarce any thing of Catullus's elegiac, except the meaſure of ſome of his verſes; and thoſe ſo rough, that they cannot be read without great offence to the ear. Ovid is generally reckoned the firſt among the elegiac writers; yet Tibullus is leſs diffuſe and more correct. Ovid's perpetual repetition of *mei*, *tui*, and *ſui*, in the laſt foot of his pentameters, is unpardonable. Tibullus and Propertius rarely fall into this fault, but into another, eſpecially the latter, from which Ovid is free; and that is, concluding the pentameter with words of three or four ſyllables; whereas harmony requires a word of no more than two.

Among the ancients, hexameters and pentameters were ſo peculiar to elegy, that this kind of metre is uſually ſtyled elegiac. Inſtead of it, we, in our tongue, uſe the word heroic.

Among our modern poems, we have only ſome elegies on funeral occaſions; but we have many that may be called ſo in the larger ſenſe of the word, as uſed by the ancients; many very ingenious ones on love; and others of a melancholy and ſoft turn.

ELEMENT, in phyſiology, a term uſed by philoſophers to denote the original component parts of bodies, or thoſe into which they are ultimately reſolvable.

The elements of Ariſtotle were four, earth, water, air, and fire. See ARISTOTELIAN *Philoſophy*.

The Carteſians admit only three elements, the firſt a materia ſubtilis, or fine duſt; the ſecond, a coarſer, but round kind; and the third, a ſtill more irregular and hooked kind of particles. See the article CARTESIAN *Philoſophy*.

Concerning the true elements of nature, the incomparable Sir Iſaac Newton thus explains himſelf in his Optics: "It ſeems probable to me, that God in the beginning formed matter in ſolid, maſſy, hard, impenetrable, moveable particles, of ſuch ſigns and figures, and with ſuch other properties, and in ſuch proportion to ſpace, as moſt conduced to the end for which he formed them; and that theſe particles, being ſolid, are incomparably harder than any porous bodies compounded of them; even ſo very hard, as never to wear or break in pieces, no ordinary power being able to divide what God himſelf made one in the firſt creation. While the particles continue entire, they may compoſe bodies of one and the

ſame nature and texture in all ages: but, ſhould they wear away, or break in pieces, the nature of things depending on them would be changed. Water and earth compoſed of old worn particles, and fragments of particles, would not be of the ſame nature and texture, now, with water and earth compoſed of entire particles in the beginning: and therefore, that nature may be laſting, the changes of corporeal things are to be placed only in the various ſeparations and new aſſociations and motions of theſe permanent particles; compounded bodies being apt to break, not in the midſt of ſolid particles, but where thoſe particles are laid together, and only touch in a few points."

The chemical elements or principles to which all bodies may be ultimately reduced, are theſe five: 1. Water, or phlegm, which, in the chemical analyſis of them, riſes firſt in form of vapour. 2. Air, which eſcapes unſeen in great quantities from all bodies, ſo as to conſtitute half the ſubſtance of ſome of them. 3. Oil, which riſes after, and appears ſwimming on, the ſurface of the water. 4. Salt, which is either volatile, or riſes in the ſtill, as that of animal ſubſtances; or fixed, as that of vegetables, which is obtained by reducing them to aſhes, making a lixivium or ley of theſe, and afterwards evaporating the moiſture; by which means the ſalt ſhoots into cryſtals. 5. Earth, or what is called *caput mortuum*, being what remains of the aſhes after the ſalt is extracted. This is the laſt element of all bodies, which can be no farther altered by any art whatſoever. See WATER, AIR, &c.

ELEMENT, in a figurative ſenſe, is uſed for the principles and foundations of any art or ſcience, as Euclid's Elements, &c.

ELEMI, or ELEMY, is a reſin of Aſiatic origin: the plant which produces it is not as yet known with certainty. There is alſo an inferior kind, brought from America, which is the only one now to be met with in the ſhops: the parent of this ſort is called by Ray, *Arbor Brazilienſis gummi elemi ſimile fundens, &c.* a Brazilian tree, yielding a gum like elemi, with winged leaves, verticillate flowers, and a fruit about the ſize and ſhape of an olive.

The true elemi comes over in large oblong maſſes or round leaves, generally wrapt up in leaves of the Indian reed. It is of a yelloviſh or rather greeniſh white colour; ſemitranſparent; of a ſoft conſiſtence, betwixt that of wax and turpentine, or dry on the outſide and ſoftiſh within: by age, it grows hard and brittle throughout. It has a moderately ſtrong, not unpleaſant ſmell, reſembling that of a mixture of fennel, daucus, and ſmallage-ſeeds. It is commonly full of impurities, which are obvious enough to the eye.

This reſin has hitherto been employed only in external applications; in nervine, vulnerary, and digeſtive plaſters and balſams. In making theſe kinds of compoſitions, we muſt be careful to avoid too great a degree of heat in mixing the ingredients; leſt the eſſential oil, the moſt uſeful part of the elemi, be loſt.

ELENCHUS, in logic, a ſophiſm, or fallacious argument, which deceives the hearer under the appearance of truth. See the article SOPHISM.

ELEOSACCHARUM, or ELÆOSACCHARUM. See the article ELÆOSACCHARUM.

ELEPHANT, *Elephas*, in zoology, a genus of quadrupeds, of the order of the jumenta, the characters of which, according to Linnæus, are theſe: it has no foreteeth; the upper canine, or dog-teeth, are conſiderable long; it has a very long flexible proboſcis or trunk, and two paps placed on the breaſt.

The teeth of this animal is what we call ivory. See IVORY.

The elephant, of which there is only one known ſpecies, is, when full grown, from ſeventeen to twenty feet high; and its body is withal ſo enormouſly bulky, that the belly reaches nearer the ground than could eaſily be conceived of a creature of its height. The trunk is, properly ſpeaking, nothing but the noſe continued to a great length; its ſubſtance is fleſhy, but firm, being compoſed of three ſeries or orders of fibres: this trunk the creature can contract or protrude forward with great violence, from the length of one foot to five or more.

Knights of the ELEPHANT, an order of knighthood in Denmark, conferred upon none but perſons of the firſt quality and merit. It is alſo called the order of St. Mary. Its inſtitution is ſaid to have been owing to a gentleman among the Daniſh croiſees having killed an elephant, in an expedition againſt the Saracens, in 1184, in memory of which king Canutus inſtituted this order, the badge of which is a towered elephant, with an image of the Holy Virgin encircled with rays, and hung on a watered ſky-coloured ribbon, like the George in England.

ELEPHANTIASIS, or ELEPHAS, in medicine, is a ſpecies of leproſy, ſo called, becauſe it affects the legs in ſuch a manner, as to make them appear like thoſe of an elephant. See LEPROSY.

The word is derived from the Greek, ελεφας, an elephant.

ELEPHANTOPUS, baſtard ſcabious, in botany, a genus of plants, the compound flower of which is tubuloſe, conſiſting of four or five hermaphrodite and ligulated corollulæ, with a narrow limb, divided into five nearly equal ſegments: the ſtamina are five very ſhort filaments: the ſeeds are ſolitary, and contained in the cup, being of a compreſſed figure, and crowned with briſtly hairs.

ELEVATION, *Elevatio*, the ſame with altitude or height. See ALTITUDE.

Angle of ELEVATION, in gunnery, that comprehended between the horizon and the line of direction of a cannon or mortar; or it is that which the chaſe of a piece, or the axis of its hollow cylinder, makes with the plane of the horizon.

ELEVATION, in architecture, the ſame with an orthographic, or upright draught of a building. See ORTHOGRAPHY.

ELEVATION *of the Hoſt*, in the church of Rome, that part of the maſs where the prieſt raiſes the hoſt above his head for the people to adore.

ELEVATOR, in anatomy, the name of ſeveral muſcles, ſo called from their ſerving to raiſe the parts of the body to which they belong: ſuch are the elevator alæ naſæ, the elevator of the auricle or external ear, the elevator of the epiglottis, of the eye-lids, humerus, lips, urethra, and thoſe of the anus, called alſo levatores. See MUSCLE.

The elevator of the eye-lids is alſo called ſuperbus, as being uſed when people put on a haughty or high look.

ELEVATOR, in ſurgery, an inſtrument to elevate or raiſe bones, as in fractures of the ſkull, &c.

ELEVE, a French term, ſometimes met with in the Engliſh language, ſignifying a diſciple or ſcholar.

ELEUSINIA, in Grecian antiquity, a feſtival kept in honour of Ceres, every fourth, by ſome ſtates, but by others, every fifth year. The Athenians celebrated it at Eleuſis, a town of Attica, whence the name.

ELEUTHERIA, another feſtival celebrated at Platæa, by delegates from almoſt all the cities of Greece, in honour of Jupiter Eleutherius, or the aſſertor of Liberty.

ELIQUATION, in metallurgy, a ſeparation of the different parts of mixed bodies, by the different degrees of fire required to melt them.

ELIRE, or CONGE D'ELIRE. See the article CONGE.

ELISIUM, or ELYSIUM. See ELYSIUM.

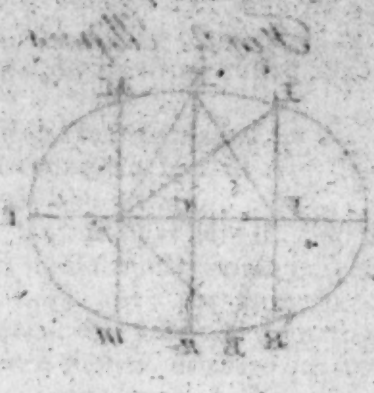
ELISION, in grammar, the cutting off or ſuppreſſing a vowel at the end of a word, for the ſake of ſound, or meaſure, the next word beginning with a vowel.

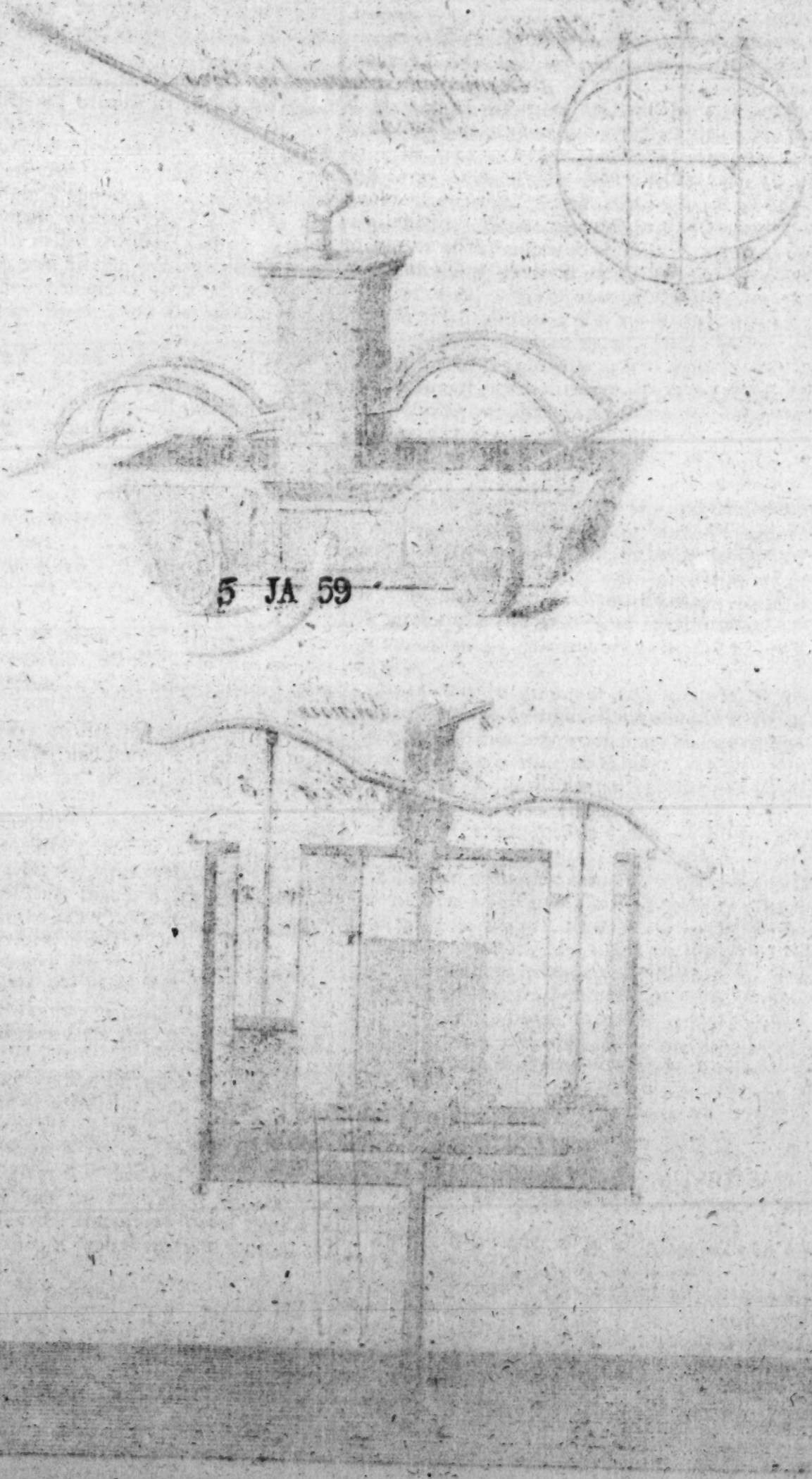
Eliſions are pretty frequently met with in Engliſh poetry, but more frequently in the Latin, French, &c. They chiefly conſiſt in ſuppreſſions of the *a*, *e*, and *i*, though an eliſion ſuppreſſes any of the other vowels: in the following example from Virgil there are three eliſions.

Phillida amo ante alias. ——

ELIXATION, in pharmacy, the extracting the virtues of ingredients by boiling or ſtewing. See DECOCTION.

ELIXIR, a compound tincture extracted from many efficacious ingredients. Hence the difference between a tincture and an elixir ſeems to conſiſt in this, that a tincture is drawn from one ingredient, ſometimes, with an addition





5 JA 59

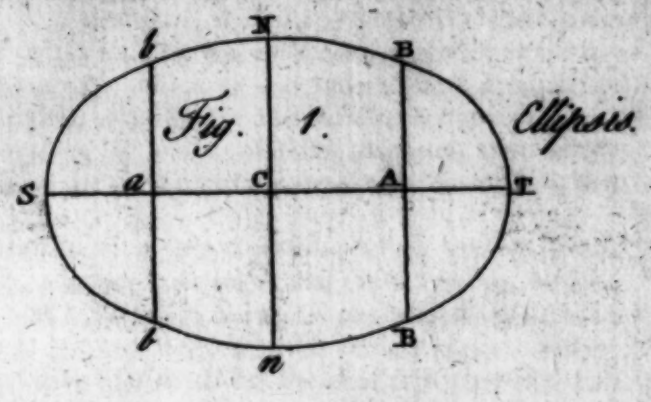


Fig. 1. Ellipsis.

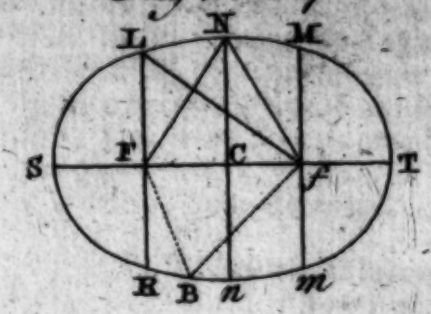


Fig. 2. Ellipsis

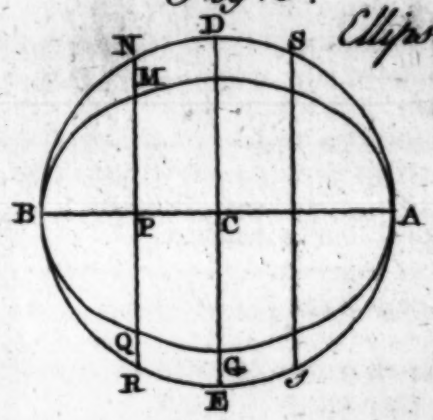


Fig. 3. Ellipsis

Engine for Extinguishing Fires

Fig. 4.

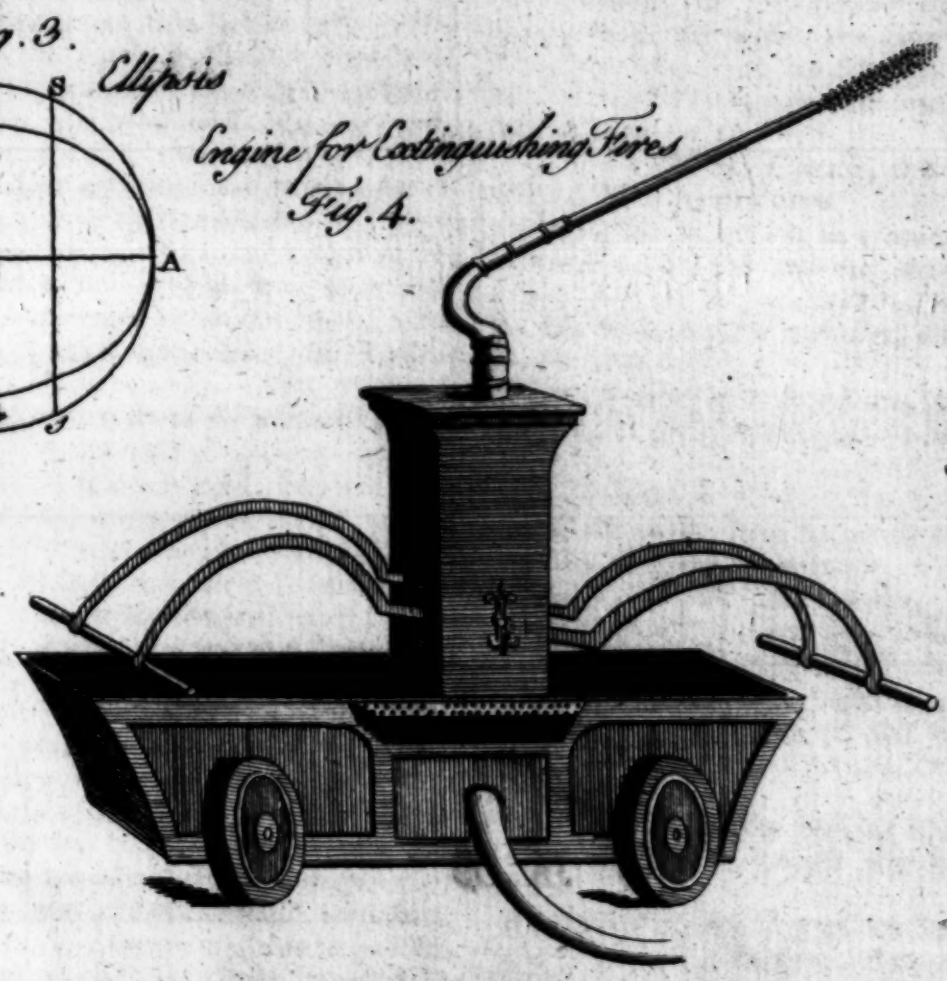
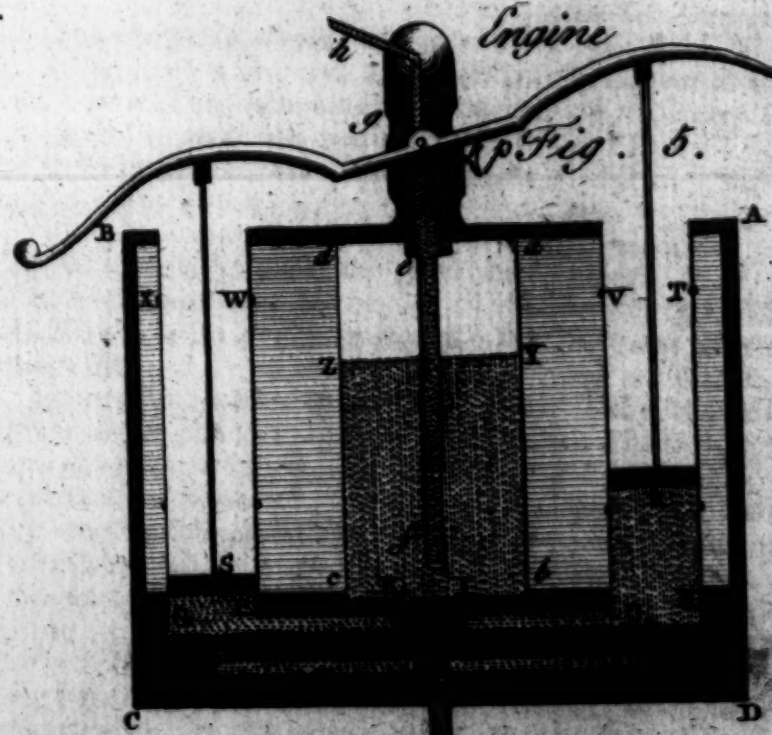


Fig. 6. Engine.



Engine

Fig. 5.

addition of another to open it, and diſpoſe it to yield to the menſtruum; whereas an elixir is a tincture extracted from ſeveral ingredients at the ſame time.

The word is Arabic, *al-eciſir*, or *al-ekſir*, and implies an artificial extraction of ſome eſſence.

ELK, *Alce*, in zoology, an animal of the deer-kind, with the horns palmated, and without a ſtem. It is a native of the northern parts of Europe; and is a very large and ſtrong animal, being equal in ſize to a horſe, but much leſs beautiful.

Elk's hoofs ſtand recommended for the cure of the epilepſy, but at preſent are only uſed as an ingredient in ſome old compoſitions.

ELL, *Ulna*, a meaſure of length, different in different countries; but thoſe moſtly uſed in England, are the Engliſh and Flemiſh ells; the former of which is three feet nine inches, or one yard and a quarter, and the latter only twenty-ſeven inches, or three quarters of a yard. In Scotland, the ell contains 37 $\frac{2}{10}$ Engliſh inches. See the article MEASURE.

ELLIPSIS, or ELLIPSE, in geometry, a figure produced from the ſection of a cone, vulgarly called an oval. See CONIC *Sections*.

The word is Greek, ελλειπσις, and derived from ελλειπω, to want or be deficient; becauſe its conjugate is leſs than its tranſverſe diameter.

If the tranſverſe diameter of an ellipſis, as T S (plate LXI. *fig.* 1.) be interſected or divided into any two parts by an ordinate rightly applied; as at the points A, C, *a*, &c. then are thoſe parts, T A, T C, T *a*, and S A, S C, S *a*, &c. uſually called abſciſſæ's (which ſignifies lines or parts cut off), and by the rectangle of any two abſciſſæ's, is meant the rectangle of ſuch two parts, as, being added together, will be equal to the tranſverſe diameter:

As T A + S A = T S. And T C + S C = T S.
Or, T *a* + S *a* = T S, &c.

Every ellipſis is proportioned, and all ſuch lines as relate to it are regulated, by the help of the following general theorem:

As the rectangle of any two abſciſſæ's: is to the ſquare of half the ordinate which divides them:: ſo is the rectangle of any two abſciſſæ's: to the ſquare of half that ordinate which divides them;

That is, T A × S A : B A *q* :: T *a* × S *a* : *b aq*. T A × S A : B A *q* :: T C × S C : N C *q*. T C × S C : N C *q* :: T *a* × S *a* : *b aq*, &c.

Theſe proportions being found to be the true and common properties of every ellipſis, all that is further required in, or about, that ſection, may be eaſily deduced from them.

There are ſeveral ways of finding the latus rectum; but, I think, none ſo eaſy, and ſhews it ſo plainly to be the third principal line in the ellipſis, as the following theorem:

As the tranſverſe diameter: is in proportion to the conjugate:: ſo is the conjugate: to the latus rectum, viz.

T S : N *n* :: N *n* : L R, the latus rectum. *fig.* 2.

From hence it is evident, that L R, thus formed, is that ordinate by which the other ordinates may be regulated and found: therefore, it is the latus rectum.

Hence it follows, that if the tranſverſe and conjugate diameters of any ellipſis are given (either in lines or numbers) the latus rectum may be eaſily found; and then any ordinate, whoſe diſtance from the conjugate is given, may be found.

The focus of an ellipſis is the diſtance of the latus rectum from the conjugate or middle of the ellipſis, and that diſtance is always a mean proportional between the half ſum and the half difference of the tranſverſe and conjugate diameters, which gives this theorem:

From the ſquare of half the tranſverſe, ſubtract the ſquare of half the conjugate; the ſquare root of their difference will be the diſtance of each focus from the middle, or common center of the ellipſis.

That is, ſuppoſing the points *f* and F to be the true focus's, viz. *f* C = C F, and T C = $\frac{1}{2}$ T S. N C = $\frac{1}{2}$ N *n*. Then T C + N C : *f* C :: F C : T C − N C. Therefore, F C *q* = T C *q* − N C *q*. Conſequently, F C = $\sqrt{\text{T C}q - \text{N C}q}$. Now from hence is produced that notable propoſition, upon which is grounded the uſual method of deſcribing an ellipſis, and drawing of tangents, &c.

If from the two focus's of any ellipſis there be drawn two right-lines, ſo as to meet each other in any point of the ellipſis's periphery, the ſum of theſe lines will be equal to the tranſverſe.

Viz. *f* N + N F = T S. *f* L + L F = T S. Or F B + B F = T S, &c.

And this propoſition muſt needs hold true, for every point in the ellipſis periphery, viz. at B, &c. as will evidently appear to any one who rightly conſiders, that as a thread juſt the length of the diameter of any circle, having its two ends tied together, and then moved about a point in the center (viz. by making it a double radius) will, by drawing another point in its extremity, deſcribe the periphery of a circle. Even ſo, if a thread, juſt the length of the tranſverſe diameter T S, have its two ends ſo fixed upon the two focus's *f* and F, as that it may be moved about them, by drawing a point in its extremity, (viz. at its full ſtretch) it will deſcribe the true periphery of an ellipſis.

Let A B (*fig.* 3.) be the tranſverſe diameter of the ellipſis A F B G, G F its conjugate diameter, A B D E the circumſcribing circle,

Becauſe in the circle A C × C B : A P × P B :: C D *q* : P N *q*; and in the ellipſis A C × C B : A P × P B :: C E *q* : P M *q*, it will be C D : C F :: P N : P M; or, as (E D =) A B : F G :: N R : M Q; but all the N R's make the circle, and the ſame number of M Q's make the ellipſis. Hence, as A B to F G, or as the longeſt diameter of the ellipſis to its ſhorteſt, ſo is the area of the circumſcribing circle to the area of the inſcribed ellipſis; that is, as A B : F G :: area of the circle, to the area of the ellipſis. Wherefore, as (A B × A B =) A B *q* : A B × F G :: circle's area, to the elliptical area.

Hence, as the circle is to its circumſcribed ſquare, or to the ſquare of its diameter; ſo is the ellipſis to the circumſcribing parallelogram, or to the rectangle of its diameter.

Hence the quadrature of the ellipſis depends upon the quadrature of the circle.

Hence alſo the area of any ſegment of the ellipſis is to the area of the correſponding circular ſegment, as the ſhorteſt diameter of the ellipſis to the longeſt.

Hence as 4, to 3,14159,26536—, or as 1, to .78539,81634, ſo is the product of the diameters of the ellipſis to its area. Wherefore, if the product of the diameters of an ellipſis be multiplied by .78539,81634, the laſt product will give its area.

ELLIPSIS, in grammar and rhetoric, is a figurative way of ſpeaking by which ſome word in a diſcourſe is retrenched, or omitted, when ſome violent paſſion will not let a perſon utter what he thinks.

ELLIPTIC, or ELLIPTICAL, ſomething belonging to an ellipſis. See ELLIPSIS.

ELLIPTICAL ARCH, a part or ſegment of the curve of an ellipſis.

Elliptical arches are frequently preferred to thoſe that are circular in various kinds of buildings, becauſe their ſpan may be equal to thoſe of the circle, without riſing to ſo great a height; and this is the reaſon why they have been preferred in bridges: but it muſt be remembered that they will decreaſe in ſtrength, in proportion as they deviate from the circle. See the article BRIDGE.

The manner of conſtructing the centers of elliptical arches will be ſufficiently evident from the figures on plate LX. if the nature and properties of the ellipſis be previouſly known. See ELLIPSIS.

Explanation of plate LX.

Fig. 1. is the center that was uſed to ſupport the vault of St. Peter's church at Rome. This vault is nearly circular.

Fig. 2. is a center of an elliptical arch for ſupporting the arch of a bridge, arcade, vault, &c.

Fig. 3. is another elliptical center lower, but of equal ſpan with that of *fig.* 2.

Fig. 4. is another center for ſupporting the vouſoirs of a vault, &c. conſiderably lower than the former.

The centers are compoſed of the following pieces of timber.

A, triangular braces.
B, perpendicular or upright beams.
C, tranſverſe or horizontal beams.
D, ſide-braces.
d, ſupporting-braces.
E, under-tranſverſe-beams.
F, jambs or ſide-pieces for ſupporting the triangular-beams.
G, large ſide-braces.
g, ſmall ſide-braces.
H, braces.
I, under-braces.
K, under-ſide-braces.
L, under-triangular-braces.
M, ſupporting-pieces.
N, curve-pieces.
P, vouſoirs.
Q, horizontal pieces of wood that ſupport the carpentry.
R, piles.
S, a ſmall pier of maſonry.

ELLIPTOIDES, in geometry, a name uſed by ſome to denote infinite ellipſes, defined by the equation $a y^{m+n} = b x^m (a - x^n)$.

There are ſeveral ſpecies of elliptoides; as for inſtance, if $a y^3 = b x^2 (a - x)$ it is a cubical elliptoid; and if $a y^4 = b x^2 (a - x^2)$ it denotes a biquadratic elliptoid, which is an ellipſis of the third order, with reſpect to the Apollonian ellipſis.

ELM, *Ulmus*, in botany, a genus of trees, whoſe characters are the following.

The flower conſiſts of one leaf, which is ſhaped like a bell, having many ſtamina, or threads, in the center: from the bottom ariſes the pointal, which afterwards becomes a membranaceous or leafy fruit, almoſt heart-ſhaped; in the middle of which is placed a pear-ſhaped ſeed veſſel, containing one ſeed, for the moſt part of the ſame ſhape.

Theſe trees are very proper to plant in hedge-rows, upon the borders of fields, where they will thrive much better than when planted in a wood, or cloſe plantation; and their ſhade will not be very injurious to whatever grows under them; but when theſe trees are tranſplanted out upon banks after this manner, the banks ſhould be well wrought and cleared from all other roots, otherwiſe the plants, being taken from a better ſoil, will not make much progreſs in theſe places. About Michaelmas will be a good time for this work, for the reaſon before aſſigned; but when they are planted, there ſhould be ſome ſtakes fixed in by them, to which they ſhould be faſtened, to prevent their being diſplaced by the winds; and part of their heads ſhould be taken off, before they are planted, which will alſo be of uſe in preventing their being eaſily overturned by winds; but by no means ſhould their leading ſhoot be ſtopped; nor their branches too cloſely cut off; for, if there are not ſome ſhoots left to draw and attract the ſap, they will be in danger of miſcarrying.

In planting of theſe trees, great care ſhould be taken not to bury their roots too deep; which is very injurious to them, eſpecially if they are planted on a moiſt loam or clay; in which caſe, if the clay is near the ſurface, it will be the beſt way to raiſe the ground in an hill, where each tree is to be planted, which will advance their roots above the ſurface of the ground, ſo that they will not be in danger of rotting in winter with moiſture.

When theſe trees are propagated by ſuckers taken from the foot of old trees, they are commonly laid into the ground very cloſe in beds, where, in dry weather, they may be frequently watered, to encourage their putting out roots. In theſe beds they are left two years; by which time thoſe that live will be well rooted, though a great many of them generally die; then they ſhould be tranſplanted into the nurſery.

The timber of the common Engliſh elm is generally preferred to the reſt; though that of the witch elm is often as good, and is the largeſt tree, when planted on a kindly ſoil: but the Dutch elm affords the worſt timber, and never will grow to the ſtature of either of the other ſorts; ſo that this ſhould not be cultivated for the timber; therefore the beſt way to be ſure of the kinds which a perſon would chooſe to propagate, is to have a nurſery of ſtools, in order to furniſh layers; for when they are grubbed up from hedge-rows, there will often be many ſorts intermixed, eſpecially if the people who go about to gather them, furniſh them; becauſe they take them indifferently, wherever they can procure them; ſo that when they are planted out thus blended together, there will be a conſiderable difference in their growths, which will deface the plantation.

ELOCUTION, in rhetoric, the adapting words and ſentences to the things or ſentiments to be expreſſed. It conſiſts in elegance, compoſition, and dignity. The firſt, comprehending the purity and perſpicuity of a language, is the foundation of elocution. The ſecond ranges the words in proper order; and the laſt adds the ornaments of tropes and figures to give ſtrength and dignity to the whole. See STYLE, PERIOD, FIGURE, &c.

ELOGY, *Elogium*, a praiſe or panegyric beſtowed on any perſon or thing, in conſideration of its merit. The beauty of elogy conſiſts in an expreſſive brevity. Elogiums ſhould not have ſo much as one epithet properly ſo called, nor two words ſynonymous. They ſhould ſtrictly adhere to truth; for extravagant and improbable elogies rather leſſen the character of the perſon or thing they would extol.

ELOHA, in Scripture, the ſingular of Elohi, one of the names of God.

ELOHI, ELOI, or ELOHIM, in Scripture, one of the names of God. But it is to be obſerved, that angels, princes, great men, judges, and even falſe gods, are ſometimes called by this name. The ſequel of the diſcourſe is what aſſiſts us in judging rightly concerning the true meaning of this word. It is the ſame as Eloha, one being the ſingular, and the other the plural. However, Elohim is often conſtrued in the ſingular number, particularly when the true God is ſpoken of; but when falſe gods are ſpoken of, it is conſtrued rather in the plural.

ELONGATION, in aſtronomy, is the removal of a planet to the fartheſt diſtance it can be from the ſun, as it appears to an eye placed on the earth.

The word is Latin, from *elongo*, to be diſtant from.

The utmoſt elongation of Venus can be but 45 degrees, and that of Mercury but 30 degrees; which is the reaſon this planet is ſo rarely ſeen.

ELOPEMENT, in law, is where a married woman departs from her huſband, and cohabits with an adulterer; in which caſe the huſband is not obliged to allow her any alimony out of his eſtate, nor is he chargeable for neceſſaries for her of any kind. However, the bare advertiſing a wife in the Gazette, or other public papers, is not a legal notice to perſons in general not to truſt her; tho' a perſonal notice given by the huſband to particular perſons, is ſaid to be good.

An action lies, and large damages may be recovered, againſt a perſon for carrying away and detaining another man's wife.

ELOQUENCE, the art of ſpeaking well, ſo as to affect and perſuade.

Cicero defines it the art of ſpeaking with copiouſneſs and embelliſhment.

Eloquence and rhetoric differ from each other, as the theory from the practice; rhetoric being the art which deſcribes the rules of eloquence, and eloquence that art which uſes them to advantage. For the moſt part, however, they are uſed indiſcriminately for each other.

ELUL, one of the Hebrew months, anſwering pretty nearly to our Auguſt. There are but twenty-nine days in it. It is the twelfth month of the civil year, and the ſixth of the eccleſiaſtical. Upon the ſeventh or ninth day of this month the Jews faſt, in memory of what happened after the return of thoſe who went to view the promiſed land.

ELUTRIATION, in metallurgy, the ſeparating the lighter matters from the mixed ores of metals, by means of great quantities of fair water.

ELYSIUM, or ELYSIAN FIELDS, in heathen mythology, certain plains abounding with woods, fountains, verdure, and every delightful object; ſuppoſed to be the habitation of heroes and good men, after death.

According

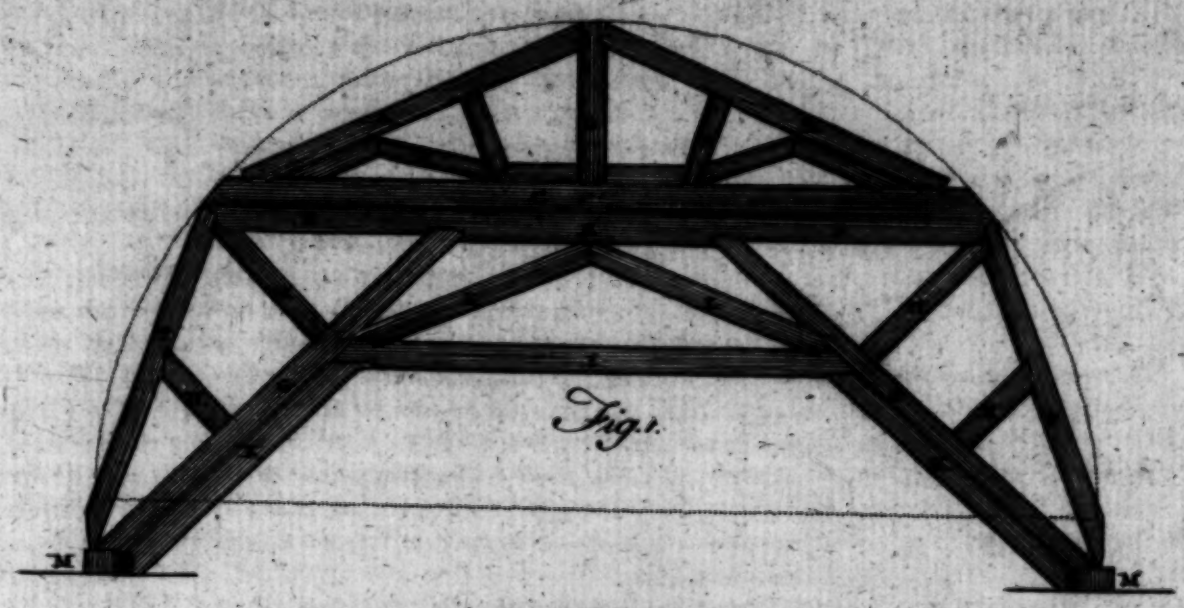


Fig. 1.

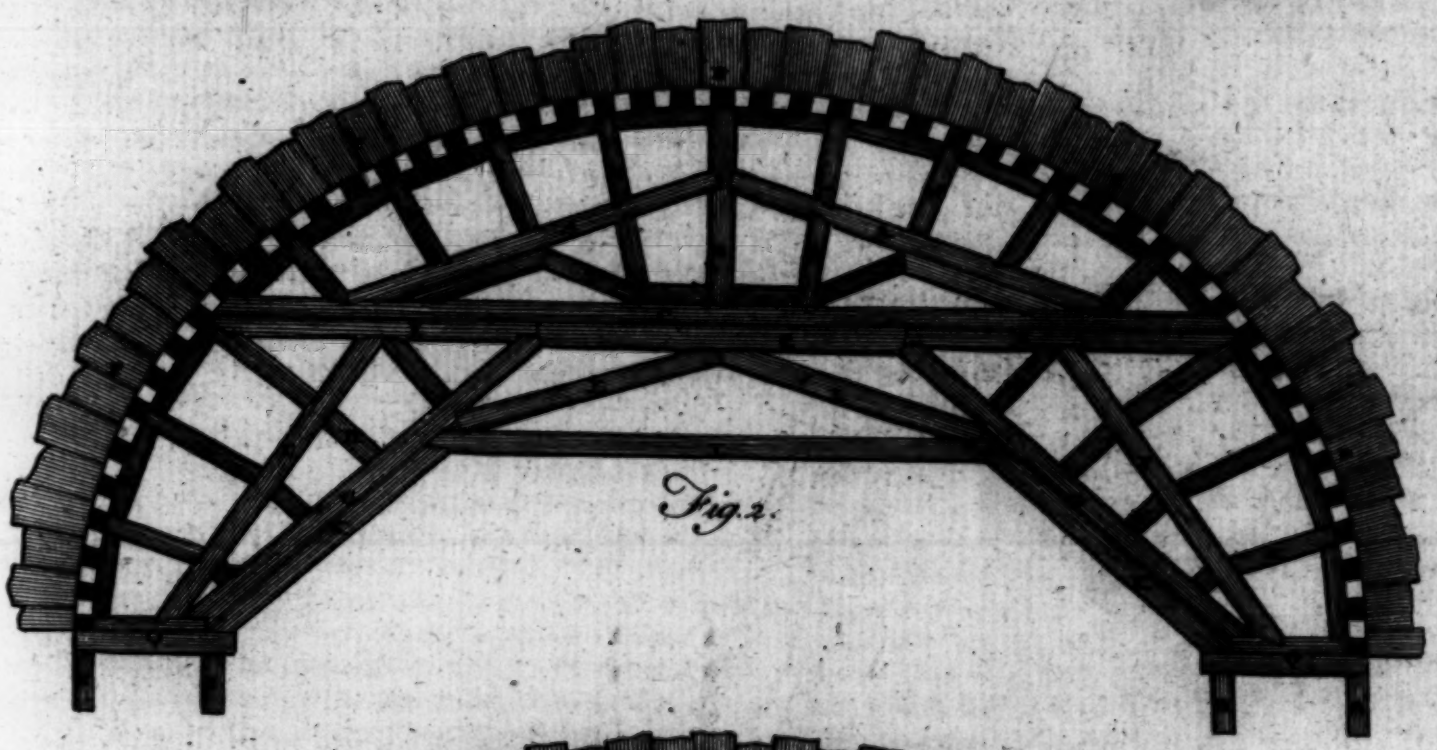


Fig. 2.

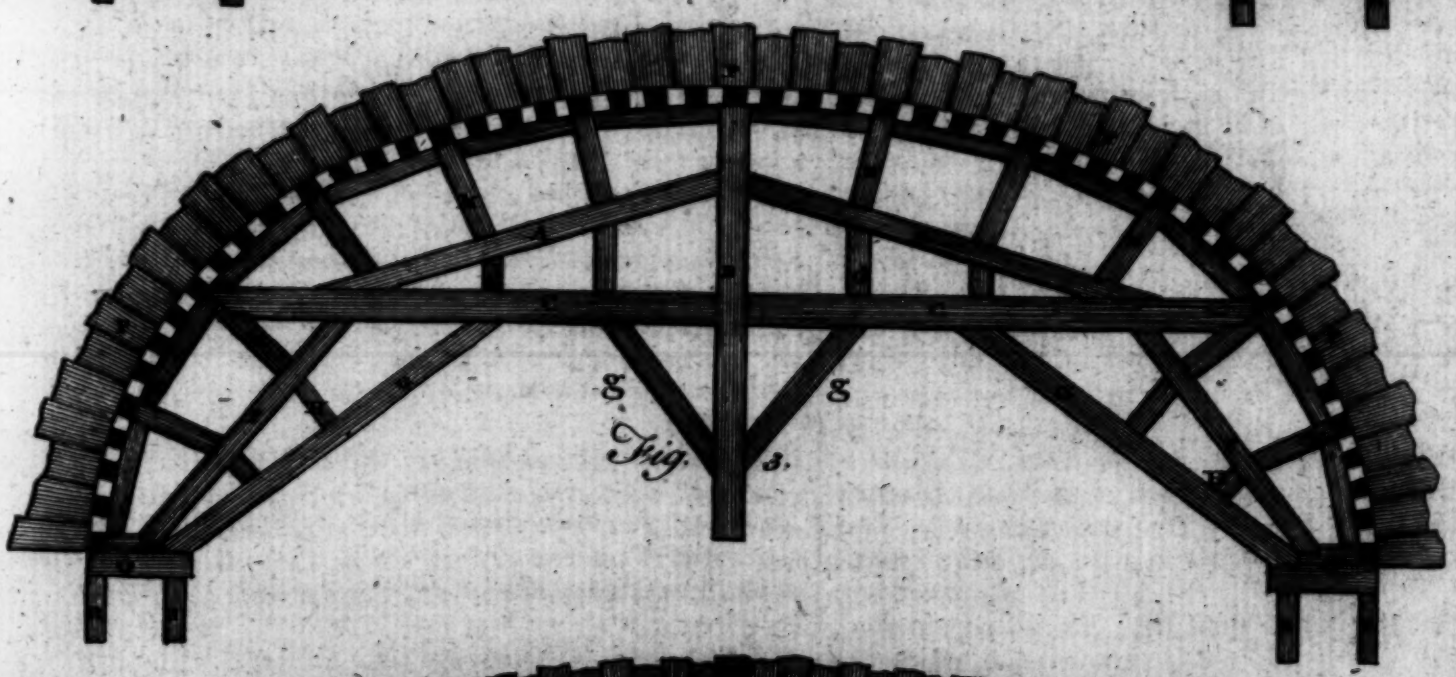


Fig. 3.

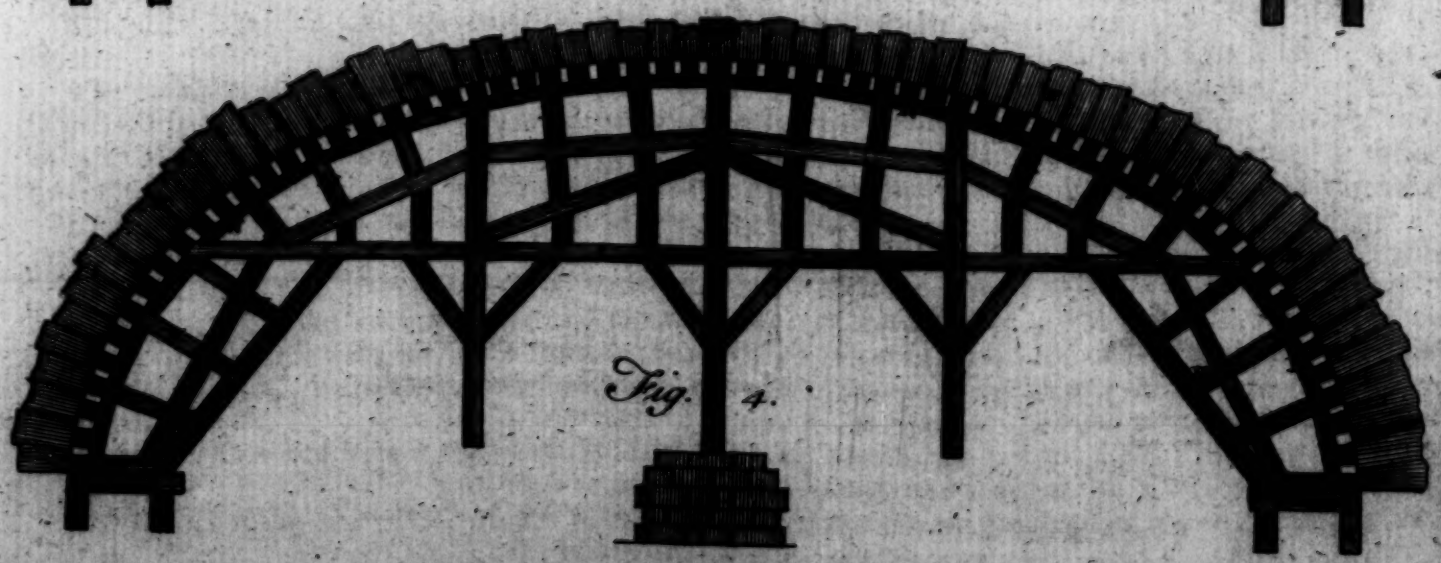


Fig. 4.

T. Lodge Sculp.

5 1A 59

According to ſome, the fable of elyſium is of Phœnician extraction, or rather founded upon the account of Paradiſe delivered in the Scriptures. As to the ſituation of theſe happy regions, authors are not agreed. Homer makes them the ſame with certain pleaſant meadows near Memphis, on the banks of the Acheruſian lake, mentioned by Diodorus Siculus, in his deſcription of the funerals of the Egyptians. Virgil ſeems to place them in Italy, only under ground; and others in other places: but the generality of authors will have them to be ſituated in the Fortunate Iſlands.

ELYTROIDES, or VAGINALIS, in anatomy, the ſecond proper membrane that involves the teſtes. See TESTICLE.

EMANCIPATION, in the Roman law, the ſetting free a ſon from the ſubjection of his father; ſo that whatever moveables he acquires, belong in propriety to him, and not to his father, as before emancipation.

EMARGINATED, among botaniſts, an appellation given to ſuch leaves as have a little indenting on their ſummits: when this indenting is terminated on each ſide by obtuſe points, they are ſaid to be obtuſely emarginated; whereas when theſe points are acute, they are called acutely emarginated.

EMAUX DE L'ESCU, in heraldry, the metal and colour of the ſhield or eſcutcheon. See the article SHIELD.

EMBALMING is the opening a dead body, taking out the inteſtines, and filling the place with odoriferous and deſiccative drugs and ſpices, to prevent its putrifying.

EMBARGO, in commerce, an arreſt on ſhips, or merchandize, by public authority; or a prohibition of ſtate, commonly on foreign ſhips, in time of war, to prevent their going out of port; ſometimes to prevent their coming in; and ſometimes both for a limited time.

EMBASSADOR, or AMBASSADOR. See AMBASSADOR.

EMBASSY, the office or function of an ambaſſador.

EMBATTLED, in heraldry, the ſame with crenelle. See CRENELLE.

EMBER-WEEKS, or DAYS, in the Chriſtian church, are certain ſeaſons of the year ſet apart for the imploring God's bleſſing, by prayer and faſting, upon the ordinations performed in the church at ſuch times.

Theſe ordination-faſts are obſerved four times in the year, viz. the Wedneſday, Friday, and Saturday after the firſt Sunday in Lent, after Whit-Sunday, after the fourteenth of September, and the thirteenth of December; it being enjoined, by a canon of the church, that deacons and miniſters be ordained, or made, only upon the Sundays immediately following theſe ember-faſts.

The ember-weeks were formerly obſerved in different churches with ſome variety, but were at laſt ſettled as they are now obſerved, by the council of Placentia, in the year 1095. The council of Mentz, convened by Charlemagne, mentions the ember-weeks as a new eſtabliſhment.

EMBLEM is a kind of painted ænigma, or certain figures delineated or cut metaphorically, expreſſing ſome action, with reflections underneath, which in ſome meaſure explain the ſenſe of the device, and at the ſame time inſtruct us in ſome moral truth, or other matter of knowledge.

The word is derived from the Greek, εμβαλλω, to throw upon.

The emblem is ſomewhat plainer than the ænigma. The Greeks gave this name to inlaid or Moſaic works, and even to all kinds of ornaments of vaſes, garments, &c. and the Latins uſed emblem in the ſame ſenſe. The invention of emblems is certainly modern; they were entirely unknown to the ancients.

EMBLEMENTS, among lawyers, denote the profits of ſown lands; but are ſometimes uſed, more largely, for any products that naturally ariſe from the ground.

EMBOLISMIC, intercalary, or belonging to the emboliſmus.

The word is derived from the Greek, εμβαλλω, to inſert or put in.

EMBOLISMUS, the exceſs of the ſolar year above the lunar, whereby the lunations happen every ſubſequent year eleven days ſooner than in the foregoing, which, when they amount to thirty days, make a new month, called the emboliſmical lunation, or emboliſmatical month; which muſt be added to make the common lunar year equal to the ſolar.

EMBOLUS, the moveable part of a pump, or ſyringe, called alſo the piſton, or ſucker. See the article PISTON, PUMP, SYRINGE, &c.

EMBOSSING, or IMBOSSING, in architecture and ſculpture, the forming or faſhioning works in relievo, whether cut with a chiſſel, or otherwiſe.

EMBRACE *the Volt*, in the manege. A horſe is ſaid to embrace a volt when, working upon volts, he makes a good way every time with his fore-legs.

EMBRACEOR, among lawyers, a perſon who, having received a reward ſo to do, comes to the bar with one of the parties, and ſpeaks in the caſe; or privily labours the jury, or ſtands in court to over-look them, whereby they are awed or put in fear. Actions of this kind will be embracery, whether the jurors give verdict on the ſide of the party or not. The penalty of this offence is twenty pounds, and impriſonment of the party at the diſcretion of the court: and may be proſecuted either by indictment at common law, as well as by action on the ſtatute. But attorneys and other lawyers are excepted.

EMBRASURE, in architecture, the enlargement made of the aperture of a door or window on the inſide of the wall; its uſe being to give the greater play for the opening of the door, or caſement, or to admit the more light. When the wall is very thick, they ſometimes make embraſures on the outſide.

EMBRASURE, in fortification, a hole or aperture in a parapet, through which the cannon are pointed to fire into the moat or field.

Embraſures are generally twelve feet diſtant from one another, every one of them being from ſix to ſeven feet wide without, and about three within: their height above the platform is three feet on that ſide towards the town, and a foot and a half on the other ſide towards the field; ſo that the muzzle may be ſunk on occaſion, and the piece brought to ſhoot low.

EMBROCATION, in ſurgery and pharmacy, an external kind of remedy, which conſiſts in an irrigation of the part affected, with ſome proper liquor, as oils, ſpirits, &c. by means of a woollen or linen cloth, or a ſponge, dipped in the ſame.

The uſe of embrocation is either to attenuate and diſlodge ſomething obſtructed underneath the ſkin, to eaſe pains, or to irritate the part into more warmth and a quicker ſenſe of feeling.

The pumping uſed in natural baths is properly an embrocation.

EMBROIDERY, a work in gold, or ſilver, or ſilk thread, wrought by the needle upon cloth, ſtuffs, or muſlin, into various figures. In embroidering ſtuffs, the work is performed in a kind of loom, becauſe the more the piece is ſtretched, the eaſier it is worked.

EMBRYO, in phyſiology, the firſt rudiments of an animal in the womb, before the ſeveral members are diſtinctly formed; after which period it is denominated a fœtus. See the articles CONCEPTION, GENERATION, and FOETUS.

EMBRYO-PLANT, the ſame with plantula ſeminalis. See the article PLANTULA.

EMBRYOTHLASTES, in midwifery, an inſtrument contrived for breaking the bones, for the more eaſy extraction of the fœtus, in difficult labours.

EMBRYOTOMY, the cutting a fœtus to pieces whilſt in the womb, practiſed in caſes of neceſſity, when there is no other way of ſaving the mother.

EMBRYULCUS, a hook for extracting the child in difficult labours.

EMERALD, *Smaragdus*, in natural hiſtory, the moſt beautiful of all the claſs of coloured gems, when perfect. It is found ſometimes in the roundiſh or pebble form, ſometimes in the columnar or cryſtalline one; the pebble emeralds, however, are the moſt valued; there are multitudes found of the ſize of a large pin's head, for one of any tolerable bigneſs; though now and then there occur ſtones

of the ſize of a horſe-bean, and even up to that of a walnut, though this laſt very rarely. The pebble emeralds are found looſe in the earth of mountains, and in the beds of rivers; the cryſtalliform ones are uſually met with adhering to a white, opaque, cryſtalline matter, though ſometimes to pieces of jaſper or of the praſius, a coarſer and ſofter gem of the ſame colour, only with ſome tinge of a yellowiſh caſt, and called the root of the emerald. The pebble emeralds are in their natural ſtate bright and tranſparent, though leſs gloſſy than the columnar ones; both are always of a perfect and pure green. It has this green in all the different ſhades, from very dark to extremely pale, and is probably ſometimes entirely colourleſs, though then the Engliſh jewellers call it white ſapphire.

Emeralds are found in the Eaſt-Indies, and in many parts of America, particularly about the gold mines of Peru; they are alſo met with in Sileſia, Bohemia, and in ſome other parts of Europe; but they are very different in luſtre and value, as they come from theſe different parts. The Oriental emeralds are of equal hardneſs with the ſapphire; thoſe of Peru are of much the ſame hardneſs with the garnet, and therefore of proportionably leſs beauty than the Oriental; as to thoſe of the ſeveral parts of Europe, they are but little harder than the cryſtal; but when they are not harder than that ſtone, they are not emeralds at all, but only cryſtals tinged green by copper, and uſually found in mines of that metal. Theſe are very beautiful, but vaſtly inferior to the very worſt of emeralds in hardneſs. The Oriental emeralds are at preſent found only in Cambay, and are there very ſcarce, and few of late have been imported into Europe; the princes of that part of the world being themſelves very fond of them: large quantities of the fineſt emeralds in the world are to be ſeen among their regalia. What we ſee at the Engliſh jewellers under the name of Oriental emeralds are all from Peru, and many of them very beautiful; they are found in the mountains over the gold mines, among a duſky greyiſh earth that fills up the perpendicular fiſſures of the ſtrata of the earth, and ſometimes adhering to the ſides of thoſe fiſſures in their cryſtalline ſhape.

The ſmaragdus of the ancients, properly ſo called, was evidently the ſame with our emerald; though they comprehended alſo under this name every gem, or even ſtone of any conſiderable beauty, and of a green colour.

The emerald is of the number of thoſe gems that owe their colour to the metalline ſulphurs; and therefore loſe it in the fire, becoming colourleſs as cryſtal; though ſtill very hard and of a fine luſtre. The Engliſh druggiſts ſell us, under the name of this gem, fragments of coloured cryſtals and ſpars, which are found in abundance about the mines of copper and iron. It is very certain indeed that the emerald owes its colour to the former of theſe metals, becauſe the factitious paſtes or glaſſes may be coloured to a true ſmaragdine hue by copper; but it does not follow that all the green cryſtals and ſpars have the particles of the ſame metal in the ſame proportion, or that they have not alſo other particles very improper to be given internally.

It will ſtop hæmorrhages and diarrhœas, and ſweeten or obtund the too acrid humours: but as this is recorded of the emerald, as found among the druggiſts, it belongs rather to the cryſtal than to the gem. And perhaps it would be better for the world if both this and the other fragments of the gems were baniſhed from the compoſitions in which they are ordered, and common cryſtal uſed in their ſtead.

To counterfeit EMERALDS. Take of natural cryſtal, four ounces; of red lead, four ounces; verdigriſe, forty-eight grains; crocus martis, prepared with vinegar, eight grains; let the whole be finely pulveriſed and ſifted; put this into a crucible, leaving one inch empty; lute it well, and put it into a potter's furnace, and let it ſtand there as long as they do their pots. When cold, break the crucible, and you will find a matter of a fine emerald-colour, which, after it is cut and ſet in gold, will ſurpaſs in beauty an Oriental emerald.

EMERGENT YEAR, in chronology, the ſame with epocha, whence any æra, or method of reckoning time, commences: ſuch is that of the creation of the world, of the birth of our Saviour, &c. See the article EPOCHA.

EMERSION, in philoſophy, is the riſing of any ſolid above the ſurface of a fluid, eſpecially lighter than itſelf, into which it had been violently immerged or thruſt.

EMERSION, in aſtronomy, is the time when any planet that is eclipſed, begins to emerge or get out of the ſhadow of the eclipſing body.

EMERUS, *Scorpion Sena*, in botany, a genus of plants, whoſe characters are as follow.

It hath leaves like thoſe of the colutea: the flowers are papilionaceous: the pods are ſlender, and contain two or three cylindrical ſhaped ſeeds in each.

Theſe ſhrubs are eaſily propagated by ſowing their ſeeds, which they commonly produce in great plenty, in March, upon a bed of light ſandy earth, obſerving to keep the bed clear from weeds; and in very dry weather you muſt often refreſh the bed with water, which ſhould be given carefully, leſt the ſeeds ſhould be waſhed out of the ground by haſty watering. When the plants are come up, you muſt continue the ſame care; and the Michaelmas following, if your plants have thriven well, you may draw out the largeſt; which may be tranſplanted into the nurſery, at three feet diſtance row from row, and a foot aſunder in the rows. This will give room to thoſe plants which are left to grow in the ſeed bed; in which place they may remain another year, when they will alſo be fit to tranſplant into a nurſery; where they ſhould be trained up in the manner you deſign them to grow, either in round heads, or in rude plants. In one or two years more they will be fit to plant out, where they are to remain for good: in doing of which you ſhould be careful, in taking them up, not to break or wound their roots; nor ſhould they remain too long in the nurſery before they are tranſplanted; for they are ſubject to ſhoot downright roots, which, when cut off, oftentimes prove the death of the tree. In all other reſpects it muſt be treated like other flowering ſhrubs; amongſt which, this is commonly ſold at the nurſeries. It delights in a dry ſoil, and may alſo be propagated by laying down the tender branches; which take root in about a year's time, and may then be tranſplanted into a nurſery, and managed in the ſame manner as the ſeedings. *Miller's Gard. Dict.*

EMERY, *Smiris*, *Smerillus*, *Smyrites*, ſo called from σμαω, or σμεω, to cleanſe or poliſh, a ſpecies of ſtone of which there are three ſorts mentioned by authors; a golden, a cupreous, and a ferrugineous emery. The golden emery is ſaid to be found in the Peruvian and other American mines, to be of a reddiſh colour, to have ſmall veins or ſpecks of gold and ſilver imbeddded in it, to be very rare, and its exportation to be prohibited by the king of Spain: the cupreous ſort to be likewiſe reddiſh, but more equal and free from veins, to hold no gold or ſilver, and to be found in copper mines in Europe: the ferrugineous, to be of a ſparkling whitiſh, a dark grey, or a blackiſh colour, to be found in rich iron mines, and to be the leaſt valuable ſort.

The common emery, whatever be its colour, whether reddiſh, greyiſh, or blackiſh, is a compact ſtone, ſo hard as to cut glaſs like the diamond; impregnated with iron, and a very ſmall portion of copper. It is met with in Norway, Sweden, England, Saxony, and other countries. Bruckman relates, that the emery found at St. Georgenſtadt in Miſnia is ſuperior to the Spaniſh. It is uſed for cutting and poliſhing precious ſtones, for poliſhing agate, porphyry, marble, glaſs, metalline ſpecula, iron and ſteel, and the various utenſils and ornaments made of theſe kinds of ſubſtances: for theſe purpoſes the emery is ground in mills, the powder paſſed through ſieves of different degrees of fineneſs, and thus divided into different ſortments, the fineſt of which, for the nicer uſes, are further divided by waſhing them over ſeveral times with water. The refuſe emery, in grinding, or ſuch as has been uſed in poliſhing, is, in France, dried and kept apart, under the name of *potée d'emery*. Some have employed powdered emery, from its power of poliſhing hard ſtones, as a dentifrice: but for this uſe it is by no means proper, as it wears off the natural poliſh of the teeth.

Several attempts have been made to melt this mineral with the ſeveral fluxes uſed in aſſays for iron, as alkaline

ſalt,

ſalt, borax, charcoal duſt, pitch, tallow, &c. but a fire ſufficiently ſtrong to conquer the refractory ſtony matter, could never be procured. Emery in its crude ſtate is not affected by the magnet. All acids extract ſomewhat from the emery, but none of them diſſolve one half of it.

Putty of EMERY, a kind of dirty matter found on the lapidaries wheels, containing part of the powder of emery.

EMETICS, *Emetica*, are medicines which induce vomiting.

The word is derived from the Greek, εμεω, to vomit.

Emetics are either mild and gentle, or of a more ſtrong and draſtic quality. The milder ſort were principally uſed by the ancients, ſince they are ſafe, and generally, by their quantity, ſtimulate the ſtomach to vomit, eſpecially when it is weak. But theſe do not act beyond the limits of the ſtomach, from which they very advantageouſly evacuate crude, phlegmatic, and bilious humours, produced by improper aliments, or a bad digeſtion.

The more ſtrong and draſtic emetics, when exhibited in a ſmall doſe, by their fine, cauſtic, ſalino-ſulphureous acrimony, act not only on the nervous coat of the ſtomach and inteſtines, by ſpaſmodically conſtricting them; but if exhibited in a ſomewhat larger doſe, they penetrate beyond the ſtomach, into the highly nervous biliary ducts, into the glands of the inteſtines, meſentery, and pancreas, as alſo into the liver, and expel their contained humours from theſe parts. Sometimes alſo they affect the whole nervous ſyſtem, and prove highly injurious to the conſtitution.

It is proper, in order to make emetics work more eaſily, to exhibit them always in a liquid form, or in a ſufficient quantity of ſome moiſtening, relaxing, and pinguious vehicle: for vomiting not only requires a powerful conſtriction of the pylorus and bottom of the ſtomach, but alſo a relaxation of the ſuperior orifice of the œſophagus.

Sydenham lays it down as a rule, that whenever a vomit and bleeding are neceſſary, bleeding ſhould always precede the exhibition of an emetic.

Common ſalt is uſed to check the operation of emetics; which it will certainly do, and make them run off by ſtool: violent vomitings are alſo ſtopped by copious draughts of warm diluting fluids, by mild oils, by opiates, aromatics, by grateful acids, and corroborating medicines, either taken internally, or applied externally to the region of the ſtomach.

EMETOLOGY, that part of medicine which treats of emetics.

The word is formed from the Greek, εμετος, a vomit, and λογος, a diſcourſe.

EMINENCE, a title of honour peculiar to cardinals. See the article CARDINAL.

EMINENCE, in the military art, a high or riſing ground, which overlooks and commands the low places about it: ſuch places within cannon-ſhot of a fort, are a great diſadvantage; for if the beſiegers become maſters of them, they can, from thence, fire into the fort.

EMINENTIAL EQUATION, an artificial equation, containing another equation eminently: it is ſometimes uſed in the inveſtigation of the areas of curved-lined figures. See EQUATION.

EMISSARY, in a political ſenſe, a perſon employed by another to ſound the opinions of people, ſpread certain reports, or act as a ſpy over other people's actions. See the article SPY.

EMMENAGOGUES, EMMENAGOGA, in phyſic, are medicines which promote the menſes or monthly courſes.

The word is derived from the Greek, εμμηνια, the menſtrual diſcharge, and αγω, to draw, or force.

Emmenagogues do this, either by giving a greater force to the blood in its circulation, whereby its momentum againſt the veſſels is increaſed; or by making it thinner, whereby it will more eaſily paſs through any outlets. The former intention is helped by chalybeates and all other ſubſtances of the like gravity and elaſticity; and this is the caſe of a leuco-phlegmatic habit, or the green ſickneſs and its cure: but in the latter caſe, where the blood is florid and too high, attenuating alteratives and detergents are the only remedies, becauſe they are fitteſt to carry the blood through thoſe little apertures deſtined for its diſcharge into the uterus. *Quincy.*

EMOLLIENTS are ſuch medicines as ſheathe and ſoften the aſperities of the humours, and relax and ſupple the ſolids at the ſame time.

The word is derived from the Latin *emollio*, to ſoften.

Their effects may be thus accounted for; by what means ſoever the juices in the human body have obtained any ſharpneſs, ſo as to vellicate the fibres and nervous parts, as is often the caſe; thoſe things which are ſmooth, ſoft, and yielding, cannot but wrap up the points and render them imperceptible; whereby they may be gradually, by the courſe of circulation, brought to ſome proper emunctory, without doing any injury by the way. Such ſharp particles likewiſe draw the fibres into ſpaſms, keep them too tenſe, and frequently occaſion thereby obſtructions of the worſt kind. In all ſuch caſes, therefore, emollients lubricate and moiſten the fibres, ſo as to relax them into their proper dimenſions, whereby ſuch diſorders ceaſe. *Quincy.*

EMPASTING, or IMPASTING, in painting, is the laying on of colours thick and bold, or the applying ſeveral lays of colours, ſo as they may appear thick.

The term is alſo uſed when the colours are laid diſtinct and aſunder, and not ſoftened or loſt in each other. See the article COLOURING.

EMPATTEMENT, in fortification, the ſame with talus. See the article TALUS.

EMPERESS, or EMPRESS, denotes either the wife of an emperor, or a woman who governs ſingly an empire, in her own right.

EMPEROR, *Imperator*, a title of honour among the ancient Romans, conferred on a general who had been victorious, and now made to ſignify a ſovereign prince, or ſupreme ruler of an empire.

EMPETRUM, berry-bearing-heath, in botany, a genus of plants, the flower of which conſiſts of three petals, of an oval oblong figure: the ſtamina are three very long capillary filaments: the fruit is a globoſe, depreſſed, and unilocular berry, containing nine ſeeds, gibbous on one ſide, and angulated on the other.

EMPHASIS, in rhetoric, a particular ſtreſs of the voice and action, laid on ſuch parts or words of the oration, as the orator wants to enforce upon his audience. See ACCENT.

EMPHYSEMA, in phyſic, is any flatulent tumour, generally taken for a ſoft one, ariſing from air that is contained in the cells of the membrana celluloſa.

The word is Greek, from εν and φυσαω, to inflate.

EMPIRE, *Imperium*, in political geography, a large extent of land, under the juriſdiction or government of an emperor. See the article EMPEROR.

EMPIRIC, an appellation given to thoſe phyſicians who conduct themſelves wholly by their experience, without ſtudying phyſic in a regular way. Some even uſe the term, in a ſtill worſe ſenſe, for a quack who preſcribes at random, without being at all acquainted with the principles of the art.

EMPLASTER, *Emplaſtrum*, in pharmacy, the ſame with plaſter. See PLASTER.

EMPYEMA, in phyſic, is, ſtrictly ſpeaking, a collection of purulent matter, in any part whatſoever; but it generally ſignifies that in the cavity of the breaſt only; and which ſometimes happens upon the opening of abſceſſes, or ulcerations of the lungs, or membranes incloſing the thorax.

The word is derived from the Greek, εν, and πυον, purulent matter.

EMPYREUM, a term uſed by divines for the higheſt heaven, where the bleſſed enjoy the beatific viſion.

EMPYREUMA, among chemiſts and phyſicians, the fiery taſte or offenſive ſmell which brandies, and other bodies prepared by fire, are impregnated with.

EMRODS, or HÆMORRHOIDS. See the article HÆMORRHOIDS.

EMULGENT, or RENAL ARTERIES, thoſe which ſupply the kidneys with blood; being ſometimes ſingle, ſometimes double on each ſide. See ARTERY.

EMULSION, in pharmacy, properly ſignifies medicines which reſemble milk. Thus ſolutions of gums, reſins,

reſins, or ſpermaceti, made by means of the yolk of an egg, in a proper vehicle, are called emulſions.

EMUNCTORY, in anatomy, a general term for all thoſe parts which ſerve to carry off the excrementitious parts of the blood and other humours of the body. Such more eſpecially are the kidneys, bladder, and moſt of the glands.

ENÆMON, *εναιμων*, in medicine, an epithet often applied by Hippocrates and Galen, to ſuch topical medicines as are appropriated to a wound newly inflicted, before the blood be ſtopped.

ENÆOREMA, in medicine, that pendulous ſubſtance which floats in the urine. It is alſo called ſublimamentum, and nubeculæ, from its reſemblance to little clouds.

ENALLAGE, in grammar, is when a poſſeſſive pronoun is put for a relative, or one mood or tenſe of a verb is put for another, &c.

ENALLAGE, in rhetoric, is a figure whereby the diſcourſe is changed and reverſed, contrary to all the rules of the language; but this not done altogether at pleaſure, or without reaſon.

ENALURON, according to Guillim, is a border charged all round with birds; though others will have it to ſignify, in orle, or form of a border.

ENAMEL, vulgarly called AMEL, is a kind of coloured glaſs, uſed in painting in enamel.

ENAMEL *Painting*, a ſpecies of painting differing from all other kinds of painting, in employing, as a vehicle for the colours to hold the parts together, and bind them to the ground they are laid upon, glaſs or ſome vitreous body; which being mixed with the colours, and fuſed or melted by means of heat, becomes fluid; and having incorporated with the colours in that ſtate, forms together with them a hard maſs when grown cold; and anſwers, therefore, the ſame end in this, as oil, gum-water, ſize, or varniſh, in the other kinds of painting.

The glaſs or vitreous body applied to this purpoſe of mixing with the colours, in order to bind them to the grounds, is called a flux; and makes one principal claſs of the ſubſtances uſed in enamel painting. When this flux is eaſily fuſible, that is, melts with a leſs degree of heat, it is, in the ſtyle of thoſe who work in enamel, ſaid to be ſoft, and when it is reluctant to melt, and requires a greater degree of heat, it is called hard; and theſe terms are as well applied to the matter of the enamel grounds, and all other vitreous ſubſtances concerned, as to the fluxes. It is, in general, a perfection of the flux to be ſoft, or run eaſily into fuſion: but the great point, with reſpect to this particular, is, that when ſeveral mixtures of colours and fluxes are uſed at the ſame time, they ſhould all correſpond to each other in the degree of this quality; otherwiſe ſome would be rendered too fluid, and perhaps run the matter of the enamel ground into fuſion, and mix with it, while others remained ſolid and inſufficiently fuſed themſelves. It is always neceſſary, likewiſe, that the enamel of the ground ſhould be conſiderably harder than the mixtures for the colours: for if they both melt with the ſame degree of heat, they will neceſſarily run together.

It is requiſite that the body painted in enamel ſhould undergo a heat ſufficient to melt ſoft glaſs, for the matter of ſuch body can only be gold, ſilver, copper, porcelain, or china-ware, hard glaſs, and earthen-ware: and where the metals are uſed, if the painting be of the nature of a picture, or demand a variety of colours, it is neceſſary that a ground of white, or ſome other colour, ſhould be laid on the metal; the body of which ground muſt neceſſarily be of the ſame vitreous nature as the flux, but harder; as nothing elſe can endure ſo great a heat that is capable of incorporating with, and binding the matter of the white, or other colour, to the ſurface of the metal. The grounds, therefore, make another principal claſs of the ſubſtances uſed in enamel painting.

The third claſs is the colours, which muſt likewiſe be bodies capable of ſuffering the heat of melted glaſs: and ſuch as will either themſelves be converted into glaſs, or kindly incorporate with it in a melted ſtate. This of courſe confines the matter of ſuch colours to metals, earths, or other mineral bodies; all vegetable and animal ſubſtances being calcined and analyzed with a greatly leſs degree of heat than the loweſt ſufficient to work enamel.

The fourth kind of ſubſtance is what is called the ſecondary vehicle; which is, ſome fluid body for laying on the ground, and working with the pencil, the flux and colours when mixed together: ſince, as they form only a dry powder, they could not be uſed as paint without ſome ſuch medium. But as this is to ſerve only for ſpreading and laying on the matter of the enamel, and not, like other vehicles, to aſſiſt in holding the colours together, and binding them to the ground, that being in this kind of painting the office of the flux; it is neceſſary, that it ſhould be ſome ſuch ſubſtance as will evaporate and dry away without leaving any part behind; which would otherwiſe be heterogeneous matter with regard to the enamel, and conſequently injurious to it. Eſſential oils have been, therefore, uſed for this purpoſe, as they have this quality of wholly drying away on the firſt approach of heat, together with a ſlight unctuoſity, which renders them capable of making the matter of the enamel work properly with the pencil.

The baſis of enamel is the fineſt cryſtal, made of the beſt kali from Alicant, and ſand vitrified together. To this fundamental compoſition are added crocus martis for yellow, and æs uſtum for green.

There are three kinds of enamel; the firſt for imitating precious ſtones; the ſecond is for painting in enamel; and the third is uſed by the enamellers, jewellers, and goldſmiths, on gold, ſilver, and other metals. The compoſition is the ſame in the main in all three kinds; the difference only conſiſts in giving it the proper colour and tranſparency.

The white enamel uſed by painters is the ſame with the common enamel, only it is ground and cleanſed with aqua-fortis; then waſhed in fair water, and pounded again in a flint or agate mortar.

The black is made of perigeux, well calcined and ground with oil of aſpic, with an equal quantity of the enamellers or goldſmiths black added thereto.

The ruddy brown is made with leys of vitriol and ſalt-petre, or with the ruſt of iron ground on an agate with oil of aſpic.

The yellow enamel for jewellers, goldſmiths, &c. is brought chiefly from Venice and Holland, in little thin cakes of different ſizes, with the maker's mark ſtruck on it with a puncheon.

Vermilion red is made of vitriol calcined in a moderate fire for half an hour, between two crucibles luted together; afterwards waſhed in aqua-fortis, and then in fair water.

Lake-red is compoſed of fine gold, diſſolved in aqua-regia, with ſal-ammoniac or common ſalt; then put into a cucurbit with ſpring water and mercury in a ſand heat for twenty-four hours: then the powder at the bottom is to be ground with double its weight of flour of ſulphur, and put into a crucible over a gentle fire: and, after the ſulphur is exhaled, the remaining red-powder is ground with rocaille.

Blue is made of the azure or lapis lazuli uſed by oil-painters, well purified with brandy, and ſet in a bottle for five or ſix days expoſed to the ſun.

An amber colour is made by white copperas calcined. From the combination of theſe ſeven or eight colours ariſes the variety of all the reſt.

Manner of laying on and burning the ENAMEL *Grounds.* — The matter of the enamel muſt be firſt finely levigated and ſearched: and the body to be enamelled ſhould be made perfectly clean. The enamel muſt be then laid on as even as poſſible by a bruſh or pencil, being firſt tempered with oil of ſpike; and the diſtance of time betwixt the laying on the ground and burning the piece ſhould not be too great; becauſe the oil will exhale and leave the matter of the enamel a dry incohering powder; which will be liable to be rubbed or ſhaken off by the leaſt violence. This is the common method; but there is a much better way of managing this part of the work by means of a ſearce, in which the enamel is ſpread with very little trouble, and the greateſt part of the oil of ſpike ſaved. The method of performing this is, to rub the ſurface to be enamelled over with oil of ſpike; and then, being laid on a ſheet of paper or piece of leather, to ſave

that part of the enamel which does not fall on a proper object, to ſearce the matter upon the oiled ſurface till it lie of a proper thickneſs; but great care muſt be taken, in this method of proceeding, not to ſhake or move too forcibly the pieces of work thus covered with the powdered enamel.

It is uſual to add oil of turpentine to the oils of ſpike or lavender, in order to make them go further, and ſave the expence attending the free uſe of them; and others add alſo a little olive or linſeed oil, or ſome, in the place of them, crude turpentine. The uſe of the ſpirit of turpentine is very allowable; for it is the ſame for this purpoſe as the oils of ſpike or lavender; except that it wants the glutinous quality which makes them ſerviceable in ſpreading the enamel: but with reſpect to the uſe of the oils of olive and linſeed, or any other ſubſtantial oil, it is very detrimental, tending to reduce the metalline calxes; and leaving a ſmall proportion of black coal or aſhes, which muſt neceſſarily injure the white colour of the ground.

When plates, as in the caſe of pictures, dial-plates, &c. are to be enamelled, they ſhould always be made convex on the outerſide, and concave within; and all pieces of enamel formed of metal, where the figures does not admit of their being thick and ſolid, ſhould be of the ſame kind of form: otherwiſe they will be very apt to warp in the heat; and cannot be brought ſtraight, after they are taken out of the fire, without cracking the enamel. For this reaſon, likewiſe, it is proper to enamel the work all over, as well on the wrong as right ſides, to prevent the heat from calcining the metal; which would both contribute to its warping, and weaken the texture of it.

The enamel being laid on the body to be enamelled, when the fixed muffle is uſed, the piece muſt be gently lifted on to the falſe bottom; and put in that ſtate into the muffle fixed in the furnace, by thruſting the falſe bottom into it as far as it will go: but it is beſt to defer this till the fire be perfectly in order, which muſt be known by putting a bit of tile or china with ſome enamel on it of the ſame tone with that uſed as a proof; and another proof of the ſame kind may be alſo put along with the work into the muffle; which, being taken out, may ſhew how the operation proceeds.

When coffins are uſed, the ſame general method is to be purſued: the pieces of work to be enamelled are to be laid on the bottom of the coffin till it be covered: and then the ſecond flooring or falſe bottom is to be fixed in its place, and covered in the ſame manner; after which the lid is to be put on; and well ſecured, in the joints it forms with the ſides of the coffin, by fire-lute. The proof, in this caſe, ſhould be laid on the lid, on the part next the ſide door of the furnace; and it may be expedient, eſpecially till the working of the furnace, and the kind of enamel uſed be very well underſtood, to have two or three of theſe proofs. The enamel work being thus put into the coffins, they ſhould be ſet on the dome of the furnace, that they may be moderately heated, before they be put into the furnace, which would otherwiſe endanger their cracking; and when they are ſo heated, proof having been made, by means of a ſmall bit of china, or copper covered with the enamel, that the fire be of a due force, they muſt be conveyed into the furnace thro' the ſide door, and muſt reſt on the pieces of fire-ſtone placed for that purpoſe on the flooring in the back part of the furnace. It is requiſite nevertheleſs, that the conveying them into the furnace ſhould be managed with particular care to prevent the ſhaking off the enamel; and it muſt be done by means of the peel or inſtrument adapted to this purpoſe; on which the coffin being laid, it muſt be gently thruſt into the furnace till the coffin be in its proper ſituation, with reſpect to diſtance from the ſides of the furnace; and then the further end of the peel muſt be turned ſlowly towards the front of the furnace; the coffin being at the ſame time ſhoved off from it by means of the flat end of the tongs, introduced through the door for feeding the fire, till it ſtand entirely on the fire-ſtones, when the peel muſt be withdrawn. The operation being finiſhed, the peel muſt be again introduced under the coffin, by raiſing firſt the neareſt end of it, by means of the tongs through the door in the front; and then the other parts gradually, till the peel ſupport it; and then they muſt be drawn out together, and may be beſt placed on the dome of the furnace, that by cooling more gradually the temper of the enamel may be improved.

If it be required to burn a ſingle piece or two in the furnace, it may be done by means of the common or looſe muffle: in which caſe the enamel work being laid on the bottom or flooring of the muffle, and the muffle put over it, the whole muſt be conveyed into the furnace, by means of the tongs with turned points, through either of the doors; and a proof may be at the ſame time put in, on a piece of tile or ſpare bottom of a muffle: and the proceedings in other reſpects may be the ſame as with the fixed muffle, or the coffins.

Where there is no furnace, and it is deſired to burn enamel work on an open hearth, preparations muſt be made accordingly, and the flooring of the muffle being laid at a proper diſtance from the nozzle of the bellows, the work muſt be laid on it, and covered with the muffle; which being done, pieces of charcoal muſt be heaped over them, and the fire being lighted, muſt be blown up with the bellows, till it be ſufficient to flux the enamel; which muſt be examined by the proof put into the fire along with the work. The coals muſt then be taken off from the muffle, and the muffle, with the flooring and enamelled work, removed out of the fire, but kept near it to prevent their cooling too faſt; and if there be more work to be burnt, another muffle, &c. may be immediately put in the place of the other, and the ſame operation repeated; for it is a matter of indifference, whether the coals be burning when the work is put on the hearth, or kindled afterwards.

Pit coal may be uſed in the furnace, where enamel is burnt with the fixed muffle, or in coffins; which is indeed one principal conveniency attending the uſe of them, as it ſaves a conſiderable expence of charcoal; but where the open muffle is uſed, charcoal alone ſhould be employed; as the fumes of mineral coal are very detrimental to ſome colours, and deſtructive of the grounds, if whitened by arſenic, as the common white glaſs.

Manner of laying on and burning the ENAMEL *Colours.*—The colours being prepared, and reduced to powder by due levigation, and waſhing over where they are required to be extremely fine, and there is no unvitrified ſalt in the mixture, they muſt be tempered on a china or Dutch tile with oil of ſpike or lavender, to which moſt artiſts add likewiſe oil of turpentine; and ſome, a little linſeed or olive oil; and then uſed as paint of any other kind: but it ſhould be avoided to mix more of the colours with the eſſential oils than will be immdiately uſed; becauſe they dry away extremely faſt, and would not only be waſted, but give a coheſion to the particles of the colours, that would make them work leſs freely when again diluted with the oil.

The colours being thus laid on the pieces to be painted, the proceeding muſt be in all reſpects the ſame as with the grounds, in whatever manner they are to be burnt, either in the muffles or coffins; but greater nicety muſt be obſerved with reſpect to the fire, as the effects of any error in that point are of much greater conſequence in the burning the colours than grounds; eſpecially if the white of the grounds be formed from the calx of tin or antimony, and not arſenic.

Pit coal, as was above obſerved, may be employed for burning as well the colours as the grounds, where the muffle or coffins are uſed, or any other method purſued that wholly hinders the ſmoke and fumes from having any acceſs to the enamel.

ENARTHROSIS, in anatomy, a ſpecies of diarthroſis. See the article DIARTHROSIS.

ENCÆNIA, the name of three ſeveral feaſts celebrated by the Jews in memory of the dedication, or rather purification, of the temple, by Judas Maccabeus, Solomon, and Zorobabel.

This term is likewiſe uſed in church hiſtory for the dedication of Chriſtian churches.

ENCAMPMENT, the pitching of a camp. See the article CAMP.

ENCANTHIS, in ſurgery, a tubercle ariſing either from the caruncula lachrymalis, or from the adjacent red ſkin; ſometimes ſo large, as to obſtruct not only the

puncta lachrymalia, but alſo part of the ſight, or pupil itſelf.

It is of two kinds, viz. mild, without hardneſs or pain; or malignant, which is livid and very painful. The mild kind is to be treated firſt by ſcarifying, and afterwards applying eſcharotic or cauſtic medicines; and if this proves inſufficient, the tumour may be touched, but with great caution, with lapis infernalis; and to divert the humours from the eye, iſſues and ſetons, with phlebotomy and cooling purges, are proper. If all theſe fail, the ſurgeon is to extirpate the tumour; in which caſe it is better to leave part of the morbid tubercle, than cut off any part of the lachrymal caruncle, as the remains of it may be afterwards cleared away by eſcharotics. After the operation, it is proper to apply deterging and healing medicines, or a collyrium of lapis tutiæ, myrrh, &c. till the wound is healed.

As to the malignant encanthis, inclining to be cancerous, it is generally better to let it alone, and to mitigate its uneaſineſs with cooling and lenient collyria, rather than exaſperate it by the operation, or by eſcharotic medicines.

ENCAUSTICE and ENCAUSTUM, the ſame with enamelling and enamel. See ENAMELLING and ENAMEL.

ENCEINTE, in fortification, is the wall or rampart which ſurrounds a place, ſometimes compoſed of baſtions or curtains, either faced or lined with brick or ſtone, or only made of earth. The enceinte is ſometimes only flanked by round or ſquare towers, which is called a Roman wall.

ENCEPHALI, in medicine, worms generated in the head, where they cauſe ſo great a pain, as ſometimes to occaſion diſtraction.

The encephali are very rare, but there are ſome diſeaſes wherein they ſwarm; from whence we are told peſtilential fevers have wholly ariſen. Upon the diſſection of one who died of this fever, a little, ſhort, red worm was found in the head, which Malmſey wine, wherein horſe radiſh had been boiled, could only deſtroy. This medicine was afterwards tried on the ſick, moſt of whom it cured.

The like worms have alſo been taken out by trepanning, and the patient cured. Thoſe worms that generate in the noſe, ears, and teeth, are alſo called encephali.

ENCEPPE, in heraldry, denotes fettered, chained, or girt about the middle, as is uſual with monkeys.

ENCHANTER, a perſon ſuppoſed to practiſe enchantment, or faſcination.

ENCHASING, INCHASING, or CHASING, the art of enriching and beautifying gold, ſilver, and other metal-work, by ſome deſign, or figures repreſented thereon, in low relievo.

Enchaſing is practiſed only on hollow thin works, as watch-caſes, cane-heads, tweezer-caſes, or the like. It is performed by punching or driving out the metal, to form the figure, from within ſide, ſo as to ſtand out prominent from the plane or ſurface of the metal. In order to this, they provide a number of fine ſteel-blocks, or puncheons, of divers ſizes; and the deſign being drawn on the ſurface of the metal, they apply the inſide upon the heads or tops of theſe blocks, directly under the lines or parts of the figures; then, with a fine hammer, ſtriking on the metal, ſuſtained by the block, the metal yields, and the block makes an indenture, or cavity, on the inſide, correſponding to which there is a prominence on the outſide, which is to ſtand for that part of the figure.

Thus the workman proceeds to chaſe and finiſh all the parts by ſucceſſive application of the block and hammer, to the ſeveral parts of the deſign: and it is ſurpriſing to conſider with what beauty and juſtneſs, by this ſimple piece of mechaniſm, the artiſts in this kind will repreſent foliages, groteſques, animals, hiſtories, &c.

ENCHYSMA, in medicine, the ſame with clyſter. See the article CLYSTER.

ENCLITICA, in grammar, particles which are ſo cloſely united with other words, as to ſeem part of them, as in *virumque*, &c.

There are three enclitic particles in Latin, viz. *que*, *ne*, *ve*; but there are a great many in the Greek, as τε, τις, μω, μοι, σφ, σοι, &c.

ENCRATITES, *Encratitæ*, in church hiſtory, heretics who appeared towards the end of the ſecond century: they were called Encratites, or Continentes, becauſe they gloried in abſtaining from marriage, and the uſe of wine and animal food. Their chaſtity, however, was a little ſuſpected, on account of their uſing all ſorts of means to draw women into their ſect, and always keeping company with them.

ENCROACHMENT, or INCROACHMENT, in law. See INCROACHMENT.

ENCYCLOPÆDIA, the circle of arts and ſciences.

The word is formed from the Greek εν, in, κυκλος, a circle, and παιδεια, art, ſcience, or learning.

ENDECAGON, in geometry, the ſame with hendecagon. See HENDECAGON.

ENDEMIC, or ENDEMICAL DISEASES, thoſe to which the inhabitants of particular countries are ſubject more than others, on account of the air, water, ſituation, and manner of living.

The word is derived from the Greek εν, in, and δημος, people.

ENDIVE, *Endivia*, in botany, &c. the broad-leaved ſuccory. See the article CICHORIUM.

Marſigli deſcribes a plant, which he calls ſea-endive, from its reſemblance to the common garden endive.

ENDORSE, in heraldry, an ordinary, containing the eighth part of a pale, which Leigh ſays is only uſed when a pale is between two of them.

ENDORSED, *Endorſé*, in heraldry, is ſaid of things borne back to back, more uſually called adoſſé.

ENDOWMENT, in law, denotes the ſettling a dower on a woman; tho' ſometimes it is uſed figuratively, for ſettling a proviſion upon a parſon on the building of a church; or the ſevering a ſufficient portion of tithes for a vicar, when the benefice is appropriated.

ENEMA, in medicine, the ſame with clyſter. See the article CLYSTER.

ENEMY, in law, an alien or foreigner, who publicly invades the kingdom.

ENERGUMENS, in church hiſtory, perſons ſuppoſed to be poſſeſſed by the devil, concerning whom there were many regulations among the primitive Chriſtians.

They were denied baptiſm, and the euchariſt; at leaſt this was the practice of ſome churches: and though they were under the care of exorciſts, yet it was thought a becoming act of charity to let them have the public prayers of the church, at which they were permitted to be preſent. See the article EXORCISM.

ENERGY, ενεργεια, a term of Greek origin, ſignifying the power, virtue, or efficacy of a thing. It is alſo uſed, figuratively, to denote emphaſis of ſpeech. See EMPHASIS.

ENFILADE, in the art of war, is uſed in ſpeaking of trenches, or other places, which may be ſcoured by the enemy's ſhot, along their whole length. In conducting the approaches at a ſiege, care muſt be taken that the trenches be not enfiladed from any work of the place. See the article TRENCHES.

ENFRANCHISEMENT, in law, the incorporating a perſon into any ſociety or body politic: thus, where any perſon is enfranchiſed, or made free, of any city, borough, or company, he is ſaid to have a freehold therein during life; and cannot, for barely endeavouring any thing againſt the corporation, forfeit the ſame.

Naturalization is alſo another kind of enfranchiſement. See NATURALIZATION.

ENGASTRIMYTHI, in pagan theology, the pythians or prieſteſſes of Apollo, who delivered oracles from within, without any action of the mouth or lips.

ENGINE, in mechanics, is a compound machine, made of one or more mechanical powers, as levers, pullies, ſcrews, &c. in order to raiſe, project, or ſuſtain any weight, or produce any effect which could not be eaſily effected otherwiſe.

Engines are extremely numerous; ſome uſed in war, as the battering-ram, balliſta, waggons, chariots, &c. others in trade and manufactures, as cranes, mills, preſſes, &c. others to meaſure time, as clocks, watches, &c. and others for the illuſtration of ſome branch of ſcience, as the

PLATE LXII.

Facing Fire Engine.

Fig. 3. Engine.

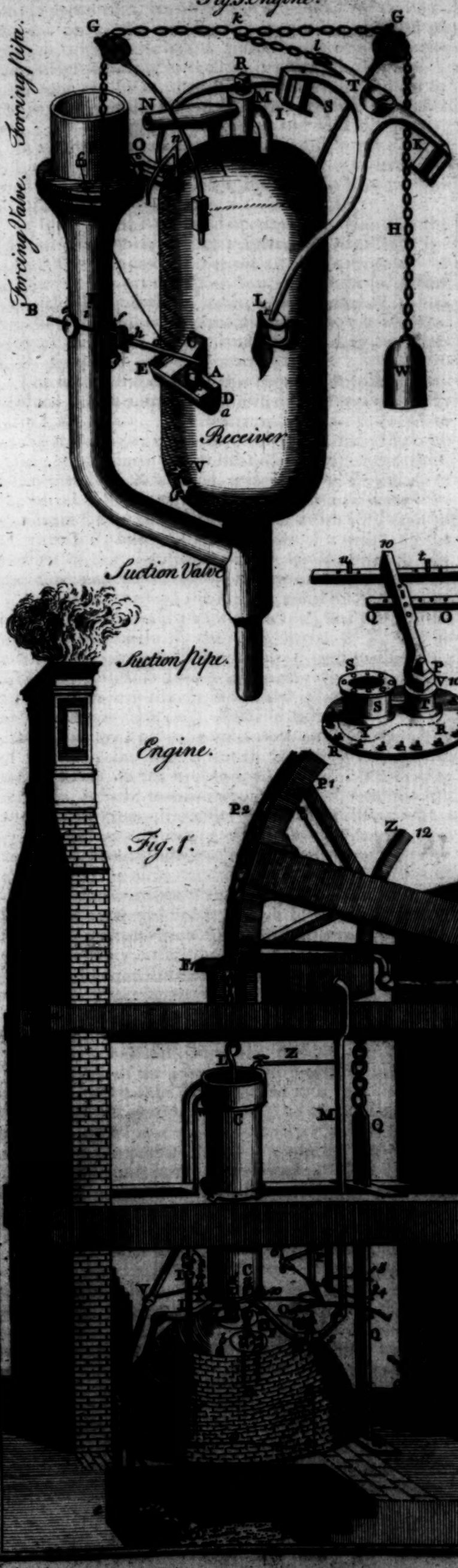


Fig. 1.

Fig. 3. Ermine.

Fig. 4. Ermine.

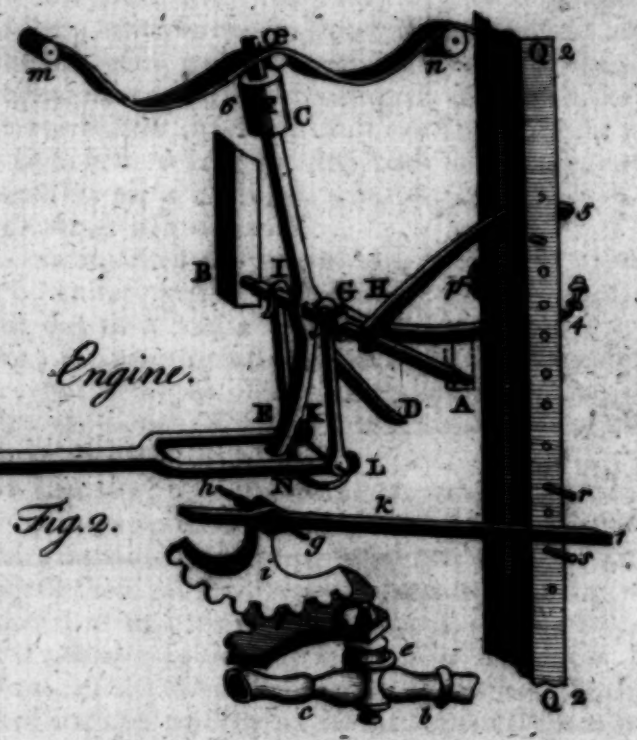


Fig. 2.

5 JA 59

the orrery, cometarium, and the like. See BATTERING-RAM, BALLISTA, &c.

In general we may obſerve, concerning engines, that they conſiſt of one, two, or more of the ſimple powers variouſly combined together; that in moſt of them the axis in peritrochio, the lever, and the ſcrew, are the conſtituent parts; that in all a certain power is applied to produce an effect of much greater moment; and that the greateſt effect, or perfection, is when it is ſet to work with four ninths of that charge which is equivalent to the power, or will but juſt keep the machine in equilibrio. See the articles MAXIMUM and MECHANICS.

In all machines, the power will juſt ſuſtain the weight, when they are in the inverſe ratio of their diſtances from the center of motion. See the articles POWER and EQUILIBRIUM.

It being of the utmoſt importance to diminiſh the friction of engines, ſeveral contrivances have been invented for this purpoſe. See the article FRICTION.

ENGINE for extinguiſhing fires, a machine for raiſing a conſiderable quantity of water, in one continued ſtream, for the extinguiſhing accidental fires. See a perſpective view of the whole engine, ready for working, in plate LXI. *fig.* 4.

The nature and effect of this engine will be eaſily underſtood from a perpendicular ſection of it repreſented in plate LXI. *fig.* 5. The water is raiſed by the preſſure of the atmoſphere, by the force of the piſtons, and by the ſpring of condenſed air, in the following manner: thus, when the piſton R is raiſed, a vacuum would be made in the barrel T V, did not the water follow it from the inferior canal E M, though the valve H, which riſes through the tube E F, immerſed in the water of a veſſel, by the preſſure of the atmoſphere on the ſurface thereof. By the depreſſion of the piſton R, the water in the barrel T V is forced through the ſuperior canal O N, to enter by the valve I, into the air veſſel *a b c d*; and the like being done alternately by the other barrel W X, and its piſton S, the air-veſſel is by this means continually filling with water, which greatly compreſſes the air above the ſurface of the water in the veſſel, and thereby proportionably augments its ſpring, which is at length ſo far increaſed, as to re-act with great force on the ſurface Y Z of the ſubjacent water; which aſcending through the ſmall tube *e f*, to the ſtop-cock *p*, is there, upon turning the cock, ſuffered to paſs through a pipe *h*, fixed to a ball and ſocket, from the orifice of which it iſſues with a great velocity, to a very great height or diſtance, in a continued ſtream, directed every way, or to any particular place, by means of the ball and ſocket.

The greateſt artifice of this engine is its contrivance to produce a continued ſtream, which is done by compreſſion, and the conſequent increaſed elaſticity of the air in the barrel *a b c d*, called the air-veſſel: for the air, being an elaſtic fluid, will be capable of compreſſion in any degree by the water forced in through the valves at I K; and, ſince the force of the air's ſpring will always be inverſely as the ſpace which it poſſeſſes, it follows, that, when the air veſſel is half full of water, the air will be compreſſed into half the ſpace it poſſeſſed at firſt, and therefore its ſpring will be twice as great as at firſt.

But this ſpring at firſt was equal to the preſſure of the atmoſphere; for if it was not, it could not have ſuſtained or reſiſted the preſſure of the atmoſphere which ſtood over it, and conſequently could not have filled the veſſel before the water was driven in; which yet we find it did, and maintained an æquilibrium with the common air.

The veſſel then being half filled with water, or the air compreſſed into half its firſt ſpace, its ſpring will be in this caſe equal to twice the preſſure of the atmoſphere; and therefore, when the ſtop-cock at *p* is turned, the air within the ſubjacent water, with twice the force it meets with from the external air in the pipe *e f*, will cauſe the water to ſpout out of the engine to the height of thirty-two or thirty-three feet, if the friction be not too great.

When the air veſſel is $\frac{2}{3}$ full of water, the ſpace which the air takes up is only $\frac{1}{3}$ of its firſt ſpace; whence its ſpring being three times as great as that of the common air, it will project the water with twice the force of the atmoſphere, or throw it to the height of 64 or 66 feet.

In the ſame manner, when the air veſſel is $\frac{1}{4}$ full of water, the air will project it to the height of 96 or 99 feet; and when $\frac{3}{4}$ full of water, to the height of 132 feet.

As the air veſſel is the cauſe of the continual ſtream, we may naturally infer that, if ſuch an air veſſel were adapted to the common houſe-pump, it would then become a fire engine, or very uſeful for extinguiſhing fires that may happen in or near the houſe. Now this may be effected in a manner, either the ſame with, or analogous to, that which follows: A B C D (*fig.* 6.) is the barrel of the pump, P H the rod and piſton; C W the pipe going down to the water of the well at W; towards the lower part of the barrel is a ſhort tube, by which the air veſſel F E is fixed to, and communicated with, the barrel of the pump. A M N L is a collar of leather ſo fixed on the top of the barrel, and adapted to the rod, that it may move freely in the leather, without permitting the air to paſs in or out between. The nozzle or ſpout D has a ſtop-cock S to ſhut off the water, or let it paſs out as required. Q is a piece ſcrewed on to direct the ſtream by a ſmall pliant leathern pipe at the end.

Now it is plain, when the piſton is raiſed from the bottom of the pump barrel, the water above it will be forced into the air veſſel, and there compreſs the air, the ſtop-cock being ſhut; it will alſo compreſs the air on the top of the barrel, for the water will not be higher than the ſpout D at firſt, when the ſtop-cock is ſhut: but afterwards, as the air is confined, it will be compreſſed at top, and the water will riſe to I.

This compreſſed air, in each place, will act upon the water by its ſpring, and upon turning the ſtop-cock, will force it out in a continual ſtream, through a pipe at Q; and with a greater or leſſer degree of force, as occaſion requires, that being abſolutely in the power of the perſon working the pump This invention we owe to the learned Sir James Creed.

Fire ENGINE, or *Steam* ENGINE, a machine for raiſing water by the help of fire. The fire-engine is the moſt admirable, curious, and compounded machine that we find among all thoſe whoſe inventions have been owing to the diſcoveries of modern philoſophy, and which affords the greateſt advantages to mankind. The fire engine is of two ſorts, of which we ſhall here give the theory and figures of each, according to the lateſt perfection in which they are made.

The marquis of Worceſter, in his century of inventions, publiſhed in the year 1663, is probably the firſt who propoſed raiſing great quantities of water by the force of fire turning water into a ſteam; and he mentions ſome engine of this kind, which he ſays played a continual ſtream, in the manner of a fountain, forty feet high. He alſo ſays, that a perſon attending it turned two cocks; that one veſſel of water being conſumed, another begins to force and re-fill with cold water; and this alternately and ſucceſſively, the fire being attended and kept conſtantly burning by the ſame perſon, in the interim between turning the cocks.

Captain Savery, having read this account, immediately attempted to raiſe water by fire, and was the firſt who erected an engine for this purpoſe, in the form we have ſince had them. To ſecure the invention to himſelf, he purchaſed all the books that were to be found, printed by the marquis upon that occaſion, and burnt them; and at the ſame time declared that he found out the method by accident. He made many experiments to bring the machine to perfection, and erected ſeveral for gentlemen's ſeats.

But the progreſs of the engine was ſtopped, till long time afterwards, when Mr. Newcomen and Mr. J. Cawley contrived another way to raiſe water by fire, where the ſteam to raiſe the water from the greateſt depths of mines is not required greater than the preſſure of the atmoſphere; and this is the preſent ſtructure of the engine, which is now of about fifty-five years ſtanding.

We ſhall ſhew, under the article PUMP, that water may be drawn from any depth by a compound pump. Suppoſe the depth = 150 feet, and the diameter of the pump at plate LXII. *fig.* 1. be 7 $\frac{1}{4}$ inches, then the weight of a cylindric column of water 150 feet high, and 7 $\frac{1}{4}$ inches diameter, will be about 3000 lb weight. If now the rod of this pump were hung by a chain to the end

of the lever *h h*, as at H, and at the other end another power were applied, as at L, with a ſuperior force, the pump might be worked, and the water raiſed by that power.

Now this power cannot be human, or the ſtrength of man; for it will require a hundred men to pull down the beam, each pulling with the force of thirty pound; and an hundred men to relieve them, when weary; for the pump in a mine muſt not ſtand ſtill: but two hundred men would be too expenſive. If we allow horſes, and one horſe equal to five men, there muſt be twenty horſes working at a time, and twenty more to relieve theſe; which great number of horſes, though leſs expenſive than the men, will be found too great for moſt mines: and neither men nor horſes would be able to give more than fifteen or ſixteen ſtrokes in a minute.

Some other power therefore muſt be applied, and this may be effected as follows: B is a large boiler, whoſe water, by the fire under it, is converted into an elaſtic ſteam. The great cylinder C C is fixed upon it, and communicates with it by the pipe D *d*; on the lower orifice of which, within the boiler, moves a broad plate, by means of the ſteam-cock, or regulator E 10, ſtopping or opening the paſſage to prevent or permit the ſteam to paſs into the cylinder, as occaſion requires. The diameter of the pipe D is about four inches.

The ſteam in the boiler ought always to be a little ſtronger than the air, that when let into the barrel, it may be a little more than a ballance to the external air, which keeps down the piſton at the bottom *d n*. The piſton being by this means at liberty, the pump-rod will, by its great weight, deſcend at the oppoſite end to fetch a ſtroke; for the weight of ſeventy or eighty yards of iron rod amounts to nine or ten hundred weight; whereas the piſton, and other weights at the other end, is not above four or four and a half hundred weight. The end of the lever at the pump, therefore, will always preponderate the other, and deſcend when the piſton is at liberty.

The handle of the ſteam cock E 10, being turned towards *n*, opens a pipe D to let in the ſteam; and being turned towards O, it ſhuts it off, that no more can enter. The piſton is now raiſed towards the top of the barrel at C, and the barrel is full of ſteam. The lever O 1 muſt then be lifted up, to turn, by its teeth, the injecting cock at N, which permits the water brought from the ciſtern *g*, by the pipe *g* M N, to enter the bottom of the barrel at *n*, where it flies up in the form of a fountain, and ſtriking againſt the bottom of a piſton, the drops, being driven all over the cylinder, will, by their coldneſs, condenſe the ſteam into water again, and precipitate it to the bottom of the barrel.

Mr. Henry Beighton made an experiment to determine the rarity of the ſteam, and found the content of the barrel of ſteam was 113 gallons; and ſince there were ſixteen ſtrokes in a minute, therefore $113 \times 16 = 1808$ gallons of ſteam per minute. He alſo obſerved, that the boiler required to be ſupplied with water at the rate of five pints per minute: and ſince 282 cubic inches make a gallon, $35\frac{1}{4}$ make a pint, and $5 \times 35\frac{1}{4} = 176\frac{1}{4}$ in five pints; alſo the cubic inches of ſteam are $1808 \times 282 = 509856$; if then we ſay, as $176\frac{1}{4} : 509856 :: 1 : 2893$; or one cubic inch of water is expanded into 2893 inches of ſteam; conſequently the ſteam in the barrel is reduced to $\frac{1}{2893}$ part, when turned to water by the jet of cold water; and therefore a ſufficient vacuum is made in the barrel, for the piſton to deſcend unballanced, by the preſſure of the air.

The piſton being forced down, raiſes the other end of the lever, and conſequently the piſton of the pump which brings up and diſcharges the water at *p*. Now this whole operation of opening and ſhutting the ſteam regulator and injection cock will take up but little more than three ſeconds; and will therefore produce very well ſixteen ſtrokes in a minute.

That the ciſtern *g* may always be ſupplied with water, there is an arch *x* fixed near the arch H at the pump-end, from whence another pump-rod *k*, with its piſton, draw water from a ſmall ciſtern near the mouth of a pit, ſupplied from the water raiſed at *p*, and forces it up the pipe *m m m* into the ciſtern *g*, which, therefore, can never want water.

That the leathers of the piſton C may be always ſupple and ſwelled out ſo as to be always air-lights, a ſmall ſtream of water is ſupplied from the injecting pipe M by the arm *z*. On the top of the cylinder is a larger part or cup L, to hold the water that lies on the piſton, leſt it ſhould overflow when the piſton is got to its greateſt height, as at W; at which time, if the cup be too full, the water will run down the pipe V to the waſte well at Y.

The water in the boiler which waſtes in generating ſteam, is ſupplied by a pipe I *i* about three feet long, going into the boiler a foot below the ſurface of the water. On the top of this pipe is a cup or funnel I ſupplied by the pipe W with water from the top of the ciſtern, which has the advantage of being always warm, and not ſo apt to check the boiling of the water in the copper.

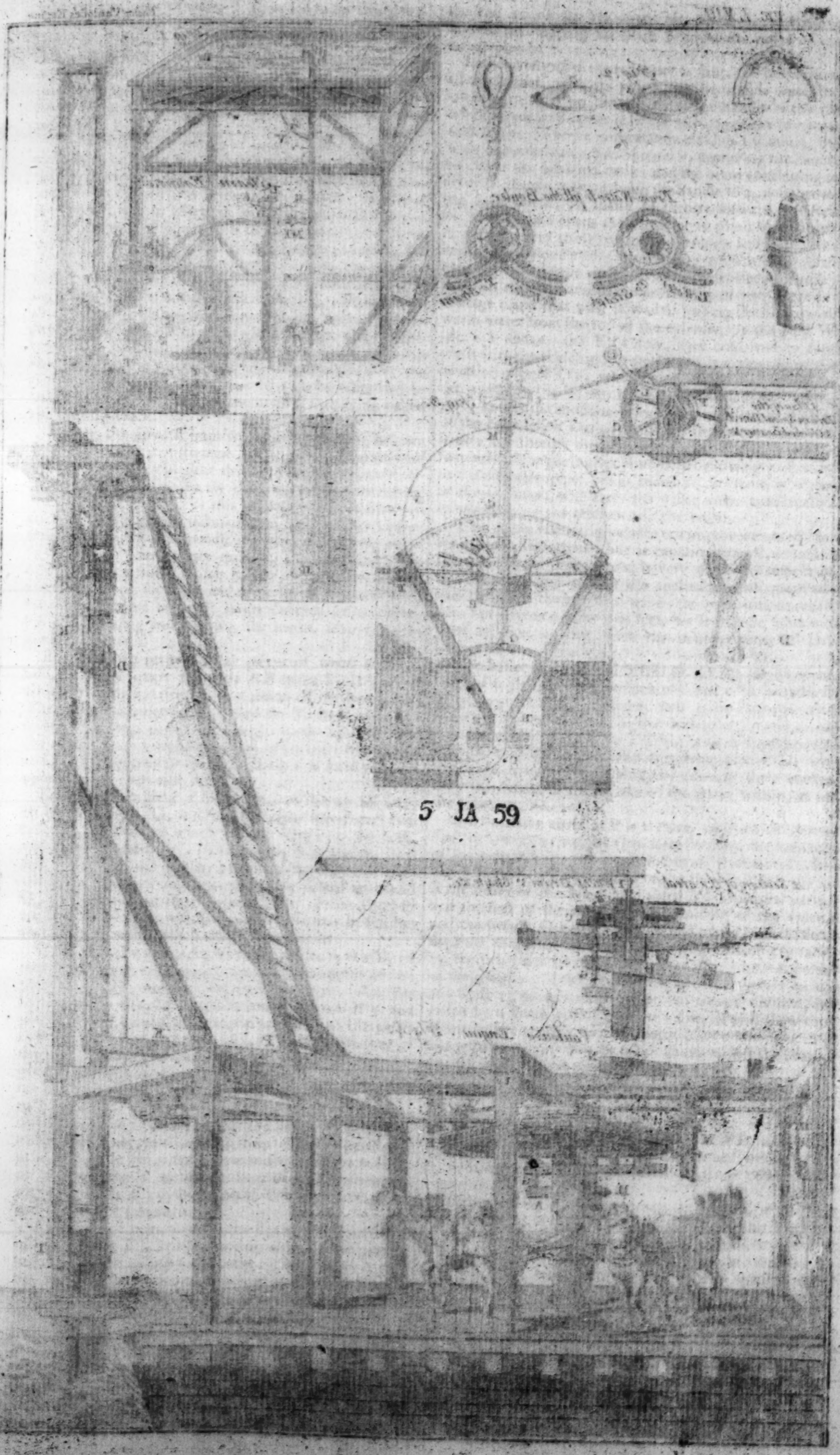
That the boiler may not have the ſurface of the water too low, which would endanger burſting, or too high, which would not have room enough for ſteam, there are two gage-pipes at G; one going a little below the ſurface of the water when at a proper height, and the other ſtanding a little above it. When every thing is right, the ſtop-cock of the ſhorter pipe, being open, gives only a ſteam, and that of the long one water; but, if otherwiſe, both cocks will give ſteam when the ſurface is too low, and both give water when it is too high; and hence the cock which feeds the boiler at I may be opened to ſuch a degree, as always to keep the ſurface of water to its due height.

The cold water, conſtantly injected into the cylinder to condenſe the ſteam, is carried off by the eduction-pipe *d* T Y, going from the bottom of the cylinder to the waſte well Y, where going a little under water, it has its end turned up, with a valve Y, to keep the air from preſſing out into the pipe, but permitting the injected water coming the other way to be diſcharged, whereby the cylinder is kept empty.

Leſt the ſteam ſhould grow too ſtrong for the boiler, and burſt it, there is a valve fixed at *b*, with a perpendicular wire ſtanding up from the middle of it, to put weights of lead upon, by which to examine the ſtrength of the ſteam puſhing againſt it from within. Thus the ſteam is known to be as ſtrong as the air, if it will raiſe up ſo much weight on the valve, as is at the rate of fifteen pounds to an inch ſquare; becauſe that is the weight of air, nearly, on every ſquare inch. When the ſteam becomes ſtronger than is required, it will liſt up the valve, and go out. This valve is called the puppet-clack.

The ſteam has always a variable ſtrength, yet never $\frac{1}{15}$ ſtronger or weaker than common air: for it has been found that the engine will work well when there is the weight of one pound on each ſquare inch of the valve *b*. This ſhews that the ſteam is then $\frac{1}{15}$ part ſtronger than the common air. Now as the height of the feeding pipe from the funnel F to the ſurface of the water S *s* is not above three feet, and three feet and a half of water is $\frac{1}{15}$ of the preſſure of the air; if the ſteam were $\frac{1}{15}$ part ſtronger than air, it would puſh the water out at E; which, ſince it does not, it cannot be ſtronger than air, even in this caſe, where, the regulator being ſhut, it is moſt of all confined.

When the regulator is opened, the ſteam gives the piſton a puſh, which riſes it up a little way; then filling a greater ſpace, it comes to be of the ſame ſtrength, and ſo a balance to the atmoſphere; thus the piſton, being at liberty, riſes to the top W. The ſteam, now expanded into the whole capacity of the cylinder, is weaker than the air, and would not ſupport the piſton, were it not for the greater weight at the other end of the lever, which keeps it up. The ſteam each ſtroke drives the injected water of the preceding ſtroke out of the eduction pipe *d* T Y, and would itſelf follow, and blow out at the valve Y, which is not loaded, if it were ſtronger than the air, which it never does. If it were exactly equal to the ſtrength of the air, it would juſt drive all the water out at Y, but could not follow itſelf, the preſſure being on each ſide the valve equal by ſuppoſition. If it be weaker than the air, it will not force all the water out of the pipe *d* T Y, but the ſurface will ſtand, ſuppoſe, at T,



5 JA 59

PLATE LXIII. Facing Vaulolie's Engine.

Fig. 1.

Steam Engine

Fig. 2.

From Water to fill the Boyler.

To Water To Steam

To Water To Steam

A Plan of the Drum Spiral Barrel &c. Hooked Leaver &c.

Fig. 3.

D

A Section of the great Wheel Drum & Shaft &c.

Vaulolie's Engine. Fig. 4.

where the column of water TY, added to the ſtrength of the ſteam, is equal to the preſſure of the air. When the ſteam is $\frac{1}{10}$ weaker than the air, the height TY = three feet and a half. Now, ſince the whole perpendicular diſtance from *d* to Y is but four feet, and the ſteam always ſufficient to expel the water; it is plain it can never be more than $\frac{1}{13}$ part weaker than the air, when weakeſt.

There is air in all the water injected; and though that air cannot be taken out or condenſed with the ſteam, yet will it precipitate and fall through the ſteam to the bottom of the cylinder, as being much heavier. For ſteam is to water, as 1 to 2893, in its denſity; but the denſity of air is to that of water, as 1 to 864, nearly; therefore, the rarity of ſteam is to that of air, as 2893 to 864; the air will, therefore, fall through the ſteam to the bottom, and from thence be driven out through a ſmall pipe opening into the cup at 4, on which is a valve. Now, when the ſteam firſt ruſhes into the cylinder, and is a little ſtronger than the outward air, it will force the precipitated air to open the valve at 4, and make its eſcape; but the ſteam cannot follow, becauſe it is weaker than the outward air, as the piſton gives it room by aſcending to expand. This valve, from the noiſe it makes, is called the ſnifting-clack.

Among the greateſt improvements of this engine, we may reckon that contrivance by which the engine itſelf is made to open and ſhut the regulator and injunction-cock, and that more nicely than any perſon attending could poſſibly do it. For this purpoſe, there is fixed to an arch 12, at a proper diſtance from the arch P, a chain, from which hangs a perpendicular piece or working beam QQ, which comes down quite to the floor, and goes through it in a hole, which it very exactly fits. This piece has a long ſlit in it, and ſeveral pin-holes and pins, for the movement of ſmall levers deſtined to the ſame office of opening and ſhutting the cocks, after the following manner.

Between two perpendicular pieces of wood on each ſide, there is a ſquare iron axis AB (plate LXII. *fig.* 2.) which has upon it ſeveral iron pieces of the lever kind. The firſt is the piece CED, called the Y, from its repreſenting that letter inverted by its two ſhanks E and D; on the upper part is a weight F to be raiſed higher or lower, and fixed, as occaſion requires. This Y is fixed very faſt upon the ſaid iron axle AB.

From the axle hangs a ſort of an iron ſtirrup IKLG, by its two hooks IG, and having on the lower-part two holes K, L, through which paſſes a long iron pin LK, and keyed in the ſame. When this pin is put in, it is alſo paſſed through the two holes in the ends E, N, of the horizontal fork or ſpanner EQN, joined at its end Q, to the handle of the regulator V 10. From Q to O are ſeveral holes, by which the ſaid handle may be fixed to that part of the end which is moſt convenient.

Upon this axis AB is fixed at right angles to the Y, an handle or lever G 4, which goes on the outſide of the piece Q 2, Q 2, and lies between the pins. Another handle is alſo faſtened upon the ſame axle, viz. H 5, and placed at half a right-angle to the former G 4; this paſſes through the ſlit of the piece Q 2, Q 2, lying on one of the pins. Hence we ſee, that when the working beam goes up its pin in the ſlit, it lifts up the ſpanner H 5, which turns about the axle ſo faſt, as to throw the Y, with its weight F, from C to 6, in which direction it would continue to move, after it had paſſed the perpendicular, were it not prevented by a ſtrap of leather fixed to it at *o*, and made faſt at the ends *m* and *n*, in ſuch a manner as to allow the Y to vibrate backwards and forwards about a quarter of a circle, at equal diſtances on this ſide, and that of the perpendicular.

As things are repreſented in the figure, the regulator is open, its plate TY being ſhewn on one ſide the pipe S, which joins the cylinder and boiler. The piſton is now up, and alſo the working beam near its greateſt height; the pin in the ſlit has ſo far raiſed the ſpanner H 5, that the weight F on the head of the Y is brought ſo far from *o*, as to be paſt the perpendicular, and ready to fall over towards *m*, which, when it does, it will by its ſhank E, with a ſmart blow, ſtrike the iron pin KL, and drawing the fork horizontally towards the beam Q, will draw the end 10 of the regulator towards 6, and thereby ſhut it, by ſlipping the plate Y under the holes of the throat-pipe S.

Immediately after the regulator is ſhut, the beam riſing a little higher, with its pin S on the outſide upon the lower part, lifts up the end *k* 1 of the handle of the injection-cock, and opens it by the turning of the two parts with teeth. The jet immediately making a vacuum, the beam again deſcends, and the pin *r*, depreſſing the handle *k* 1, ſhuts the injection-cock; and the beam continuing to deſcend, the pin *p* bears down the handle G 4, and throwing back the Y, its ſhank D throws forward the fork NQ, and again opens the regulator to admit freſh ſteam. After this every thing returns as before; and thus is the engine moſt wonderfully contrived to work itſelf. After the engine had been made, as above deſcribed, for many years, it received another improvement of very great advantage; and that was, inſtead of feeding the boiler with warm water from the top of the cylinder, by the pipe W (*fig.* 1.) above, and F *f* below, they contrived to ſupply it with the ſcalding hot water which comes out of the eduction-pipe *d* T Y, which now, inſtead of going to the waſte-well at Y, was turned into the boiler on the top part; and as the eduction-pipe before went out at the ſide of the cylinder, it was now inſerted in the bottom of the ſame; and though the preſſure of ſteam in the boiler be ſomewhat ſtronger in the cylinder, yet the weight of water in the eduction-pipe, being added to the force of ſteam in the cylinder, will carry the water down continually, by overcoming the reſiſtance in the boiler.

This is the lever-engine with the improvements of Mr. Newcomen and others; but as captain Savary's, or rather the marquis of Worceſter's, is very cheap in reſpect of this machine, and as it is alſo applicable with great advantage when the height to which the water is to be raiſed does not exceed 100 or 150 feet, we ſhall here ſubjoin a view of that engine, with the improvements of Dr. Deſaguliers.

The boiler BB (plate LXIII. *fig.* 1.) is a large copper body of a globular form, which will beſt of all withſtand the very great force of ſteam, that is in this caſe neceſſary. Round the body of this boiler the fire and flame are conducted, as ſhewn at TTT. It has a copper cover ſcrewed on, which contains the ſteam-pipe CD, and two gage-pipes N, O, which, by turning their cocks, ſhew the height of the ſurface of the water within, as in the other engine.

On the ſame cover at P is a valve, over which lies a ſteelyard, with its weight Q to keep it down, the ſtrength of the vapour being this way moſt exactly eſtimated: for being in the nature of a lever of the third ſort, it is plain, if the beam of the lever be divided into ten equal parts, and the firſt of them be upon the middle of the valve, and the weight Q hangs at the ſecond, third, fourth, &c. diviſion, that then the force of the ſteam which can raiſe up the valve will be two, three, four, &c. times as great as the weight. If the area of the valve be a ſquare inch, and Q = 15 pounds, hanging at the ſecond diviſion, is raiſed by a ſteam puſhing up the valve, it will ſhew the ſteam will then preſs with the force of two atmoſpheres; but great care muſt then be taken about it, leſt the ſteam, ſo very ſtrong, burſt the boiler to pieces.

The ſteam is carried from the boiler to the copper-veſſel A, by means of the pipe CD; and is let into the ſame by turning the handle K of the ſteam-cock DI. The key of this cock is kept down by the ſcrew L, and held up by the gibbet DL. The handle turned from K to *k*, admits a paſſage to the ſteam into the copper receiver A.

This receiver A communicates at bottom with the ſuction-pipe ZH going down to the water H in the well X; and above, with the forcing-pipe EE, which goes up a little above the water of the reſervoir R; between theſe two pipes are two valves F and G, both opening upwards. The ſteam being let in upon the water of the receiver A, forces it up the valve F, and the pipe EE, to the reſervoir, and then the ſaid receiver is full of hot ſteam.

This ſteam, in the receiver, is condenſed by a jet of cold water coming from the forcing-pipe by the ſmall pipe MI, being let in and ſhut off by the cock at M.

The ſteam being condenſed by this jet, will be reduced within a very ſmall ſpace, and ſo make a vacuum; upon which the water in the well will ruſh up the forcing-pipe to reſtore the æquilibrium, and thus again fill the receiver A; the little air being compreſſed within a ſmall compaſs at the top above *a b*.

That there may be always water in the force-pipe for the jet, there is a little pipe which brings the water to it from the reſervoir, with the ſmall ſtop-cock Y to ſhut it off upon occaſion. The valves at F and G are examined at any time, by unſcrewing the pin 1 to looſen the ſtrap 2, and let down the flanch 3; all which parts are ſhewn larger in *fig.* 2.

By the particular contrivance of the cock at D I, and its key, the water is made to paſs from the force-pipe to the boiler, to ſupply the waſte in ſteam. This is plainly ſhewn in the ſection of the cock and key, where 5 is the top of the key; 6 is a hole on one ſide, which goes down to the bottom to convey the ſteam or jet of water alternately to the receiver; 7 is a notch on the other ſide, to take in the water from the force-pipe, and conduct it to the boiler B. How this is done is eaſy to conceive from a view of the two ſections of the cock and key in two poſitions within it.

The boiler may hold five or ſix hogſheads, and the receiver one hogſhead per hour. This ſteam makes a vacuum ſo effectually, as to raiſe water from the well to the height of 29 or 30 feet; and ſuppoſe the ſteam able to lift up the ſteelyard, with its weight hanging at the ſixth diviſion, it will then be able to raiſe a column of water about 50 yards high, as being then ſix times ſtronger than the preſſure of the air, as is eaſily underſtood from what has been ſaid under ENGINE for extinguiſhing fires, the water being raiſed in a ſimilar manner in both machines; there by the preſſure of condenſed elaſtic air; and here by the preſſure of rarified elaſtic ſteam.

The elaſticity of the ſteam increaſing with its heat, and the ſpace, into which it endeavours to expand itſelf, being as its elaſticity or ſtrength, and ſince we know that water expanded into vapour, of the ſame ſtrength of the air, occupies near 3000 times the ſpace as before, it follows, that, when the ſteam has twice that ſtrength, it will be expanded into 6000; if it be five times as ſtrong as the air's ſpring, it will become expanded into 15000 times that ſpace, and ſo on, beyond the reach of experiments; from all which it appears, how near a perfect vacuum we may approach by this engine, or any other, by means of rarified vapours.

The following engine, which was invented by Mr. De Moura of Portugal, F. R. S. is an improvement of that above deſcribed, as it is rendered capable of working itſelf.

This engine conſiſts of a receiver, a ſteam, and an injection-cock; a ſuction and a forcing-pipe, each furniſhed with a valve; together with a boiler, which, on account of its bulk and weight, was not ſent with the reſt; but, as it may be of the common globular ſhape, and having nothing particular in its conſtruction, a deſcription of it will not be neceſſary, as alſo, the reſt of theſe parts already mentioned being eſſential to every machine of this kind, a further account of them may be diſpenſed with. What is peculiar to this engine, is a float within the receiver, compoſed of a light ball of copper, which is not looſe therein, but faſtened to the end of an arm, which is made to riſe and fall by the float, while the other end of the arm is faſtened to an axis; and conſequently, as the float moves up and down, the axis is turned round one way or the other. This axis is made conical, and paſſes through a conical ſocket; which laſt is ſoldered to the ſide of the receiver. Upon one of the ends of the axis, which projects beyond the ſocket, is fitted a ſecond arm, which is alſo moved backward and forward by the axis, as the float riſes and falls. By theſe means, the riſing and falling of the ſurface of the water within the receiver communicates a correſpondent motion to the outſide, in order to give proper motions to the reſt of the geer, which regulates the opening and ſhutting of the ſteam and injection-cocks; and ſerves the ſame purpoſe as the plug-frame, &c. in Newcomen's engine. The particular conſtruction and relation of thoſe pieces, will better appear by the figure and references, than can be done by a general deſcription.

AB, (p. LII. *fig.* 3.) an arm, which is faſtened to *a b*, a conical axis, which goes through a conical ſocket in C, a triangular piece ſoldered to the receiver. This piece has this ſhape to give liberty to the arm to riſe and fall, that carries the float on the inſide. D E is a ſmall ciſtern ſoldered to the receiver, which, being kept full of water, keeps the axis and ſocket air-tight. This ciſtern is conſtantly kept full of water, by means of a ſmall leakage through the wooden peg *c*, which follows the pack-thread *e d* to the ciſtern.

e, is a ſmall weight to counterpoiſe the float within.

f, is a ſlider, which being ſet nearer to, or farther from, the axis, will riſe or fall a greater or leſſer ſpace, as may be required; and is faſtened by the ſcrew *g*. This ſlider is furniſhed with a turn-about, *h i*, which is alſo faſtened by a ſcrew, and not at the end *i*, and ſerves to adjuſt the length of F G G H, a chain, which gives motion, by means of the ſhorter chain *k l*, to I K L, the balance, which opens and ſhuts the cocks; and moves upon the ſmall axis L.

G, G, are two pullies ſupported by two arms that are faſtened to the ſide of the receiver, and give the chain a proper direction in order to move the balance.

M N is the ſteam-cock; the end N being ſuppoſed to be detached from a pipe that gives it communication with the boiler.

O is the injection-cock, whoſe key is turned by the arm O *m*.

P Q is the injection-pipe, communicating between the forcing-pipe above the valve, and the top of the receiver.

R S is the arm by which the key of the ſteam-cock is worked.

I, K, two rollers annexed to the balance, which is furniſhed with two ſmall rollers, *n*, *o*, which open and ſhut the injection-cock, by acting upon the arm O *m*, in ſuch a manner, that when the ſteam-cock is opened, the injection is ſhut, and *vice verſa*.

T is a bell of advice, which, moving along with the balance, continues to ring as long as the engine is at work.

V is a cock which ſerves to diſcharge the air from the receiver, and is opened by hand when neceſſary.

W is a weight ſufficient to raiſe the balance to a perpendicular poſture, when it is inclined to the right, and alſo to overcome the friction of the float, axis, pullies, chain, &c.

To put the engine in motion, preſs down the arm A B, which will bring the balance over to the right ſide, and in its motion will open the ſteam-cock, and ſhut the injection; ſet open the cock at V, that the air may be diſcharged by the entrance of the ſteam into the receiver. This being done, ſhut that cock, and let go the arm; the weight W will bring over the balance to the left, and in its motion ſhut the ſteam-cock, and open the injection; this preſently condenſing the ſteam into water, in a great meaſure, leaves a vacuum in the receiver. Things remain in this ſituation, till the preſſure of the atmoſphere has cauſed the water to mount through the ſuction-pipe into the receiver, where, as its ſurface riſes, it cauſes the float to aſcend; and, depreſſing the arm A B, raiſes the balance till it has paſſed the perpendicular; and in its deſcent, which is done by its own gravity, the roller K lays hold of the arm R S, again opens the ſteam-cock, and ſhuts the injection. The receiver being now almoſt filled with water, the balance cannot return till the ſurface of the water therein ſubſides, and ſuffers the float to deſcend. This is performed by the elaſticity of the ſteam, which, at the ſame time that it fills the receiver, drives out the water through the forcing-pipe; and when the ſurface is deſcended ſo low as to ſuffer the weight W to bring the balance beyond the perpendicular towards the left, it then falls of its own accord, and, in falling, the roller I lays hold of the arm R S, ſhuts the ſteam-cock, and opens the injection as above.

When the engine is deſired to be ſtopped, obſerve, when the balance lies to the right, to turn round the arm O *m* of the injection-cock, ſo that the tail of the ſteam-

cock

cock may miſs it in the next motion; ſo that at the ſame time that the receiver is filled with ſteam, and the ſteam-cock ſhut, the injection not being opened, the motion will ſtop for want thereof.

In the Philoſophical Tranſactions, N°. 461, there is an account of an improvement made in the ſteam-engine by Mr. Payne, as follows. He has contrived two iron-pots, or veſſels, of a conical form, inverted as repreſented by ABEF, (p. LXIII. *fig.* 3.) on the upper-part of which is fixed a round globular copper-head, about five feet and a half in diameter, as L M N. There is then placed on the inſide a ſmall machine H, called the diſperſer, with ſpouts *a*, *b*, *c*, *d*, *e*, &c. round the ſides fixed to it, and the bottom thereof reſts on a center pin O. In this machine is fixed an upright tube G, with holes at the bottom, and a funnel P on the top to receive a ſpout of water from a conduit-pipe Q, by the ſtop-cock R.

This veſſel being completed, two or more of them are placed in a reverberatory arch for conveying the intenſe heat of a ſtrong fire, the flame of which encompaſſes the iron-veſſels, and keeps them in a red heat during the time of their uſe; at which time the cog-wheel I, being turned by proper machines, whirls the diſperſer about with great velocity, and cauſes the water in it, by a centrifugal force, to fly through the ſpouts, againſt the ſides of the red-hot pots, which immediately converts the greateſt part thereof into vapour, or elaſtic ſteam, which is conveyed by a common pipe and cock to the barrel of the engine, to put the piſton in motion; and the waſte water is conveyed away at bottom, by means of a pipe at C D, with a valve at D to keep out the air.

Mr. Vauloüe's ENGINE, *invented for driving the Piles at Weſtminſter Bridge.*

A. (plate LXIII. *fig.* 4.) The great ſhaft on which are the great wheel and drum.

B. The great wheel with cogs, that turns a trundle-head with a fly to prevent the horſes falling when the ram is diſcharged.

C. The drum on which the great rope is wound.

D. The follower, with a roller at one corner, in which are contained the tongs that take hold of the ram, and are faſtened to the other end of the great rope which paſſes over the pulley, near the upper end of the guides, between which the ram falls.

E. The inclined planes which ſerve to open the tongs, and diſcharge the ram.

F. The ſpiral barrel that is fixed to the drum, on which is wound a rope with a counterpoiſe, to hinder the follower from accelerating, when it falls down to take up the ram.

G. The great bolt which locks the drum to the great wheel.

H. The ſmall lever which has a weight fixed at one end, paſſes through the great ſhaft below the great wheel, and always tends to puſh the great wheel upwards, and locks the drum to the great wheel.

I. The forcing-bar which paſſes through the hollow axis of the great ſhaft, and bears upon the ſmall lever, and has near the upper-end a catch, by which the crooked lever keeps it down.

K. The great lever which preſſes down the forcing-bar, and diſcharges the great bolt, at the time the long end is lifted up by the follower.

L. The crooked lever, one end of which has a roller, which is preſſed upon by the great rope; the other end bears upon the catch of the forcing-bar, during the time the follower is deſcending.

M. The ſpring that preſſes againſt the crooked lever, and diſcharges it from the catch of the forcing-bar, as ſoon as the great rope ſlackens and gives liberty to the ſmall lever to puſh up the bolt.

By the horſe going round, the great rope is wound about the drum, and the ram is drawn up till the tongs come between the inclined planes, when they are opened, and the ram is diſcharged.

Immediately after the ram is diſcharged, the roller which is at one end of the follower, takes hold of the rope that is faſtened to the long end of the great lever, and lifts it up; the other end preſſes down the forcing-bar, unlocks the drum, and the follower comes down by its own weight.

As ſoon as the follower touches the ram, the great rope ſlackens, and the ſpring M diſcharges the crooked lever from the catch of the forcing-bar, and gives liberty to the ſmall lever to puſh up the great bolt, and to lock the drum to the great wheel, and the ram is drawn up again as before.

ENGINEER, or INGINEER, properly ſignifies one ſkilled in the nature of engines in general; but it is commonly applied to an officer who is appointed to inſpect and contrive any attacks, defences, &c. of a fortified place.

ENGLAND, the ſouthern diviſion of Great Britain, ſituated in the Atlantic ocean, between the ſecond degree eaſt and ſixth degree weſt longitude, and between 49 deg. 55 min. and 55 deg. 55 min. north latitude.

There are in England, including Wales, fifty-two counties, two archbiſhoprics, twenty-four biſhoprics, two univerſities, twenty-nine cities, upwards of eight hundred towns, and near ten thouſand pariſhes; ſuppoſed to contain about ſeven million of perſons.

As to the polity, trade, law, civil and religious antiquities, &c. of England, their ſeveral branches are treated of under the articles PARLIAMENT, PRIVY-COUNCIL, COURT, CUSTOM-HOUSE, ADMIRALTY, &c.

New ENGLAND, comprehending the colonies of Maſſachuſets, New Hampſhire, Connecticut, Rhode-Iſland, and Providence Plantation, is ſituated between the 67th and 73d deg. weſt longitude, and between the 41ſt and 45th deg. north latitude.

The provinces into which New-England is divided, have different conſtitutions, and generally different governors, who have a negative voice in the choice of the members who are to ſerve as their council; and beſides, all laws muſt be ſent to Old England to receive the approbation of the crown, and no act of government is valid without the governor's conſent in writing.

ENGLISH, or the ENGLISH-TONGUE, the language ſpoken by the people of England, and, with ſome variation, by thoſe of Scotland, as well as part of Ireland, and the reſt of the Britiſh dominions.

The ancient language of Britain is generally allowed to have been the ſame with the Gaulic, or French; this iſland, in all probability, having been firſt peopled from Gallia, as both Cæſar and Tacitus affirm, and prove by many ſtrong and concluſive arguments, as by their religion, manners, cuſtoms, and the nearneſs of their ſituation. But now we have very ſmall remains of the ancient Britiſh tongue, except in Wales, Cornwall, the iſlands and highlands of Scotland, part of Ireland, and ſome provinces of France; which will not appear ſtrange, when what follows is conſidered.

Julius Cæſar, ſome time before the birth of our Saviour, made a deſcent upon Britain, though he may be ſaid rather to have diſcovered than conquered it; but, about the year of Chriſt forty-five, in the time of Claudius, Aulus Plautius was ſent over with ſome Roman forces, by whom two kings of the Britons, Codigunus and Caractacus, were both overcome in battle: whereupon a Roman colony was planted at Malden in Eſſex, and the ſouthern parts of the iſland were reduced to the form of a Roman province: after that, the iſland was conquered as far north as the Firths of Dumbarton and Edinburgh, by Agricola, in the time of Domitian; whereupon a great number of the Britons, in the conquered part of the iſland, retired to the weſt part called Wales, carrying their language with them.

The greateſt part of Britain being thus become a Roman province, the Roman legions, who reſided in Britain for above two hundred years, undoubtedly diſſeminated the Latin tongue; and the people being afterwards governed by laws written in Latin, muſt neceſſarily make a mixture of languages. This ſeems to have been the firſt mutation the language of Britain ſuffered.

Thus the Britiſh tongue continued, for ſome time, mixed with the provincial Latin, till, the Roman legions being called home, the Scots and Picts took the opportunity to attack and harraſs England: upon which, king Vortigern, about the year 440, called the Saxons to his aſſiſtance, who came over with ſeveral of their neighbours, and having repulſed the Scots and Picts, were rewarded for their ſervices with the iſle of Thanet, and

the whole county of Kent: but growing too powerful, and not being contented with their allotment, diſpoſſeſſed the inhabitants of all the country on this ſide of the Severn: thus the Britiſh tongue was in a great meaſure deſtroyed, and the Saxon introduced in its ſtead.

In the beginning of the ninth century, the Danes invaded England, and getting a footing in the northern and eaſtern parts of the country, their power gradually increaſed, and they became ſole maſters of it in about two hundred years. By this means the ancient Britiſh obtained a tincture of the Daniſh language; but their government, being of no long continuance, did not make ſo great an alteration in the Anglo-Saxon, as the next revolution, when the whole land, in the year 1067, was ſubdued by William the Conqueror, duke of Normandy in France: for the Normans, as a monument of their conqueſt, endeavoured to make their language as generally received as their commands, and thereby rendered the Britiſh language an entire medley.

Thus was the ancient Britiſh language, in a manner, extirpated by the Romans, Danes, and Saxons, and ſucceeded by the Saxon, and after that blended with the Norman French. But, beſides theſe, a change in the language has been effected by two other cauſes. The firſt is that of commerce; for as the inhabitants of Great Britain have been for a long ſeries of years greatly addicted to trade, the names of offices, dignities, names of wares, and terms of traffic, have been introduced, and formed according to the genius of our own tongue. The ſecond is that of learning, from which our tongue has received no ſmall improvement; for, as to the Greek and Latin, the learned have, together with the arts and ſciences, now rendered familiar among us, introduced abundance, nay almoſt all the terms of art in the mathematics, philoſophy, phyſic, and anatomy; and we have entertained many more from the Latin, French, &c. for the ſake of neatneſs and elegancy: ſo that, at this day, our language, which, about 1800 years ago, was the ancient Britiſh, or Welſh, &c. is now a mixture of Saxon, Teutonic, Dutch, Daniſh, Norman, and modern French, embelliſhed with the Greek and Latin. Yet this, in our opinion, is ſo far from being a diſadvantage to the Engliſh tongue, as now ſpoke; for all languages have undergone changes, and do continually participate with each other; that it has ſo enriched it, as now to become the moſt copious, ſignificant, fluent, courteous, amorous, and maſculine language in Europe, if not in the world: this, indeed, was Camden's opinion of it in his time, and Dr. Heylin's in his time: if then the Engliſh tongue, in the opinion of theſe learned authors, deſerved ſuch a character in their days, how much more now, having ſince received ſo conſiderable improvements from ſo many celebrated writers.

ENGRAFTING, or GRAFTING, in gardening. See GRAFTING.

ENGRAILED, or INGRAILED, in heraldry, a term derived from the French, *greſly*, hail; and ſignifying a thing the hail has fallen upon and broke off the hedges, leaving them ragged, or with half rounds, or ſemi-circles, ſtruck out of their edges.

ENGRAVING, the art of cutting on wood, metals, precious ſtones, &c. figures, landſcapes, letters, &c.

ENGRAVING *on Wood*. See the article CUTTING *in Wood*.

ENGRAVING *on Copper*, the making, correſpondently to ſome delineated figure or deſign, ſuch concave lines on a ſmooth ſurface of copper, either by cutting or corroſion, as render it capable, when charged properly with any coloured fluid, of imparting by compreſſion an exact repreſentation of the figure or deſign to any fit ground of paper or parchment.

The method by which engraving is at this time performed, is of three kinds: by the graver or tool alone, which is in common language the only kind called engraving: by corroſion with aqua-fortis, which is generally called etching: and by covering the ſurface of a copper-plate with lines, in ſuch manner, that the whole would produce the effect of black in an impreſſion; and then ſcraping or burniſhing away part of the lines, ſo as to cauſe the remainder to have the ſame effect as if they had been cut on the even ſurface, according to the delineation of any figure or deſign; which laſt kind is called ſcraping in mezzotinto. See ETCHING and MEZZOTINTO.

Engraving with the tool was the kind originally practiſed, and it is yet retained for many purpoſes. For tho' the manœuvre of etching be more eaſy, and other advantages attend it; yet where great regularity and exactneſs of the ſtroke or lines are required, the working with the graver is much more effectual; on which account it is more ſuitable to the preciſion neceſſary in the execution of portraits; as there every thing the moſt minute muſt be made out and expreſſed, according to the original ſubject, without any licenſe to the fancy of the deſigner in deviating from it, or varying the effect either by that maſterly negligence and ſimplicity in ſome parts, or thoſe bold ſallies of the imagination and hand in others, which give ſpirit and force to hiſtory painting.

The principal inſtruments uſed in engraving with the tool, are gravers, burniſhers, an oil-ſtone, and a cuſhion for bearing the plates.

Gravers are made in ſeveral forms with reſpect to the points, ſome being round, others ſquare, and a third kind lozange. The round-pointed is beſt for ſcoring lines; the ſquare for cutting broad and deep; and the lozange for more delicate and fine ſtrokes and hatches. La Boſſe recommends, as the moſt generally uſeful, ſuch as are of a form betwixt the ſquare and lozange; and adviſes, that they ſhould be of a good length; ſmall towards the point, but ſtronger upwards, that they may have ſtrength enough to bear any ſtreſs there may be occaſion to lay upon them; for if they be too ſmall and mounted high, they will bend, which frequently cauſes their breaking, eſpecially if they be not employed for very ſmall ſubjects.

Burniſhes are another kind of inſtruments uſed to aſſiſt in the engraving on ſome occaſions, as well as to poliſh the plates. Thoſe uſed for engraving may be ſuch as are made for other purpoſes; which, being to be procured every where, do not require a further deſcription here. The principal application of them in engraving, beſides their uſe in poliſhing the plates, is to take out any ſcratches, or accidental defacings, that may happen to the plates during the engraving; or to leſſen the effect of any parts that may be too ſtrongly marked in the work, and require to be taken down.

A cuſhion, as it is called, is likewiſe generally uſed for ſupporting the plate in ſuch manner, that it may be turned every way with eaſe. It is a bag of leather filled with ſand, which ſhould be of the ſize that will beſt ſuit the plates it is intended to bear. They are round and about nine inches over, and three or four inches in thickneſs.

The cuſhion, made as above directed, being laid on the table firmly fixed, the plate muſt be put upon it; and the graver being held in the hand, according to the inſtructions before given, the point muſt be applied to the plate, and moved in the proper direction for producing the figures of the lines intended: obſerving, in forming ſtraight lines, to hold the plate ſteady on the cuſhion; and where they are to be finer, to preſs more lightly, uſing greater force where they are to be broader and deeper. In making circular or other curve lines, the hand and graver muſt be held ſteady, with the arm reſting upon the table; and the plate moved upon the cuſhion under the graver, ſo that as each proper part paſſes the point, the figure intended may be cut upon it: for crooked and winding lines cannot be produced with the ſame neatneſs and command by any other means. After part of the work is engraved, it is neceſſary to ſcrape it with the ſharp edge of a burniſher, or graver, paſſed in the moſt level direction over the plate, to take off the roughneſs formed by the cutting of the graver; but great care muſt be taken not to incline the edge of the burniſher, or tool uſed, in ſuch manner, that it may take the leaſt hold of the copper; as it would otherwiſe produce falſe ſtrokes or ſcratches in the engraving: and that the engraved work may be rendered more viſible, it may afterwards be rubbed over with a roll of felt dipped in oil. In uſing the graver, it is neceſſary to carry it as level as poſſible with the ſurface of the plate; for otherwiſe, if the fingers ſlip betwixt them, the line that will be produced, whether curve or ſtraight, will become deeper and deeper in the progreſs of its formation; which entirely prevents

ſtrokes

ſtrokes being made at one cut, that will be fine at their extremities, and larger in the middle; and occaſions the neceſſity of retouching, to bring them to that ſtate. For this reaſon it is very neceſſary for thoſe, who would learn to engrave in perfection, to endeavour, by frequent trials, to acquire the habit of making ſuch ſtrokes both ſtraight and curving, by lightening or ſinking the graver with the hand, according to the occaſion. If after finiſhing the deſign, any ſcratches appear, or any part of the engraving be falſely executed, ſuch ſcratches, or faulty parts, muſt be taken out by the burniſher, and further poliſhed, if neceſſary, by the abovementioned roll; and the plate may be cleanſed as at firſt, by crumbs of bread and chalk, in order that the obliterated part may be reſtored, where there is occaſion, by reingraving it.

The plate being thus engraved, it is proper to take off the edges, by uſing firſt a rough file, and afterwards a ſmoother; and to blunt the corners a little, by the ſame means; after which, the burniſher ſhould be paſſed over the filed places, to take away the ſcorings, that no part of the printing-ink may be retained in them.

ENGRAVING *on precious Stones*, is the repreſenting of figures, or devices, in relievo, or indented, on divers kinds of hard poliſhed ſtones.

The art of engraving on precious ſtones is one of thoſe wherein the ancients excelled; there being divers antique agats, cornelians, and onyx's, which ſurpaſs any thing of that kind the moderns have produced. Pyrgoteles among the Greeks, and Dioſcorides under the firſt emperors of Rome, are the moſt eminent engravers we read of: the former was ſo eſteemed by Alexander, that he forbad any body elſe to engrave his head: and Auguſtus's head, engraven by the latter, was found ſo beautiful, that the ſucceeding emperors choſe it for their ſeal.

All the polite arts having been buried under the ruins of the Roman empire, the art of engraving on ſtones met the ſame fate. It was retrieved in Italy at the beginning of the fifteenth century, when one John of Florence, and after him Dominic of Milan, performed works of this kind no way to be deſpiſed. From that time, ſuch ſculptures became common enough in Europe, and particularly in Germany, whence great numbers were ſent into other countries; but they came ſhort of the beauty of thoſe of the ancients, eſpecially thoſe on precious ſtones; for, as to thoſe on cryſtal, the Germans, and, after their example, the French, &c. have ſucceeded well enough.

In this branch of engraving, they make uſe either of the diamond, or emery.—The diamond, which is the hardeſt, and moſt perfect of all precious ſtones, is only cut by itſelf, or with its own matter. See DIAMOND.

As to rubies, emeralds, hyacinths, amethyſts, garnets, agats, and other of the ſofter ſtones, they are cut on a leaden wheel, moiſtened with emery and water; and poliſhed with tripoli, on a pewter-wheel. Lapis, opal, &c. are poliſhed on a wooden wheel.

To faſhion and engrave vaſes of agat, cryſtal, lapis, or the like, they have a kind of lathe, like that of the pewterers, excepting, that whereas the latter is to hold the veſſels which are to be wrought with proper tools; the former generally holds the tools, which are turned by a wheel, and the veſſel held to them to be cut and engraved, either in relievo, or otherwiſe; remembering, from time to time, to moiſten the tools with diamond duſt and oil, or at leaſt emery and water.

To engrave figures or devices on any of theſe ſtones, when poliſhed, ſuch as medals, or ſeals, &c. they uſe a little iron wheel, the two ends of whoſe axes are received within two pieces of iron placed upright, as in the turner's lathe, to be brought cloſer, or ſet further apart, at pleaſure. At one end of one of the axes are fitted the proper tools, being kept tight by a ſcrew. Laſtly, the wheel is turned by the foot, and the ſtone applied by the hand to the tool; and thus ſhifted and conducted, as occaſion requires.

The tools are generally of iron, ſometimes of braſs. As to their form it is various, but generally bears ſome reſemblance to chiſſels, gouges, &c. ſome have ſmall round heads like buttons, others like ferrels, to take the pieces out; others flat, &c. Theſe tools are not applied directly againſt the ſtone, but, as it were, ſidewiſe; thus wearing, and, as it were, grinding off the ſubſtance: and ſtill, whether it be figures, or letters, or characters, the manner of application is the ſame. The tools, as above obſerved, are to be frequently moiſtened with diamond duſt, and oil of olives. When the ſtone is engraven, they poliſh it on a wheel of bruſhes, made of hogs briſtles, with tripoli. For the larger and leſs delicate works, they have copper or pewter tools, on purpoſe to poliſh the ground, or plain parts, with tripoli, &c. which they apply after the ſame manner as thoſe wherewith the graving is performed.

ENGRAVING *on Steel* is chiefly employed in cutting punches for coins, medals, &c.

The methods of engraving, with the inſtruments, &c. are the ſame for coins, as for medals and counters: all the difference conſiſts in their greater or leſs relievo; the relievo of coins being much leſs conſiderable than that of medals; and that of counters ſtill leſs than that of coins.

The engraver in ſteel uſually begins with punches, or punchions, which are in relievo, and ſerve for making the creux, or cavities of the matrices, and dies. Though, ſometimes, he begins immediately with the creux; but it is only when the intended work is to be cut very ſhallow. The firſt thing is to deſign his figures; then he moulds them in white wax, of the ſize and depth required; and from this wax he graves his punch.

This punch is a piece of ſteel, or at leaſt of iron and ſteel mixed; on which, before they temper or harden it, the intended figure, whether a head, or a reverſe, is cut, or carved in relievo. The inſtruments uſed in this graving in relievo, which are much the ſame as thoſe wherewith the finiſhing of the work in creux is effected, are of ſteel. The principal are gravers of divers kinds, chiſſels, flatters, &c. When the punch is finiſhed, they give it a very high temper, that it may the better bear the blows of the hammer, wherewith it is ſtruck, to give the impreſſion to the matrice.

What they call matrice, or matrix, is a piece of good ſteel of a cubic form, called alſo a die; whereon the relievo of the punch is ſtruck in creux. It is called matrix, becauſe, in the cavities or indentures thereof, the coins, or medals, ſeem formed, or generated, as animals are in the matrix of their mother. To ſoften this ſteel, that it may more eaſily take the impreſſions of the punch, they make it red-hot; and, after ſtriking the punch thereon in this ſtate, they proceed to touch up or finiſh the ſtrokes and lines, where, by reaſon of their fineneſs, or the too great relievo, they are any thing defective, with ſome of the tools abovementioned.

The figure thus finiſhed, they proceed to engrave the reſt of the medal, as the mouldings of the border, the engrailed ring, letters, &c. All which, particularly the letters, and graining, or engrailment, are performed with little ſteel punches, well tempered, and very ſharp. Add, that as they ſometimes make uſe of punchions, to engrave the creux of the matrix; ſo, on ſome occaſions, they make uſe of the creux of the matrix to engrave the relievo of the punch.

To ſee and judge of the engraving in creux, divers means have been deviſed to take the impreſſions therefrom, as the work proceeds. Sometimes they make uſe of a compoſition of common wax, turpentine, and lamp black; which, always retaining its ſoftneſs, eaſily takes the impreſſion of the part of the graving it is applied to. But, this only ſerving to ſhew the work piece-meal, they have had recourſe to other ways, to ſhew the whole figure. The firſt, by pouring melted lead on a piece of paper, and clapping the matrice thereon: the ſecond, with melted ſulphur, managed the ſame way: and the third, proper only where the graving is ſhallow, by laying a piece of ſoft paper on the graving, and over the paper a leaf of lead; when, giving two or three blows with a hammer on the lead, the paper takes the impreſſion of the work.

When the matrix is quite finiſhed, they temper it, rub it well with pumice-ſtone, and clean out the ſtone again with a hair-bruſh; and, laſtly, poliſh it with oil and emery.

ENGUICHE, in heraldry, is ſaid of the great mouth

of a hunting horn, when its rim is of a different colour from that of the horn itſelf.

ENHARMONIC, in the ancient muſic, one of their genera or kinds of muſic, ſo called from its ſuperior excellence; though wherein it conſiſted, ſays Mr. Malcolm, is hard to ſay: it was allowed by all to be ſo very difficult, that few could ever practiſe it.

Others ſay it is a ſpecies of muſic, the modulation whereof proceeds by intervals leſs than ſemitones; as the ſemitone minor, enharmonic dieſis, and third major.

ENIXUM, among chemiſts, a kind of neutral ſalt, generated of an acid and an alkali.

The ſal enixum of Paracelſus, is the caput mortuum of ſpirits of nitre with oil of vitriol, or what remains in the retort after the diſtillation of this ſpirit, being of a white colour, and pleaſing acid taſte.

ENMANCHE, in heraldry, is when lines are drawn from the center of the upper-edge of the chief to the ſides, to about half the breadth of the chief; ſignifying ſleeved, or reſembling a ſleeve, from the French *manche*.

ENNEAGON, in geometry, a figure conſiſting of nine angles, and as many ſides.

The word is derived from the Greek εννεα, nine, and γονια, an angle.

ENNEAHÆDRIA, in natural hiſtory, the name of a genus of ſpars.

The word is derived from the Greek εννεα, nine, and εδρα, a ſide.

The bodies of this genus are ſpars, compoſed of nine planes, in a triagonal column, terminated at each end by a triagonal pyramid.

ENNEANDRIA, in botany, a claſs of plants, with hermaphrodite flowers, and nine ſtamina, or male parts, in each.

The word is derived from the Greek εννεα, nine, and ανηρ, male.

The plants of this claſs are the bay-tree, rhubarb, &c.

ENNERIS, in the naval architecture of the ancients, a galley or veſſel with nine tiers of oars. See the article GALLEY.

ENS, among metaphyſicians, denotes entity, being, or exiſtence: this the ſchools call *ens reale*, and *ens poſitivum*, to diſtinguiſh it from their *ens rationis*, which is only an imaginary thing, or exiſts only in the imagination.

ENS, among chemiſts, imports the power, virtue, and efficacy, which certain ſubſtances exert upon our bodies.

ENS VENERIS, the ſublimate of equal quantities of dulcified calx of vitriol, and the dried flowers of ſal ammoniac, a ſmall proportion of which turns a large one of the infuſion of galls black: it is red, ſaline, and aſtringent; and ſaid to be an excellent medicine in diſtempers ariſing from a weakneſs of the ſolids, as the rickets, and the like.

ENSIFORM, in general, ſomething reſembling a ſword; thus we find mention of enſiform leaves, enſiform cartilage, &c.

The word is compounded of the Latin, *enſis*, a ſword, and *forma*, reſemblance.

ENSIGN, in the military art, a banner, under which the ſoldiers are ranged according to the different companies or parties they belong to.

ENSIGN is alſo the officer that carries the colours, being the loweſt commiſſioned officer in a company of foot, ſubordinate to the captain and lieutenant.

ENSIGN, in naval affairs, a ſort of banner or flag hoiſted on a pole called the enſign-ſtaff over the ſtern of a ſhip.

It is uſed to diſtinguiſh the ſhips of different nations from one another, as alſo the different ſquadrons of a fleet from each other. See FLAG and SIGNAL.

ENTABLATURE, or ENTABLEMENT, in architecture, is that part of an order of a column, which is over the capital, and comprehends the architrave, frieze, and corniche.

The entablature is alſo called the trabeation, and ſeems borrowed from the Latin, *trabs*, a beam; though others derive it from *tabulatum*, a ceiling, becauſe the frieze is ſuppoſed to be formed by the ends of the joiſts which bear upon the architrave.

It is different in different orders; for notwithſtanding that it conſiſts of the three beforementioned diviſions in all; yet theſe parts are made up of more or fewer particular members or ſubdiviſions, according as the order is more or leſs rich. Vignola makes the entablature a quarter of the height of the whole column in all the orders. In the Tuſcan and Doric, the architrave, frieze, and corniche, are all the ſame height. In the Ionic, Corinthian, and Compoſite, the whole entablature being of fifteen parts, five of theſe go to the architrave, four to the frieze, and ſix to the corniche. See the articles TUSCAN, DORIC, &c.

Mr. le Clerc obſerves, that were we to regard only the laws of ſtrength and weakneſs, we ſhould rather diminiſh the entablature of ſuch columns as have pedeſtals, than thoſe which have none. As to the projecture of the entablature, it ſhould never be forgot, that its principal deſign is to ſhelter what is underneath.

ENTABLATURE, in maſonry, is uſed ſometimes to denote the laſt row of ſtones on the top of the wall of a building, on which the timber and covering reſt. This is often made to project beyond the naked of the wall, to carry off the rain.

ENTAIL, in law, is a free eſtate intailed; that is, abridged and limited to certain conditions preſcribed by the donor or grantor. See the articles FEE, RECOVERY, and TAIL.

ENTE, in heraldry, a method of marſhalling more frequent abroad than with us, and ſignifying grafted or ingrafted.

ENTELECHIA, εντελεχεια, a word uſed by Ariſtotle to expreſs the ſoul, and which, not occurring in any other author, has given the commentators upon that philoſopher great trouble to diſcover its true meaning.

ENTEROCELE, in ſurgery, is a kind of ſwelling, in which the inteſtine falls into the groin or ſcrotum.

The word is Greek, and derived from εντερον, an inteſtine, and κηλη, a hernia, tumour, or rupture.

This diſorder ariſes from a violent diſtention of the peritonæum and rings of the abdominal muſcles, through which the inteſtine prolapſes into the ſcrotum; and proceeds from ſome violence by a fall, blow, or ſtraining to leap, lift up great weights, vomiting, &c. and according to the nature of the cauſe, the rupture is formed either inſtantly or imperceptibly by degrees. This rupture is always attended with pains, and uſually happens but in one ſide, never in both at a time: ſometimes the inteſtine alone falls down; at other times it is accompanied with the omentum. The tumour appears ſoft to the touch like an inteſtine, or bladder, diſtended with wind: it firſt appears ſmall in the ingueh, and gradually deſcends down to the teſticle of the ſame ſide in the ſcrotum, which is thereby ſometimes diſtended halfway down the thigh, and even down to the knee: the other ſymptoms are the ſame with thoſe of the bubonocele.

The tumour is encreaſed by crying, plentiful eating, lifting, or carrying any burden; is contracted with cold, and dilated with heat: it may be diſtinguiſhed generally from the hydrocele or pneumatocele, by its returning into the abdomen with a murmuring noiſe.

This kind of rupture may be ſuſtained with but little inconveniencies by men not addicted to hard labour, and women with child; but it ſhould never be left to itſelf without a ſupport or truſs, leſt, by ſome accident, the inteſtines ſhould become incarcerated, and incapable of being returned. When the diſorder is recent, and in a young ſubject, it may be perfectly cured without danger of a relapſe; as it may alſo in adults and old people, by conſtantly wearing a proper truſs. It is leſs dangerous when the inteſtine is attended with the omentum. When the inteſtine is returnable, the ſurgeon ſhould immediately reduce the parts, and retain them in their proper ſituation, and to cloſe up the aperture firmly with a truſs, bandage, or by inciſion, termed celotomy.

Another method conſiſts chiefly in paſſing a ſmall gold wire round the upper part of the proceſs of the peritonæum, near the ring of the abdominal muſcles, leaving the teſticle in its natural poſition: the wire is twiſted by a pair of forceps, ſo as to confine the proceſs of the peritonæum, without compreſſing the ſpermatic veſſels, in order to prevent the inteſtine from falling through it

again: this method, however, is not thought effectual in moſt caſes by Heiſter.

In order to preſerve the teſticle, ſome ſurgeons do not tie the proceſs of the peritonæum and ſpermatic veſſels with a ligature, but having returned the inteſtines and omentum, they then ſcarify the ring of the abdomen, through which the inteſtine prolapſed, together with the ſkin, in order to render the cicatrix more firm. If in the interocele the inteſtine cannot be reduced, eſpecially if it adhere to the proceſs of the peritonæum, ring of the abdominal muſcles, ſcrotum, or teſticle, no truſs or bandage will be of any ſervice: there is, then, but one method of ſaving the patient, by a ſevere operation; in order to which the integuments are to be divided; and when the ſacculus appears, it is to be ſeparated, and a ſmall aperture made in it big enough to introduce a quill, or ſome other inſtrument, to ſeparate the inteſtine from all its adheſions, before it is protruded into the abdomen, which ſhould always be done where the inteſtine adheres; after which the wound is to be healed, and the patient ſecured from a relapſe, by wearing the bandage-ſpica. See BANDAGE and TRUSS.

If the ſtricture of the inteſtine is ſo great as to render all means ineffectual to reduce the rupture; the ſurgeon muſt then have recourſe to the knife to ſave the patient.

ENTERO-EPIPLOCELE, in ſurgery, is a kind of rupture in which the inteſtines and omentum, or caul, fall down together into the ſcrotum.

The word is derived from the Greek εντερον, an inteſtine; and επιπλοον, the caul.

ENTERO EPIPLOMPHALUS, in ſurgery, is a rupture cauſed by the inteſtine and caul falling down through the navel.

The word is formed from the Greek εντερον, a gut, επιπλοον, the caul, and ομφαλος, the navel.

This is a diſorder common to women with child.

ENTERO-HYDROMPHALUS, in ſurgery, is when the tumour is cauſed by the gut and water ſwelling out at the navel.

The word is formed from the Greek εντερον, a gut, υδωρ, water, and ομφαλος, the navel.

ENTEROLOGY, a treatiſe on the bowels, which generally includes the contents of the three cavities, the head, breaſt, and belly.

The word is Greek, and derived from εντερον, a gut, and λογος, a diſcourſe.

ENTERPLEADER, in law, ſignifies the diſcuſſing or trial of point, incidentally falling out, before the principal cauſe can be determined.

ENTERSOLE, in architecture, a kind of little ſtory, ſometimes called a mezanzine, contrived occaſionally at the top of the firſt ſtory, for the conveniency of a wardrobe, &c.

ENTERTAINMENT, in a theatrical ſenſe. See the article FARCE.

ENTHUSIASM, a tranſport of the mind, whereby it is led to think and imagine things in a ſublime, ſurpriſing, and yet probable manner.

The word is Greek ενθουσιασμος, and derived from ενθουσιαζω, to be agitated with divine raptures.

ENTHUSIASM, in a religious ſenſe, implies a tranſport of the mind, whereby it fancies itſelf inſpired with ſome revelation, impulſe, &c. from heaven.

There is a degree of aſſent, ſays Mr. Locke, which, with ſome men, has the ſame authority, as either faith or reaſon; and that is Enthuſiaſm; which, laying by reaſon, would ſet up revelation without it; whereby, in effect, it takes away both reaſon and revelation, and ſubſtitutes, in the room of it, the ungrounded fancies of a man's own brain, and aſſumes them for a foundation both of opinion and conduct.

Immediate revelation being a much eaſier way for men to eſtabliſh their opinions, and regulate their conduct by, than the tedious labour of ſtrict reaſoning; it is no wonder, that ſome have been very apt to pretend to it, eſpecially in ſuch of their opinions and actions as they cannot account for by the ordinary methods of knowledge, and principles of reaſon.

Hence we ſee, that, in all ages, men, in whom melancholy has mixed with devotion; or whoſe conceit of themſelves has raiſed them into an opinion of greater familiarity with God, than is allowed others; have often flattered themſelves with the perſuaſion of an immediate intercourſe with the Deity, and frequent communications from the divine ſpirit.

Their minds being thus prepared, whatever groundleſs opinion comes to ſettle itſelf ſtrongly upon their fancies, is an illumination from the ſpirit of God; and, whatſoever odd action they find in themſelves an inclination to do, that impulſe is concluded to be a call, or direction, from heaven, and muſt be obeyed. This we take to be properly Enthuſiaſm, which, though riſing from the conceit of a warm or overweening brain, works, where its once gets footing, more powerfully on the perſuaſions and actions of men, than either reaſon, or revelation, or both together; men being moſt forwardly obedient to the impulſes they receive from themſelves.

When men are once got into this way of immediate revelation, of illumination without ſearch, and certainty without proof, reaſon is loſt upon them; they are above it: they ſee the light infuſed into their underſtandings, and they cannot be miſtaken; like the light of bright ſun-ſhine, it ſhews itſelf, and needs no other proof but its own evidence: they feel the hand of God moving them within, and the impulſes of the ſpirit, and cannot be miſtaken in what they feel.—But, of this ſeeing and feeling, is it a perception of an inclination to do ſomething, or of the ſpirit of God moving that inclination? Theſe are two very different perceptions, and ſhould be carefully diſtinguiſhed.

If they know the thing to be a truth, they muſt do it, either by its own ſelf-evidence, or by the rational proofs that make it out to be ſo: if they know it to be a truth either of theſe two ways, they in vain ſuppoſe it to be a revelation: for thus all truths, of what kind ſoever, that men uninſpired are enlightened with, come into their minds. If they ſay, they know it to be true, becauſe it is a revelation from God, the reaſon is good; but then it will be demanded, how they know it to be a revelation from God? If they ſay, by the light it brings with it; they ſhould conſider, whether this be ſaying any more, than that it is a revelation, becauſe they believe it to be true; for all the light they ſpeak of, is but a ſtrong perſuaſion of their own minds, that it is a truth; which is a very unſafe ground to proceed on, either in our tenets or actions. True light in the mind is nothing elſe but the evidence of the truth of any propoſition: and, if it be not ſelf-evident, all the light it can have, is from the clearneſs of thoſe proofs upon which it is received.

God, when he makes the prophet, doth not unmake the man; he leaves his faculties in their natural ſtate, to enable him to judge of his inſpirations, whether they be of divine original, or no. If he would have us aſſent to the truth of any propoſition, he either evidences that truth by the uſual methods of natural reaſon, or elſe makes it known to be a truth which he would have us aſſent to by his authority; and convinces us, that it is from him, by ſome marks, which reaſon cannot be miſtaken in.

The holy men of old, who had revelations from God, had ſomething elſe beſides internal light of aſſurance in their own minds, to teſtify to them that it was from God. They had outward ſigns to convince them, of the author of thoſe revelations. And, when they were to convince others, they had a power given them to juſtify the truth of their commiſſion from heaven; and by viſible ſigns to aſſert the divine authority of the meſſage they were ſent with. Moſes ſaw the buſh burn without being conſumed, and heard a voice out of it. God, by another miracle, of his rod turned into a ſerpent, aſſured him likewiſe of a power to teſtify his miſſion, by the ſame miracle repeated before them to whom he was ſent.

ENTHUSIAST, a perſon poſſeſſed with enthuſiaſm.

ENTHYMEME, ενθυμημα, among logicians, denotes a ſyllogiſm, perfect in the mind, but imperfect in the expreſſion, by reaſon one of the propoſitions is ſuppreſſed, as being eaſily ſupplied by the underſtanding of thoſe

thoſe with whom we diſcourſe: as for example, *Every man is mortal; therefore every king is mortal*; where the minor propoſition, *every king is a man*, is omitted as being ſufficiently known.

There is a particular elegance in the enthymeme form of arguing, as leaving ſomewhat to the exerciſe and invention of the mind; for which reaſon it is very frequent, as well in common converſation, as in the moſt polite writers. It not only ſhortens diſcourſe, and adds a certain ſtrength and livelineſs to our reaſoning, but alſo gives the reader a pleaſure not unlike that the author himſelf feels in compoſing. By this means we are put upon exerting ourſelves, and ſeem to ſhare in the diſcovery of what is propoſed to us.

ENTIER, in the manege, a reſty horſe that not only refuſes to turn, but alſo reſiſts the hand.

ENTIERTY, or ENTIERTIE, among lawyers, implies the whole of a thing, in contradiſtinction to a moiety: thus a bond, damages, &c. are ſaid to be intire, when they cannot be apportioned.

ENTIRE TENANCY, in law, is when the ſole poſſeſſion is in one perſon, in contradiſtinction to ſeveral tenancy, which is a joint, or common poſſeſſion of two or more.

ENTITIVELY, and ENTIETY, among metaphyſicians; ſee ENS.

ENTOYER, in heraldry, denotes a border charged wholly with things without life: it ſeems to be a corruption of the French *entour*, round about.

ENTREPAS, in the manege, a broken pace or going that is neither walk nor trot, but has ſomewhat of an amble.

ENTROCHUS, in natural hiſtory, the name of a genus of foſſils, of a very regular figure and ſtructure, ſuppoſed, by many authors, to be lapides ſui generis, and ſtones in their native ſtate. They are, however, in reality, the foſſil remains of ſome marine animal, probably either of the echinus, or of the ſtar-fiſh kind, filled, like the foſſil ſpecies of the echini, with a plated ſpar. Our imperfect knowledge in the animal hiſtory has not yet been able to aſcertain to what creature they really belong; but their analogy with the other animal remains found in the foſſil world, plainly evince, that they are of that origin. They are cylindric columns, uſually about an inch in length, and are made up of a number of round joints, like ſo many ſmall wheels, or ſegments of cylinders. Theſe joints, when found ſeparate, and naturally looſe, as they ſometimes are, are called trochitæ. They are all ſtriated, from the center to the circumference, and have a cavity in their middle, which is ſometimes found empty, but more frequently filled up with various matter, of the nature of the ſtratum in which they have lain, or of ſome other native foſſil ſubſtance.

ENTRY, in law, ſignifies taking poſſeſſion of lands or tenements, where a perſon has a right ſo to do. It is alſo uſed for a writ of poſſeſſion.

Bill of ENTRY, in commerce. See BILL.

ENVELOPE, in fortification, a work of earth, ſometimes in form of a ſimple parapet, and at others, like a ſmall rampart with a parapet; it is raiſed ſometimes on the ditch, and ſometimes beyond it.

Envelopes are often made to incloſe a weak ground, where that is practicable, with ſingle lines, to ſave the great charge of horn-works and tenails, or where there is not room for ſuch large works. Some give the name of ſillon, counterguard, conſerve, and lunette, to envelopes raiſed in the moat.

ENVIRONNE, in heraldry, ſignifies ſurrounded with other things: thus, they ſay, a lion environné with ſo many bezants. See the article BEZANT.

ENUMERATION, an account of ſeveral things, in which mention is made of every particular article.

ENUMERATION, in rhetoric, a part of peroration, in which the orator, collecting the ſcattered heads of what has been delivered throughout the whole, makes a brief and artful relation, or recapitulation thereof.

ENVOY, a perſon deputed to negociate ſome affair with any foreign prince or ſtate.

ENURNY, in heraldry, is applied to a border charged with beaſts.

ENVY, in ethics, is defined to be an uneaſineſs of the mind, cauſed by the conſideration of a good we deſire, obtained by one we think leſs worthy of it than ourſelves. See the article PASSION.

EPACTS, in chronology, the exceſſes of the ſolar month above the lunar ſynodical month, or of the ſolar year above the lunar year of 12 ſynodical months.

The common lunar year of 12 ſynodical lunations conſiſts of but 354 days, 8 hours, 48 min. 57 ſec. whereas the ſolar or tropical year conſiſts of 365 days, 5 hours, 48 min. 57 ſec. it is plain therefore that the ſolar year exceeds the lunar by 10 days, 21 hours, 00 min. 19 ſec. and in the ſpace of about 33 years, the beginning of the lunar year will have moved through all the variety of ſeaſons, whence it is called the moveable lunar year; and this form of the year is at this time uſed by the Turks and Arabs.

Hence, as the Julian year is 365 days, 6 hours, and the lunar year as above only 354 days, 8 hours, 48 min. 57 ſec. the annual epact will be 10 days, 21^h $11'$ $22''$; that is, nearly 11 days. Conſequently, the epact of 2 years is 22 days; of 3 years, 33 days; or rather 3, ſince 30 days is an emboliſmic, or intercalary month.

Thus, the epact of 4 years is 14 days, and ſo of the reſt; and at the end of every 19^{th} year, the epact becomes 30 or 0; conſequently the 20^{th} year the epact is 11 again; and ſo the cycle of epacts expires with the golden number, or lunar cycle of 19 years, and begins again with the ſame.

Again, as the new moons are the ſame, that is, as they fall on the ſame day every 19 years, ſo the difference between the lunar and ſolar years is the ſame every 19 years: and becauſe the ſaid difference is always to be added to the lunar year, in order to adjuſt, or make it equal to the ſolar year; hence the ſaid difference reſpectively belonging to each year of the moon's cycle is called the epact of the ſaid year, that is, the number to be added to the ſaid year, to make it equal to the ſolar, the word being formed from the Greek επαγω, *induco, intercalo.*

Upon this mutual reſpect between the cycle of the moon, and the cycle of the epacts, is founded this rule for finding the epact belonging to any year of the moon's cycle. Multiply the year given of the moon's cycle into 11; and if the product be leſs than 30, it is the epact ſought; if the product be greater than 30, divide it by 30, and the remainder of the dividend is the epact according to the Julian account.

But as a ſynodical month or ſpace of time contained between the moon's parting from the ſun, at a conjunction, and returning to him again, is 29 days, 12 hours, 44 min. and 6 ſec. it follows, that 235 lunations are made in 6939 days, 16 hours, 43 min. 30 ſec. but in 19 Julian years are 6939 days, 18 hours; and, conſequently, the new moons, after 19 Julian years, will not return to the ſame hour of the day, but will happen 1 hour, 16 min. 30 ſec. ſooner.

And therefore, becauſe the new moons do not return at the ſame time of the day that they did 19 years before; but in 312 years they will anticipate one day: we muſt, in order to find the epact according to the Gregorian calendar, make proper allowance for the anticipation ſince the Nicene council which was held in 325.

To do this, divide the centuries of the propoſed year by 4; let the quotient be multiplied by 43, and the remainder by 17; to the ſum of theſe products add 86, and divide the whole by 25. Let the quotient (neglecting fractions) be ſubtracted from 11 times the prime or golden number, then will the remainder, rejecting thirties, be the epact required.

To find the epact until the year 1900, the following rule will ſerve:

Subtract one from the prime or golden number, multiply the remainder by 11, and, rejecting thirties as before, the remainder will give the epact.

Example.

Example. Let it be required to find the epact for the preſent year 1765.

By the firſt rule

4) 17 (1
4 (17
43
172
17
86
25) 275 | 11

G N° = 18
11
18
18
198
11
30) 187 | 6
180
7 = the epact.

By the ſecond rule

G N° = 18
1
17
11
17
17
30) 187 | 6
180
7 = the epact as before.

EPANORTHOSIS, in rhetoric, a figure by which a perſon corrects, or ingeniouſly revokes, what he juſt before alledged, as being too weakly expreſſed, in order to add ſomething ſtronger and more conformable to the paſſion with which he is agitated.

The epanorthoſis is diſtinguiſhed into two kinds: the one is when we correct or revoke the word, as in the following example of the apoſtle, "But I laboured more "abundantly than they all: yet not I, but the grace of "God, which was with me;" 1 Cor. xv. 10. where what he firſt attributed to his own merit, he chooſes afterwards to call the work of grace, as being the principal cauſe. The ſecond kind of epanorthoſis, is when we correct or revoke the ſentiment, as in the following inſtance from Cicero: *Italiam ornare, quam domum ſuam, maluit: quanquam, Italia ornata, domus ipſa mihi videtur ornatior.*

EPARER, in the manege, ſignifies the flinging of a horſe, or his yerking and ſtriking with his hind legs. See YERK.

EPAULE, in fortification, denotes the ſhoulder of a baſtion, or the place where its face and flank meet, and form the angle called the angle of the ſhoulder. See the article BASTION.

EPAULEMENT, in fortification, a work raiſed to cover ſidewiſe, is either of earth, gabions, or faſcines, loaded with earth. The epaulements of the places of arms for the cavalry, at the entrance of the trenches, are generally of faſcines mixed with earth.

EPAULEMENT alſo denotes a maſs of earth, called likewiſe a ſquare orillon from its figure, raiſed to cover the cannon of a cazemate, and faced with a wall.

It is likewiſe uſed for any work, thrown up to defend the flank of a poſt, or other place.

EPEMBOLE, in rhetoric, the ſame with parembole. See the article PAREMBOLE.

EPENTHESIS, in grammar, the interpoſition or inſertion of a letter or ſyllable in the middle of a word, as *olituum*, for *altum*; *relligio*, for *religio*; *induperator*, for *imperator*, &c.

EPHA, or EPHAH, in Jewiſh antiquity, a meaſure for things dry, containing 1.0961 of a buſhel. See MEASURE.

EPHEDRA, the ſea-grape, or ſhrub horſe-tail, in botany, a genus of plants, which has no corolla or flower-petals: the ſtamina are ſeven filaments, coaleſcing into a ſubulated column; the antheræ are roundiſh, three being ſuperior, and the other four inferior: the ſeeds are acutely oval, convex on one ſide, and plane on the other, and contained in a baccated cup.

The fruit is red, ſucculent, and of an acid auſtere taſte: its juice, taken in wine, is ſaid to be good for the coeliac paſſion and fluor albus.

EPHEMERA, in medicine, the name of a ſpecies of fever continuing the ſpace of one day, or ſometimes more; for the medical writers expreſs themſelves by *ephemera ſimplex, vel plurium dierum.*

This ſpecies of fever has this peculiar to it, that the pulſe is at firſt large, but as it becomes afterwards moderately quick and frequent, ſo it is equal, ſoft, and regular, as in a natural ſtate. The urine undergoes little or no change, nor is the diſorder preceded by a loathing of food, a ſpontaneous laſſitude of the body, diſturbed ſleep, preternatural yawning, or horror; but it ſeizes the patient ſuddenly, and afflicts him with no other ſymptoms than a pain of the head and ſtomach, a nauſea, heat, and reſtleſſneſs. The perſons moſt ſubject to this fever, are young men who have much blood, and feed heartily, and ſuch as have had any habitual diſcharge of blood ſtopped upon them, whether natural, as in the hæmorrhoidal or menſtrual diſcharges, or artificial, ſuch as frequent bleeding, cupping, and the like; and thoſe who have thrown their blood into violent emotions by the too free uſe of ſpirituous liquors, too violent exerciſe, unuſual watchings, long ſtay by large fires, a ſudden repreſſion of ſweats by cold water, or by violent paſſions, particularly anger. In the treatment of this fever, the proper courſe is to attemperate the violent motions of the blood with nitrous and the fixed antimonial medicines, and occaſionally with gentle acids. Sweat is to be promoted. Nitre, crabs-eyes, &c. may be preſcribed in ſmall doſes every three or four hours; and towards night, ſudorifics ſhould be joined to theſe, ſuch as the contrayerva-root, or the like. The ephemera, properly ſo called, differs in nothing except the time of its duration, from that which commonly laſts four days.

EPHEMERA MALIGNA is alſo a term by which ſome authors have called the ſudor anglicanus, or malignant diary fever, which generally deſtroyed the patient in twenty-four hours. See the article SUDOR ANGLICANUS.

EPHEMERA, the day-fly, in zoology, a genus of flies belonging to the neuroptera order, and ſo called from their living only one day and a night: they are about the ſize of the leſſer houſe-flies, and have two gibbous protuberances on the top of the head, reſembling eyes; add to this, that the tail is furniſhed with hairs, and the antennæ are ſhort.

Of this genus there are ſeveral ſpecies, diſtinguiſhed by their different colours, and the number of hairs in their tail; ſome having two, and others three.

EPHEMERIDES, in literary hiſtory, an appellation given to thoſe books or journals, which ſhew the motions and places of the planets for every day of the year.

It is from the tables contained in theſe ephemerides, that eclipſes, and all the variety of aſpects of the planets, are found. See the articles ECLIPSE, CONJUNCTION, OPPOSITION, &c.

EPHIPPUIM, in anatomy, the ſame with the cella turcica, being a part of the os ſphenoides. See the article SPHENOIDES.

EPHOD, in Jewiſh antiquity, one part of the prieſtly habit; being a kind of girdle which, brought from behind the neck over the two ſhoulders, and hanging down before, was put croſs the ſtomach, then carried round the waiſt, and made uſe of as a girdle to the tunic.

There were two ſorts of ephods, one of plain linen for the prieſts, and the other embroidered for the high prieſt: of this laſt Moſes gives an ample deſcription. It was compoſed of gold, blue, purple, crimſon, and twiſted cotton. Upon part of it, which paſſed over the ſhoulders, were two large precious ſtones, one on each ſhoulder: upon theſe were engraven the name of the twelve tribes, ſix upon each ſtone.

The ephod was peculiar to the prieſthood, and thought eſſential to their character; it being the opinion of the Jews, that no worſhip, true or falſe, could ſubſiſt without a prieſthood and ephod.

EPHORI, ἔφοροι, in Grecian antiquity, magiſtrates eſtabliſhed

eſtabliſhed in ancient Sparta to balance the regal power.

EPIC, or HEROIC POEM, a diſcourſe formed upon a ſtory partly real and partly feigned, repreſenting ſome one glorious and fortunate action, that is diſtinguiſhed by a variety of wonderful, yet probable and pleaſing events, and delivered in verſe by way of narration, in a ſublime and flowing ſtile, to form the manners, and inflame the mind with the love of virtue.

What diſtinguiſhes an epic from a dramatic poem, is, its being a narration that comes immediately from the poet, and is not repreſented as a tragedy by perſons introduced for that purpoſe.

The chief things to be conſidered in an epic poem are, firſt, the fable, that is, the form, and artful repreſentation of the action, which is the matter of the poem; and as the action is more or leſs perfect, ſo is the fable. The action in an epic poem, as well as in tragedy, muſt be one, not all the actions of a perſon's life; becauſe the mind is better ſatisfied with the contemplation of a ſingle object that is eaſily underſtood, than when it is perplexed with a variety, and loſt in confuſion. And on this principal action muſt all the epiſodes or under-actions ſo depend, as to become different, yet uſeful, members of the ſame body, and contribute to its ſupport. It muſt likewiſe be entire, that is, complete in all its parts, or, as Ariſtotle deſcribes it, have a beginning, a middle, and an end. Nothing ſhould go before, be intermixed with, or follow after this main action, but what is related to it; nor ſhould any ſingle ſtep be omitted in that juſt and regular proceſs, which it muſt be ſuppoſed to take from its origin to its conſummation. The epic action ought alſo to be great, that it may ſtrike us with awe, and be ſuitable to the dignity of the princes, heroes, and illuſtrious perſons, who are ſuppoſed to be ſpeaking and acting in the poem. It ſhould likewiſe be intereſting, that it may engage our paſſions and affections; and entire, that the mind may be wholly ſatisfied. As to its duration, it is not circumſcribed within any limited time; but the warmer and more violent the action is, the ſhorter muſt be its continuance. Thus the Iliad, whoſe ſubject is the anger of Achilles, contains only forty-ſeven days; but the Æneid, whoſe hero is of a quite different character, takes up a much longer time.

The manners and ſentiments fall under the ſame rule as thoſe of tragedy: and as to the diction, it ought to be perſpicuous, but at the ſame time figurative, noble, and ſublime. See TRAGEDY.

The moderns ſeem to miſtake that part of the epic and tragedy which contain the wonderful, confounding it with improbable, and uſing the two words promiſcuouſly. If it was really ſo, the wonderful would be always faulty; for that is always ſo which is improbable. The great art is a juſt temperament and mixture of both, to make it natural and probable. Scarce any of the poets but Virgil had the art, by the preparation of incidents, to manage the probability in all the circumſtances of an epic poem. Homer is not altogether ſo ſcrupulous and regular in his contrivances: his machines are leſs juſt, and all his meaſures, to ſave the probability, are leſs exact. Laſtly, the ſovereign perfection of an epic poem, in the opinion of Ariſtotle, conſiſts in the juſt proportion and perfect connection of all the parts. It is not ſufficient that all be grand and magnificent in an epic poem, but all muſt be juſt, uniform, and proportionable, in the different parts that compoſe it.

This is all that can be obſerved moſt eſſential to an epic poem: little need be ſaid about the machinery, which, among the ancient heathens, was the agency of their falſe gods, and of angels and dæmons among us chriſtians: its beauty and magnificence is well known. The dignity of an epic poem would ſcarce be kept up without it, eſpecially ſince the marvellous depends on it. The verſification of epic poetry, among the Greeks and Romans, conſiſted of hexameters, a ſort of verſe ſo peculiar to the epic, that when it is uſed upon other occaſions, it is called heroic verſe. Our Engliſh verſe comes neareſt to it both in gravity and majeſty, but at how great a diſtance? See the article HEXAMETER.

An epic or heroic poem is the beſt and moſt perfect kind of poetry; it is the greateſt work which the ſoul of man is capable of performing; and here it is the utmoſt bounds are ſet to human compoſition. All the nobleneſs and the elevation of the moſt perfect genius can hardly ſuffice to form ſuch a one as is requiſite for an heroic poet: the difficulty of finding together fancy and judgment, heat of imagination and ſobriety of reaſon, precipitation of ſpirit, and ſolidity of mind, renders this character ſo very rare: it requires great images, and yet a greater wit to form them. There muſt be a judgment ſo ſolid, a diſcernment ſo exquiſite, ſuch perfect knowlege of the language in which he writes, ſuch obſtinate ſtudy, profound meditations, and vaſt capacity, that ſcarce whole ages can produce one genius fit for an epic poet: even among the ancients themſelves, if we except Homer and Virgil, we ſhall ſcarce find one that is truly an epic poet.

EPICARPIUM, in ancient pharmacy, denotes a remedy applied in form of a plaſter to the wriſts: it conſiſted of penetrating ingredients, as garlic, onion, camphor, &c.

EPICEDIUM, ἐπικήδιον, in ancient poetry, a poem rehearſed during the funeral ſolemnity of perſons of diſtinction. See the article NENIA.

EPICERASTICA, ἐπικερασικὰ, from κεράννυμι, to mix, or attemperate. Medicines which attemperate or obtund the acrimony of the humours, and mitigate the uneaſy ſenſation of the parts thence ariſing. Among medicines of this kind, are reckoned emollient roots; as thoſe of the marſh-mallow, mallow, and liquorice.

The leaves of mallows, water-lily, the large houſe-leek-purſlane, and lettuce.

The ſeeds of barley decorticated, white henbane, lettuce, flax, white poppy, and rue.

The fruits, jubebs, raiſins, ſweet apples, ſweet prunes, ſebeſtens, ſweet almonds, and pine-nuts.

Among juices and liquors; almond-milk, ſtarch, barley-water, pinguious broths, the milk of the ſow-thiſtle, cremor of ptiſan, and the juices of the leaves of night-ſhade, and winter-cherry.

Among the parts of animals; the whites of eggs, butter, milk of all kinds, whey; the head and the feet of a calf, and alſo a ſheep's head, and broths prepared of them; jellies of hartſhorn and ivory.

Among mucilages; the ſeed of fleawort, quinces, of the ſeed and root of marſh-mallows; of the ſeed of flax, mallows, and of the root of borrage.

Among oils; oil of olives, violets, ſweet almonds, expreſſed oils of the ſeed of gourd, white henbane, and white poppy.

Among ointments; the unguentum roſatum and unguentum album camphoratum.

Among ſyrups; the ſyrups of violets, of apples, of marſh-mallows, of Fernelius, of liquorice, jubebs, poppies, and of purſlane.

Among the various ſhop preparations; the pulp of caſſia, diacodium, diapenidium, ſugar of violets, julap of violets, honey of violets.

EPICHIREMA, ἐπιχείρημα, in logic, a mode of reaſoning, which comprehends the proof of one or both the premiſes of a ſyllogiſm, before the concluſion is drawn.

EPICOENE, in grammar, a term applied to nouns, which, under the ſame gender and termination, mark indifferently the male and female ſpecies.

EPICUREAN PHILOSOPHY, the doctrine or ſyſtem of philoſophy maintained by Epicurus and his followers.

Epicurus, the Athenian, one of the greateſt philoſophers of his age, was obliged to Democritus for almoſt his whole ſyſtem, notwithſtanding he piqued himſelf upon deriving every thing from his own fund. He wrote a great number of books, which are made to amount to above 300. Though none of them are come down to us, no ancient philoſopher's ſyſtem is better known than his, for which we are moſtly indebted to the great Lucretius, Diogenes Laertius, and Tully.

His philoſophy conſiſted of three parts, canonical, phyſical, and etherial. The firſt was about the canons, or rules of judging. The cenſure which Tully paſſes upon him for his deſpiſing logic, will hold true only with regard to the logic of the ſtoics, which he could not approve of, as being too full of nicety and quirk. Epicurus was not

not acquainted with the analytical method of diviſion and argumentation, nor was he ſo curious in modes and formation as the ſtoics. Soundneſs and ſimplicity of ſenſe, aſſiſted with ſome natural reflections, was all his art. His ſearch after truth proceeded only by the ſenſes, to the evidence of which he gave ſo great a certainty, that he conſidered them as an infallible rule of truth, and termed them the firſt natural light of mankind.

In the ſecond part of his philoſophy he laid down atoms, ſpace, and gravity, as the firſt principles of all things: he did not deny the exiſtence of a God, but thought it beneath his majeſty to concern himſelf with human affairs: he held him a bleſſed, immortal being, having no affairs of his own to take care of, and above meddling with thoſe of others. See ATOMICAL PHILOSOPHY.

As to his ethics, he made the ſupreme good of man to conſiſt in pleaſure, and conſequently ſupreme evil in pain. Nature itſelf, ſays he, teaches us this truth, and prompts us from our birth to procure whatever gives us pleaſure, and avoid what gives us pain. To this end he propoſes a remedy againſt the ſharpneſs of pain: this was to divert the mind from it, by turning our whole attention upon the pleaſures we have formerly enjoyed: he held that the wiſe man muſt be happy, as long as he is wiſe; that pain, not depriving him of his wiſdom, cannot deprive him of his happineſs.

There is nothing that has a fairer ſhew of honeſty than the moral doctrine of Epicurus. Gaſſendus pretends, that the pleaſure in which this philoſopher has fixed the ſovereign good, was nothing elſe but the higheſt tranquility of mind in conjunction with the moſt perfect health of body: but Tully, Horace, and Plutarch, as well as almoſt all the fathers of the church, give us a very different repreſentation: indeed the nature of this pleaſure, in which the chief happineſs is ſuppoſed to be ſeated, is a grand problem in the morals of Epicurus. Hence there were two kinds of Epicureans, the rigid and the remiſs: the firſt were thoſe who underſtood Epicurus's notion of pleaſure in the beſt ſenſe, and placed all their happineſs in the pure pleaſures of the mind, reſulting from the practice of virtue. The looſe or remiſs Epicureans, taking the words of that philoſopher in a groſs ſenſe, placed all their happineſs in bodily pleaſures, or debauchery. Thus we have the whole myſtery of this celebrated doctrine. It was innocent in expreſſion, but criminal in thought; it had a beautiful outſide, but it was all corruption within. Theſe looſe philoſophers took up a ſeeming auſterity to diſguiſe their ſecret indulgence, and all their ſchemes of morality were but ſo many veils for their immoral behaviour.

EPICYCLE, in the Ptolemaic aſtronomy, is a little circle whoſe center is in the circumference of a greater; or it is a ſmall orb, which, being fixed in the large orb of a planet, is carried along with it, and yet by its own peculiar motion carries the body of the planet round its proper center. This ancient aſtronomers aſcribed to all the planets, except the ſun, in order to ſolve their phœnomena.

EPICYCLOID, in geometry, is a curve generated by a point taken in the periphery of a circle, that revolves upon the periphery of any other circle, either within or without it.

A point of the circumference of a circle, proceeding along a plane, in a right line, and at the ſame time revolving on its center, deſcribes a cycloid.

And the generating circle, if, inſtead of moving on a right line ſhould, move along the circumference of another circle, whether equal or unequal, the curve deſcribed by any point in its circumference is called an epicycloid.

If the generating circle proceed along the convexity of the periphery, it is called an upper or exterior epicycloid: if along the concavity, a lower or interior epicycloid.

The length of any part of the curve, that any point in the revolving circle has deſcribed from the time it touched the circle it revolved upon, ſhall be to double the verſed ſine of half the arch, which all that time touched the circle at reſt, as the ſum of the diameters of the circles, to the ſemi-diameter of the reſting circle; if the revolving circle move upon the convex ſide of the reſting circle; but if upon the concave ſide, as the difference of the diameters to the ſemi-diameter.

Dr. Halley gives a general propoſition for the meaſuring of all cycloids and epicycloids: thus, The area of a cycloid, or epicycloid, either primary, or contracted, or prolate, is to the area of the generating circle; and alſo the areas of the parts, generated in thoſe curves, to the areas of analogous ſegments of the circle; as the ſum of double the velocity of the center, and velocity of the circular motion, to the velocity of the circular motion. The demonſtration hereof, ſee in the Phil. Tranſact. N°. 218.

EPIDEMIA, ἐπιδήμια, in Grecian antiquity, feſtivals kept in honour of Apollo and Diana, at the ſtated ſeaſons when theſe deities, who could not be preſent every where, were ſuppoſed to viſit different places, in order to receive the vows of their adorers.

The feſtival took its name epidemia, from ἐπὶ, among, and δῆμος, people; on account of the imaginary preſence of thoſe deities among the people.

EPIDEMIA is alſo uſed for the private feaſts, or rejoicings, on account of the ſafe return of a friend from a voyage or journey.

EPIDEMIC, among phyſicians, an epithet of diſeaſes, which, at certain times, are popular; attacking great numbers at or near the ſame time.

EPIDEMIC diſeaſes differ from thoſe called endemic. See the article ENDEMIC.

We muſt remark, ſays the celebrated Boerhaave, that though every particular diſeaſe of the fluids, in various epidemical conſtitutions, appear, to inattentive obſervers, the ſame with regard to their names, ſigns, and their conſequences in ſome meaſure, yet the ſame diſeaſes, appearing in one epidemical conſtitution, differ exceedingly from thoſe produced in another, with reſpect to their obſcure natures; their appearances not obſervable, except by the judicious; the various times of their increaſe, ſtate, coction, criſis, effect, event, and method to be purſued for the cure. Hence it is evident, that they require a different adminiſtration of the non-naturals, different treatment and medicines: this variety, however, in epidemical diſtempers is ſo obſcure, that phyſicians have not yet been able to deduce it from any abuſe of the non-naturals: and yet there are many circumſtances which make it highly probable, that the cauſes reſide in the air, but depend more upon the inexplicable variety of exhalations contained therein, which, by their mixture with the fluids of the body, or their ſtimulus, injure the human machine, than upon any change in the ſenſible qualities thereof. But it is very ſurpriſing, that theſe epidemical diſorders ſhould be principally propagated by contagion, received from one by another perſon unaffected.

Upon the invaſion of any unknown epidemical diſtemper, the phyſician will receive ſome information with reſpect to the cure, firſt, by reducing the diſtemper to ſome more known ſpecies, which it moſt reſembles.

Secondly, by obſerving its tendency at the vernal and autumnal equinoxes, at which ſeaſons it is generally moſt prevalent.

Thirdly, by attending to the ſpontaneous phœnomena which precede, accompany, or follow, the death or recovery of the patient, and the better or worſe ſtate of the diſorder.

Fourthly, by diligently remarking the benefit or injury received, from whatever the patients are unavoidably obliged to do; whatever is taken into, or diſcharged out of the body.

Fifthly, by comparing the caſes of a great many patients labouring under the diſtemper at the ſame time.

Sixthly, by abſtaining from all remedies which are dubious, which exagitate and induce a conſiderable change in the humours, and thereby obſcure the genus of the diſeaſe.

From theſe circumſtances, duly attended to, the curative indication ariſes.

EPIDERMIS, in anatomy, the ſame with the cuticle. See the article CUTICLE.

EPIDIDYMIS, in anatomy, the name by which ſome call the two bodies more uſually known by that of paraſtatæ. See the article PARASTATÆ.

EPIGASTRIC Region, a part or ſubdiviſion of the abdomen. See Abdomen.

Epigastric Veſſels, the arteries and veins belonging to the epigaſtric region; the former being branches of the cœliac artery, and the latter of the iliac veins. See Artery and Vein.

EPIGLOTTIS, in anatomy, one of the cartilages of the larynx, or wind-pipe. It is often of the ſhape of an ivy-leaf, and joined to the thyroide cartilage; over which it appears erect, immediately behind the root of the tongue; to which it is alſo connected by its middle ligament by two lateral ones to the cornua of the os hyoides, and by two poſterior ones to the arytenoide cartilage. In the act of ſwallowing it covers the glottis, or aperture of the larynx, and prevents any thing getting into it. See the articles Larynx and Glottis.

EPIGRAM, in poetry, a ſhort poem, or compoſition in verſe, treating of one thing only, and whoſe diſtinguiſhing characters are brevity, beauty, and point.

The word epigram ſignifies inſcription; for epigrams derive their origin from thoſe inſcriptions placed by the ancients on their ſtatues, temples, pillars, triumphal arches, and the like; which, at firſt, were very ſhort, being ſometimes no more than a ſingle word, but afterwards, increaſing their length, they made them in verſe to be the better retained by the memory. This ſhort way of writing came at laſt to be uſed upon any occaſion or ſubject; and hence the name of epigram has been given to any little copy of verſes, without regard to the original application of ſuch poems.

Its uſual limits are from two to twenty verſes, though ſometimes it extends to fifty; but the ſhorter the better it is, and the more perfect, as it partakes more of the nature and character of this kind of poem: beſides, the epigram, being only a ſingle thought, ought to be expreſſed in a little compaſs, or elſe it loſes its force and ſtrength.

The beauty required in an epigram, is an harmony and apt agreement of all its parts, a ſweet ſimplicity, and polite language.

The point is a ſharp, lively, unexpected turn of wit, with which an epigram ought to be concluded. There are ſome critics, indeed, who will not admit the point in an epigram, but require the thought to be equally diffuſed through the whole poem, which is uſually the practice of Catullus, as the former is that of Martial. It is allowed, there is more delicacy in the manner of Catullus, but the point is more agreeable to the general taſte, and ſeems to be the chief characteriſtic of the epigram.

This ſort of poem admits of all manner of ſubjects, provided that brevity, beauty, and point, are preſerved; but it is generally employed either in praiſe or ſatire.

Though the beſt epigrams are ſaid to be ſuch as are compriſed in two or four verſes, we are not to underſtand it as if none can be perfect which exceed thoſe limits. Neither the antients nor moderns have been ſo ſcrupulous with reſpect to the length of their epigrams; but, however, brevity in general is always to be ſtudied in theſe compoſitions.

EPILEPSY, επιλημψια, in medicine, the ſame with what is called the falling-ſickneſs, from the patient's falling ſuddenly to the ground.

Sometimes this diſeaſe comes upon the patient unawares; but it more frequently gives notice of its approach, by a laſſitude of the whole body, a heavy pain in the head, with ſome diſturbance of the ſenſes, unquiet ſleep, unuſual dread, dimneſs of ſight, and a noiſe in the ears: in ſome there is a violent palpitation of the heart, a puffing or inflation of the breaſt, difficult reſpiration, a murmuring noiſe in the belly, fœtid ſtools, a flux of the urine, and a refrigeration of the joints: in others, there is a ſenſation as it were of cold air, aſcending from the extreme parts towards the brain and heart. At length, falling ſenſeleſs to the ground, the thumbs are ſhut up cloſe in the palms of the hands, and are with difficulty taken out; the eyes are diſtorted or inverted, ſo as nothing but the whites appear: all ſenſation is ſuſpended, inſomuch that no ſmell, no noiſe, nor even pinching of the body is able to bring them to themſelves: they froth at the mouth with a hiſſing kind of noiſe; the tongue is lacerated, or torn by the teeth, and there is a ſhaking or trembling of the joints. However, in different patients the ſymptoms vary; for ſometimes, inſtead of convulſive motions, the limbs are all ſtiff, and the patient is as immoveable as a ſtatue: in infants the penis is erected; and in young men, there is an emiſſion of the ſemen, and the urine ſometimes ſtreams out to a great diſtance. At laſt there is a remiſſion of the ſymptoms, and the patients come to themſelves after a longer or ſhorter interval; then they complain of a pain and heavineſs of the head, and a laſſitude of all their joints.

Theſe fits uſually return on certain days, or age of the moon, but eſpecially about the new or full moon; in women, chiefly about the time of menſtruation, and as to the prognoſtics they generally leave the patient about the time of puberty.

As to the cure, in adults, or grown perſons, it is extremely difficult; but in children, it is juſt the reverſe. Blifters laid on the back part of the head are of great uſe a little before the fit is expected; which may the more certainly be foreknown, as this diſeaſe is influenced by the moon. The moſt proper medicines to correct the juices ſeem to be native cinnabar, and wild valerian root; a dram of which may be taken morning and evening for three or four months, and afterwards two or three days before the new and full moon. Or, two ſcruples of the powder of wild valerian root, mixed with one of that of native cinnabar, may be taken morning and evening. Ambergriſe and muſk are alſo accounted excellent.

It muſt not however be forgot, that this diſeaſe owes its origin to ſo many different cauſes, and is bred in ſo many different conſtitutions of the body, that the ſame remedy which ſucceeds in one caſe, often fails in another; and, therefore, different medicines are to be tried, eſpecially in adults. In caſe of a plethora, bleeding in the ancles will be proper. If the humours be in fault, cathartics, iſſues, cauteries, and blifters muſt be uſed. If in children it proceeds from gripes, or the breeding of teeth, nothing is better than to cleanſe the belly by milk clyſters, with a little venice-ſoap diſſolved in them. Some epileptic powder with cinnabar, or extract of rhubarb, and made into an electuary with ſyrup of roſes and manna, may likewiſe be given in proper doſes.

During the fit, too free an uſe of volatiles, ſpirituous liquors, and ſtrong ſmells, are hurtful, as cauſing the humours to flow too much to the head. The beſt method is to place the patient in an erect poſture, and to rub the hands and feet pretty briſkly; and the beſt drink is pure water, which will mitigate, if not cure, the ſymptoms.

When the diſeaſe is cauſed by external violence, or extravaſations of humours in the head, cinnabar reduced into an impalpable powder, and given in large doſes with other cephalics and diaphoretics, has a kind of ſpecific virtue.

According to Dr. Cheyne, a milk-diet will cure the moſt inveterate epilepſy. Miſletoe is alſo ſaid to cure it, as ſure as the bark does an intermitting fever: its doſe, to grown people, is half a dram or more, in powder, to be taken every ſixth hour, drinking after it a draught of a ſtrong infuſion of the ſame plant; and if to every ounce of the powder, a dram of aſa-fœtida be added, the medicine will be ſtill more effectual. Cinnabar of antimony is alſo greatly celebrated for the cure of this diſeaſe, and may be taken from four grains to a ſcruple, in conſerve of roſemary-flowers. If the diſeaſe is inveterate, ſome adviſe to give the following pills for a month, viz. Take caſtor and gum ammoniac, of each eight grains; wild valerian-root, half a ſcruple; ſalt of tartar, ſeven grains; and as much of tincture of caſtor as is ſufficient to form them into pills, one of which makes a doſe. On every ſeventh day, a cathartic ſhould be given; and ſometimes, inſtead of the caſtor and gum, filings of ſteel may be ſubſtituted.

A decoction of guaiacum, or ſaſſafras, taken twice a day, ſix or eight ounces at a time, and continued for thirty or forty days, is alſo ſaid to cure the epilepſy; eſpecially if male piony-root, or the like, be added.

The following electuary is alſo recommended as a moſt excellent and certain anti-epileptic: Take of Peruvian bark, pulveriſed, ſix drams; of Virginia ſnake-root, likewiſe

wiſe pulveriſed, two drams; and of the ſyrup of piony-flowers, as much as is ſufficient to make a ſoft electuary. The doſe, after proper evacuations, in adults, is a dram; which ſhould be taken morning and evening for three or four months; and afterwards only repeated three or four days before the new and full moon.

EPILOBIUM, in botany, the willow-herb, a genus of plants, the corolla whereof conſiſts of four roundiſh patent petals, ſomewhat emarginated: the fruit is a very long capſule of a cylindraceous form, ſtriated, made up of four valves, and containing four cells: the ſeeds are numerous, oblong, and crowned with down.

EPILOGUE, in oratory, the end or concluſion of a diſcourſe, ordinarily containing a recapitulation of the principal matters delivered. See PERORATION.

EPILOGUE, in dramatic poetry, a ſpeech addreſſed to the audience after the play is over, by one of the principal actors therein, uſually containing ſome reflections on certain incidents in the play, eſpecially thoſe in the part of the perſon that ſpeaks it.

The epilogue is but of modern date, much later than the prologue: ſeveral have taken the exodium of the Greek drama for an epilogue; but it appears that they are very different; as the exodium was the laſt of the four parts of the tragedy, containing the unravelling the plot, anſwering to the laſt act of modern tragedy.

In the modern tragedy the epilogue has uſually ſomewhat of pleaſantry, intended, in all probability, to compoſe the paſſions raiſed in the courſe of the repreſentation. This is ridiculed by the Spectator, and compared to a merry jigg upon the organ, after a good ſermon, to wipe away any impreſſions that might have been made thereby, and ſend the people away juſt as they came. This practice, however, has the countenance of antiquity, for the Romans had ſomething of the ſame nature, though under a different name; but their exodium was a kind of farce or pantomime, brought on the ſtage when the tragedy was over, to compoſe the minds of the audience.

EPIMEDIUM, barren wort, in botany, a genus of plants, whoſe characters are as follow.

The leaves are like thoſe of ivy, and grow three on the top of each branch: the ſtalk is divided into three branches at each joint, and the triple diviſion is continued in the ſubdiviſions: the calyx is compoſed of four leaves: the flower conſiſts of four petals, which are tubulated and hollowed into blind canals, and furniſhed with four ſtamina: the ovary is ſeated in the bottom of the calyx, and is furniſhed with an erect tube or pointal, which becomes an unicapſular bivalve pod, containing round flat ſeeds.

EPINICION, in the Greek and Latin poetry, denotes a poem or compoſition on occaſion of a victory obtained. It alſo ſignifies a rejoicing, or feſtival, on account of a victory.

EPIPHANY, a Chriſtian feſtival, otherwiſe called the Manifeſtation of Chriſt to the Gentiles, obſerved on the ſixth of January, in honour of the appearance of our Saviour to the three magi, or wiſe men, who came to adore him and bring him preſents. The feaſt of Epiphany was not originally a diſtinct feſtival, but made a part of that of the nativity of Chriſt, which being celebrated twelve days, the firſt and laſt of which were high or chief days of ſolemnity, either of theſe might properly be called epiphany, as that word ſignifies the appearance of Chriſt in the world.

The kings of England and Spain offer gold, frankincenſe, and myrrh, on epiphany, or twelfth day, in memory of the offerings of the wiſe men to the infant Jeſus.

The feſtival of epiphany is called by the Greeks the feaſt of lights, becauſe our Saviour is ſaid to have been baptized on this day; and baptiſm is by them called illumination.

EPIPHONEMA, in rhetoric, a ſententious exclamation, containing a lively remark placed at the end of a diſcourſe or narration; ſuch is that of Virgil.

Fas omne abrumpit, Polydorum obtruncat, & auro
Vi potitur. Quid non mortalia pectora cogis
Auri ſacra fames?

And that of Lucretius, lib. i.

Tantum relligio potuit ſuadere malorum!

This figure cloſes a narration in a very advantageous manner, deeply impreſſes the thing related upon the memory of the reader, and leaves him well pleaſed with the ſenſe and ſagacity of his author.

EPIPHORA, in medicine, a preternatural defluxion of the eyes, when they continually diſcharge a ſharp ſerous humour, which excoriates the cheeks. The cure is performed by a derivation of the offending humour elſewhere, by bleeding, cupping, bliſters, purges, &c. The acrimony is likewiſe to be corrected by bitter chalybeate wine: ſometimes wine drank alone will perform the cure; after which, aſtringent topics are to be made uſe of. See the article RHEUM.

If an epiphora has been of long ſtanding, it is difficult to be cured, and often degenerates into a fiſtula lachrymalis. See the article FISTULA LACHRYMALIS.

EPIPHYLLOSPHERMOUS PLANTS, the ſame with capillary ones. See CAPILLARY.

EPIPHYSIS, in anatomy, a bony ſubſtance, or as it were a leſſer bone affixed to a larger or principal bone, by the intervention of a cartilage. In young people theſe epiphyſes are not continuous to the principal bone, but are only connected by the intermediate cartilage, and hence they are called appendages to the bones. It is to be obſerved of epiphyſes, 1. That they are all cartilaginous in infants; and though they afterwards grow hard, yet they never arrive at the true denſity of a bone. 2. That moſt of them degenerate into apophyſes in adults. 3. That they do not grow along the plain ſurface of the bone, but unequally, or by a mutual ingreſs with the body of it.

The uſe of the epiphyſes is very different in adults and in infants: in adults they ſeem to ſerve the bones which contain large quantities of marrow, by way of operculum, that this ſoft matter may not run out. 2. They are of ſervice to the articulators, rendering the motions more eaſy, as well as more determinate. 3. They make the whole bone lighter than it would be, if their place were ſupplied by abſolute bony matter. 4. They increaſe the power of the muſcles about the tendons, by means of their prominences. 5. They add to the ſize of the places deſtined for receiving the inſertions of the muſcles. 6. They give a firmer coheſion to the ligaments which ſerve in the articulations, and allow an entrance to the blood-veſſels. The uſes of the epiphyſes in infants are, 1. That by means of their yielding ſoftneſs, they may give way to the compreſſion in the uterus, and ſuffer the whole bulk to be more folded together than otherwiſe it could, ſo that it may lie in a ſmaller compaſs. 2. That they may give way to the elongation and growth of the bones. 3. That they may prevent the frequent fractures, which would otherwiſe unqueſtionably happen to children from their falls, and the other accidents they are liable to.

EPIPLOCELE, in medicine, is a kind of hernia, or rupture, in which the omentum ſubſides into the ſcrotum. The cure conſiſts principally in a reduction of the tumour, by returning the omentum again into the abdomen, and in ſecuring the parts from a relapſe by a truſs or bandage. See HERNIA and ENTEROCELE.

EPIPLOIS, in anatomy, a term applied to the arteries and veins diſtributed through the ſubſtance of the epiploon or caul: thus, the dextera epiplois is a branch of the right ſide of the cæliac artery, and the ſiniſtra epiplois and gaſtro-epiplois are terms by which anatomiſts call branches from the left ſide of the cæliac artery. See the articles CÆLIAC and ARTERY.

EPIPLOOMPHALON, *επιπλοομφαλον*, in medicine, an hernia umbilicalis, proceeding from the omentum falling into the region of the umbilicus or navel. See the article EXOMPHALUS.

EPIPLOON, the ſame with what is otherwiſe called omentum. See OMENTUM.

EPIPLOSARCOMPHALUS, in ſurgery, a kind of exomphalus. See the article EXOMPHALUS.

EPISCOPACY, the quality of epiſcopal government, or that form of church diſcipline, wherein dioceſan biſhops are eſtabliſhed diſtinct from and ſuperior to prieſts or preſbyters. See BISHOP.

EPISCOPAL, ſomething belonging to biſhops. See the articles BISHOP and EPISCOPACY.

EPISCOPALIANS, in church-hiſtory, an appellation given

given to those who prefer the episcopal government and discipline to all others.

EPISODE, ἐπεισόδιον, in poetry, a separate incident, story, or action, which a poet invents, and connects with his principal action, that his work may abound with a greater diversity of events: though, in a more limited sense, all the particular incidents whereof the action or narration is compounded, are called episodes. See the articles EPIC and TRAGEDY.

The episode, in its original, was only something rehearsed between the parts of the chorus, or antient tragedy, for the diversion of the audience. Episodes serve to promote the action, to illustrate, embellish, and adorn it, and carry it to its proper period. Episodes are either absolutely necessary, or very requisite. All episodes are incidents, though all incidents are not episodes; because some incidents are not adventitious to the action, but make up the very form and series of it. Examples will clear up this distinction: the storm in the first Æneid of Virgil, driving the fleet on the coast of Carthage, is an incident, not an episode, because the hero himself and the whole body of his forces are concerned in it; and so it is a direct and not a collateral part of the main action. The adventures of Nisus and Euryalus, in the ninth Æneid, are episodes, not incidents, i. e. not direct parts of the main action.

It is particularly by the art of episodes that the great variety of matter which adorns a poem is brought into the principal action: but though the episodes are a kind of digression from the subject, yet they ought to have a natural relation to the principal action, never be farfetched, and must be handled with judgment, to avoid confusion and burdening the subject with too much action. Without this restriction the episode is no longer probable, and there appears an air of affectation which becomes ridiculous. Aristotle calls all those fables episodic, which abound in episodes not necessarily nor properly connected with each other.

The most natural episodes are the propereſt to circumstantiate the principal actions, namely, the causes, the effects, the beginnings, and the consequences of it. Homer and Virgil have shewn their principal art in this particular: the action of the Iliad and that of the Æneid were in themselves exceeding short, but are so beautifully lengthened and diversified by the intervention of episodes, that they make up an agreeable story, sufficient to employ the memory without overcharging it. See the article EPIC.

Our noble poet Milton has excelled in this art; he has no other episodes than what naturally arise from the subject, and yet his poem of Paradise Lost is filled with a multitude of astonishing incidents. Those great actions, the battle of the angels, and the creation of the world, are by way of episode to this noble poem. With the like art, and in the same manner, in that part of it which regards the fall of man, he has related the fall of those angels who are his professed enemies; besides the many other beauties of such an episode, its running parallel with the great action of the poem, hinders it from breaking unity so much as another episode would have done, that had not so great an affinity with the principal subject.

EPISPASTIC, in medicine, a topical remedy, which being applied to the external parts of the body, attracts the humours to that part. See VESICATORY.

EPISTLE, ἐπιστολὴ, denotes the same with a missive letter; but is now chiefly used in speaking of antient writings, as the epistles of St. Paul, epistles of Cicero, epistles of Pliny, &c. See the article LETTER.

EPISTOLARY, something belonging to an epistle. The art of epistolary writing is acknowledged to be very entertaining and instructive. The Romans ranked it in the number of liberal and polite accomplishments. And, indeed, it enters so much into all the occasions of life, that no gentleman can avoid shewing himself in this kind of composition; the chief excellence of which consists in expressing ordinary occurrences, in an elegant and uncommon manner. However, it is proper to observe, that such is the nature of epistolary writings, in general, as unavoidably renders them obscure, since the writer passes by many things, as being well known to him to whom the letter is addressed, which must be laid open to a stranger, before he can fully comprehend what is said. Hence it is, that the epistles of the antients, whether sacred or prophane, are so difficult to be understood.

EPISTROPHE, in rhetoric, a figure, wherein that which is supposed of one thing, is strongly affirmed of another: thus, "Are they Hebrews? so am I. Are "they Israelites? so am I. Are they of the seed of "Abraham? so am I," &c.

EPISTYLE, in the antient architecture, a term used by the Greeks for what we call architrave, viz. a massive piece of stone or wood, laid immediately over the capital of a column. See ARCHITRAVE and COLUMN.

EPITAPH, a monumental inscription, which generally contains some elogium of the virtues and good qualities of the deceased, and has a turn of seriousness and gravity adapted to the nature of the subject. The elegance of epitaphs consists in a nervous and expressive brevity; and sometimes are closed with an epigrammatic point. In these compositions, no mere epithet, properly so called, should be admitted; for here illustration would impair the strength, and render the sentiment too diffuse and languid. Words that are synonimous are also to be rejected.

Though the true characteristic of the epitaph is seriousness and gravity, yet we find many that are jocose and ludicrous; some likewise have true metre and rhyme, while others are between prose and verse, without any certain measure, though the words are truly poetical, and the beauty of this last sort is generally heightened by an apt and judicious antithesis.

EPITASIS, in antient poetry, the second part or division of a dramatic poem, wherein the plot, entered upon in the first part, or protasis, was carried on, heightened and worked up till it arrived at its state or height, called catastasis. See PROTASIS, CATASTASIS, DRAMA, &c.

In the epitasis, accidents, as they are called by the moderns, arise; all things are in confusion, and involved in doubts and difficulties. Vossius says, the epitasis is contained in the second, sometimes in the third and fourth, but very rarely any part of it in the fifth act: but Dr. Trapp says, that there is no act to which the epitasis is not suitable; nay, that some of it ought always to be in the fifth act.

It is the epitasis that supports the weight and burden of the poem; upon it the crisis of the action chiefly turns. This division of tragedy is laid aside in the modern drama, instead of which plays are divided into acts. See the article ACT.

EPITASIS, in medicine, the increase of a disease, or beginning of a paroxysm, particularly in a fever. See FEVER.

EPITHALAMIUM, in poetry, a nuptial song, or composition, in praise of the bride and bridegroom, praying for their prosperity, for a happy offspring, &c.

EPITHEM, in pharmacy, a kind of fomentation, or remedy of a spirituous aromatic kind, applied externally to the regions of the heart, liver, &c. to strengthen and comfort the same, or to correct some intemperature thereof. See the article FOMENTATION.

There are principally three kinds of these external applications, the liquid, the solid, and the soft or poultice-kind. The liquid epithems are sometimes considerably thick; but when they are intended to penetrate deep, they are much better if very thin and fluid. As to the part to which the epithem is immediately applied, it is not what it is always intended to act upon, as this frequently lies deep within: the epithems, therefore, intended for this purpose, should consist of the most penetrating ingredients, for which reason astringents and inspissating remedies can be of no use; but in this form hot wine alone is sometimes used as an epithem, and often such medicines as are not to be safely taken inwardly, such as highly rectified spirits, preparations of lead, henbane, mandrake, and other poisonous plants, and the like: but we are carefully to remember in regard to these, that the pores are capable of absorbing them, and ought therefore to know the effects they are

capable of producing, when thus abſorbed in the body. As to the vehicle of the liquid epithems, they are various, as linen or woollen cloths, ſilk, ſtripes, toaſted bread, &c. They are in ſome caſes to be applied hot, in others, cold; when the intention is to reſolve, penetrate, and attract, then the hot are to be preferred; but theſe are injurious to parts conſtricted by intenſe cold.

The dry epithems are medicated powders, uſually ſewed up in a cloth, and applied to different parts of the body; for which purpoſe the powders muſt be coarſe. Sometimes the liquid epithems are added to the dry, to reduce the whole to a conſiſtence, ſuch as may be ſpread upon cloth, and applied.

EPITHET, in poetry and rhetoric, an adjective expreſſing ſome quality of a ſubſtantive to which it is joined; or ſuch an adjective as is annexed to ſubſtantives by way of ornament and illuſtration, not to make up an eſſential part of the deſcription. Nothing, ſays Ariſtotle, tires the reader more than too great a redundancy of epithets, or epithets placed improperly; and yet nothing is ſo eſſential in poetry as a proper uſe of them. The writings of the beſt poets are full of them, eſpecially Virgil.

EPITOME, in literary hiſtory, an abridgement or ſummary of any book, particularly of a hiſtory. See ABRIDGEMENT.

EPITRITUS, in proſody, a foot conſiſting of three long ſyllables and one ſhort. Of theſe, grammarians reckon four kinds; the firſt conſiſting of an iambus and ſpondee, as *sălūtāntēs*: the ſecond of a trocheus and ſpondee, as *cōncĭtāti*: the third, of a ſpondee and an iambus, as *cōmmūnĭcāns*: and the fourth, of a ſpondee and trocheus, as *incāntārĕ*. See the articles SPONDEUS, TROCHEUS, &c.

EPITROPE, in rhetoric, a Greek term for the ſame figure which the Latins call *conceſſio*. See the article CONCESSION.

EPIZEUXIS, in rhetoric, a figure which repeats the ſame word, without any other intervening: ſuch is that of Virgil; *nunc, nunc, inſurgite remis.*

EPOCHA, in chronology, a term or fixed point of time, whence the ſucceeding years are numbered or accounted. See the article ÆRA.

The moſt remarkable epochas are thoſe that follow.

EPOCHA *of the creation of the world.* See the article CHRONOLOGY.

EPOCHA *of the deluge.* According to the Hebrew text, there are 1656 years from the creation to the deluge; 1307, according to the Samaritan; 2242, according to Euſebius and the Septuagint; 2256, according to Joſephus and the Septuagint; 2262, according to Julius Africanus, Petavius, and the Septuagint; and 2255, according to Jackſon. In following the Hebrew text, this epocha begins in the year 2366 of the Julian period.

EPOCHA *of the Olympiads*, uſed principally by the Greeks, had its origin from the Olympic games, which were celebrated at the beginning of every fifth year. This epocha begins 776 years before the incarnation, or in the 3938 of the Julian period.

Varronian EPOCHA *of the building of Rome*, is fixed 753 years before our Saviour's birth, and in the 3961 of the Julian period.

EPOCHA *of Nabonaſſar king of Babylon*, made uſe of by Ptolemy, Cenſorinus, and ſeveral other authors, began 747 years before the incarnation, and in the 3967 of the Julian period.

Julian EPOCHA. The firſt year of Julius Cæſar's correcting the calendar ſtands 45 years before our Saviour's birth, and coincides with the 4669 of the Julian period.

EPOCHA *of Chriſt.* The chriſtian world generally reckoned from the epocha of the creation, the building of Rome, the conſuls regiſter, or the emperor's reign, till about 500 years after Chriſt, when the epocha of the nativity of our bleſſed Lord was introduced by Dionyſius Exiguus. He began his account from the conception or incarnation, properly called Lady-day. Moſt countries in Europe, however, at preſent reckon from the firſt of January next following, except the court of Rome, where the epocha of the incarnation ſtill obtains for the date of their bulls and briefs. But here we are to obſerve, that there are different opinions touching the year of our Saviour's birth. Capellus and Kepler fix it at about the 748th year from the building of Rome. Deckar and Petavius place the incarnation in the 749th of Rome. Scaliger and Voſſius make it fall on the 751ſt of Rome. Dionyſius Exiguus, Bede, &c. fix the birth of our Saviour to the year 751 of Rome; the diverſity of theſe opinions proceeding from the difficulty of fixing Herod the Great's death, who, as is evident from the Evangeliſts, was living at our Saviour's birth, the taxation of Cyrenius, and the time of our Saviour's beginning his miniſtry. But let this be as it will, it is generally agreed, that as to computation and uſe, the common epocha is to be followed, which places the birth of Chriſt in the 4713 of the Julian period, although the true birth rather correſponds with the 4711th of the ſame period.

Dioclefian EPOCHA, or EPOCHA *of martyrs*, called alſo the æra of the Copthi or Egyptians, becauſe the emperor Diocleſian made a great many martyrs in Egypt, begins in the year 283 of our Lord, and the 4997 of the Julian period.

EPOCHA *of the hegira*, or flight of Mahomet, uſed among the Turks, is the year of the Julian period 5335, anſwering to the year of Chriſt 622.

Yezdejerd, or *Perſian* EPOCHA, is the year of the Julian period 5345, anſwering to the year 622.

To reduce the years of one epocha to thoſe of another, obſerve the following rule: add the given year of an epocha to the year of the Julian period correſponding with its riſe, and that will give the year of the period.

EPODE, in lyric poetry, the third or laſt part of the ode, the ancient ode being divided into ſtrophe, antiſtrophe, and epode. See ODE, &c.

The epode was ſung by the prieſts, ſtanding ſtill before the altar, after all the turns and returns of the ſtrophe and antiſtrophe, and was not confined to any preciſe number or kind of verſes.

The epode is now a general name for all kinds of little verſes that follow one or more great ones, of what kind ſoever they be; and in this ſenſe a pentameter is an epode after an hexameter. And as every little verſe, which being put after another, cloſes the period, is called epode; hence the ſixth book of Horace's odes is entitled, *Liber Epodon*, Book of Epodes, becauſe the verſes are all alternately long and ſhort, and the ſhort ones generally, though not always, cloſe the ſenſe of the long one.

EPOMIS, in anatomy, a muſcle, otherwiſe called deltoides. See DELTOIDES.

EPOPOEIA, in poetry, the ſtory, fable, or ſubject treated of in an epic poem. See FABLE.

The word is commonly uſed for the epic poem itſelf. See EPIC POEM.

EPULONES, in Roman antiquity, miniſters who aſſiſted at the ſacrifices, and had the care of the ſacred banquet committed to them.

EQUABLE, an appellation given to ſuch motions as always continue the ſame in degree of velocity, without being either accelerated or retarded.

EQUAL, a term of relation between two or more things of the ſame magnitude, quantity, or quality.

EQUALITY, that agreement between two or more things, whereby they are denominated equal.

The equality of two quantities, in algebra, is denoted by two parallel lines placed between them: thus, $4+2=6$, that is, 4 added to 2, is equal to 6.

EQUANIMITY, in ethics, denotes that even and calm frame of mind and temper, under good or bad fortune, whereby a man appears to be neither puffed up, or overjoyed with proſperity; nor diſpirited, ſoured, or rendered uneaſy by adverſity.

EQUANT, ÆQUANT, or *Circle of* EQUALITY, in aſtronomy, is a circle uſed in the Ptolemaic ſyſtem to account for the eccentricity of the planets, &c.

EQUATION, or ÆQUATION, in algebra, an expreſſion of the ſame quantity, in two different, that is, diſſimilar, but equal terms or denominations.

As, when we ſay $2\times3=4+2$, that is, twice three is equal to four and two.

Stifelius defines equation to be the ratio of equality between two quantities differently denominated; as when

we

we ſay, 3 ſhill. = 36 pence. Or, 50 ſhill. = 2 *l.* 10 *s.* 50 ſhill. = 600 pence = 2400 farths. Or, $b = d + e$. Or, $12 = \frac{40-4}{3}$, &c.

Hence, the reduction of two heterogeneous, or diſſimilar quantities to the ſame value, i. e. to an equality, is called the bringing them to an equation.

The character or ſign of an equation is =.

The reſolution of problems by means of equations, is the buſineſs of algebra.

Terms of an EQUATION are the ſeveral quantities, or parts, of which an equation is compoſed, connected together by the ſigns + and —. Thus, in the equation $b + c = d$; the terms are b, c, and d, and the tenor or import of the equation is, that ſome quantity, repreſented by d, is equal to two others repreſented by b and c.

Root of an EQUATION is the value of the unknown quantity in the equation. Thus if $a^2 + b^2 = x^2$, the root x will be $\sqrt{a^2 + b^2}$. See ROOTS *of Equations*.

Simple EQUATION is that wherein the unknown quantity is only of one dimenſion, or in the firſt power, as $x = a + b$.

Quadratic EQUATION is that wherein the unknown quantity is of two dimenſions, or in the ſecond power, as $x^2 = a^2 + b^2$. See QUADRATIC *Equation*.

Cubic EQUATION is that wherein the unknown quantity is of three dimenſions, as $x^3 = a^3 - b^3$, &c. See CUBIC *Equation*.

If the unknown quantity be of four dimenſions, as $x^4 = a^4 - b^4$, the equation is called biquadratic; if of 5, a ſurſolid, &c.

In order to bring problems to an equation, the algebraiſt muſt ſubſtitute ſome letter of the alphabet for the unknown quantity; and if there be more unknown quantities than one, the reſt muſt receive their names from ſo many conditions of the problem; and if the problem be juſtly ſtated and examined, there will ſtill remain a condition at laſt, which, being tranſlated into the algebraic language, will afford him an equation, the reſolution whereof will give the unknown quantity for which the tranſlation was made; and when this unknown quantity is once diſcovered, the reſt will be eaſily found. To illuſtrate this by an inſtance: ſuppoſe it required to find three numbers, in continual proportion, whoſe ſum is 20, and the ſum of their ſquares 140. Putting x, y, z, for the names of the three numbers ſought, the queſtion will be tranſlated out of the verbal to the ſymbolical expreſſion, thus:

The queſtion in words.	In ſymbols.
Required three numbers, on theſe conditions.	x. y. z.
That they be continually proportional.	$x : y :: y : z$, or $xz = yy$.
That the ſum be 20.	$x + y + z = 20$.
And the ſum of their ſquares 140.	$x^2 + y^2 + z^2 = 140$.

Thus is the queſtion brought to theſe equations, viz. $xz = yy$, $x + z + y = 20$, and $x^2 + y^2 + z^2 = 140$; by the help whereof x, y, and z, may be found.

The ſolutions of queſtions are, for the moſt part, ſo much the more expedite and artificial, by how much the unknown quantities you have at firſt are the fewer. Thus, in the queſtion propoſed, putting x for the firſt number, and y for the ſecond, $\frac{yy}{x}$ will be the third continual proportional; which being put for the third number, bring the queſtion into equations, as follows:

The queſtion in words.	Symbolically.
There are ſought three numbers in continual proportion.	x, y, $\frac{yy}{x}$
Whoſe ſum is 20.	$x + y + \frac{yy}{x} = 20$
And the ſum of their ſquares 140.	$x^2 + y^2 + \frac{y^4}{x^2} = 140$.

You have therefore the equations $x + y + \frac{yy}{x} = 20$, and $x^2 + y^2 + \frac{y^4}{x^2} = 140$; by reduction whereof x and y are to be determined.

Take another example: A merchant increaſes his eſtate annually by one third part, abating 100 l. which he ſpends yearly in his family; and after three years he finds his eſtate doubled. Query, What is he worth? — To reſolve this, it muſt be obſerved, that there are (or lie hid) ſeveral propoſitions, which are all thus found out and laid open.

In words.	Algebraically.
A merchant has an eſtate	x
Out of which the firſt year he ſpends 100 l.	$x - 100$
And augments the reſt by one third.	$x - 100 + \frac{x-100}{3}$, or $\frac{4x-400}{3}$
And the ſecond year he ſpends 100 l.	$\frac{4x-400}{3} - 100$, or $\frac{4x-700}{3}$
And augments the reſt by one third.	$\frac{4x-700}{3} + \frac{4x-700}{9}$, or $\frac{16x-2800}{9}$
And ſo the third year he ſpends 100 l.	$\frac{16x-2800}{9} - 100$, or $\frac{16x-3700}{9}$
And by the reſt gains likewiſe one third.	$\frac{16x-3700}{9} + \frac{16x-3700}{27}$ or $\frac{64x-14800}{27}$
And he becomes at length twice as rich as at firſt.	$\frac{64x-14800}{27} = 2x$.

Therefore the queſtion is brought to this equation, $\frac{64x-14800}{27} = 2x$, by reduction whereof you will find the value of x, viz. Multiply it into 27, and you have $64x - 14800 = 54x$; ſubtract $54x$, and there remains $10x - 14800 = 0$, or $10x = 14800$; and dividing by 10, you have $x = 1480$. So that the value of his eſtate at firſt was 1480 *l.*

It appears then, that to the ſolution of queſtions about numbers, or the relations of abſtract quantities, there is ſcarce any thing more required, but to tranſlate them out of the common into the algebraic language; i. e. into characters proper to expreſs our ideas of the relation of quantities. Indeed, it may ſometimes happen, that the language wherein the queſtion is ſtated, may ſeem unfit to be rendered into the algebraical; though by making a few alterations therein, and attending to the ſenſe, rather than the ſound of the words, the tranſlation becomes eaſy enough. The difficulty here reſults merely from the difference of idioms, which is as obſervable between moſt languages as between the common and ſymbolical. However, to render the ſolution of ſuch problems a little more eaſy and familiar, we ſhall add an example or two thereof.

1°. Given the ſum of two numbers a, and the difference of their ſquares b; to find the numbers themſelves: Suppoſe the leſſer x; the other will be $a - x$; and their ſquares x^2 and $a^2 - 2ax + x^2$; whoſe difference $a^2 - 2ax$ is called b; conſequently $a^2 - 2ax = b$: whence, by reduction, $aa - b = 2ax$; or $\frac{aa-b}{2a}$ $(= \frac{1}{2}a - \frac{b}{2a}) = x$.

E. gr. Suppoſe the ſum of the numbers, or a, to be 8, and the difference of their ſquares, or b, 16; then will $\frac{1}{2}a - \frac{b}{2a}$ $(= 4 - 1) = 3 = x$; and $a - x = 5$: therefore the numbers are 3 and 5.

2°. To find three quantities, x, y, and z, the ſum of each pair whereof is given: Suppoſe the ſum of the pair x and y be a; that of x and z, b; and that of y and z, c. To determine the three numbers required, x, y, and z; we have three equations, $x + y = a$, $x + z = b$, and $y + z = c$: now, to exterminate two of the unknown quantities, e. gr. y and x, take away x, both from the firſt and ſecond equations, and we ſhall have $y = a - x$, and $z = b - x$: which values being ſubſtituted for y and z in the third equation, there will ariſe $a - x + b - x = c$; and by reduction $x = \frac{a+b-c}{2}$. Having found x, the former equations, $y = a - x$, and $z = b - x$, will give y and z.

Thus, e. gr. If the ſum of the pair x and y be 9; of x and z, 10; and of y and z, 13; then, in the value x, y, and z, write 9 for a, 10 for b, and 13 for c; and you will have $a + b - c = 6$; and conſequently x $(= \frac{a+b-c}{2})$ $= 3$, y $(= a - x) = 6$, z $(= b - x) = 7$.

3°. The power or ſtrength of one agent being given; to determine how many ſuch agents will produce a given effect

effect a, in a given time b. Suppose the power of the agent such, as that it may produce the effect c in the time d; then, as the time d is to the time b, so is the effect c, which the agent can produce in the time d, to the effect it can produce in the time b, which accordingly will be $\frac{bc}{d}$. Then, as the effect of one agent $\frac{bc}{d}$ is to the joint effect of them all, a, so is that one agent to all the agents: consequently the number of agents will be $\frac{ad}{bc}$.

Thus, e. gr. If a clerk, or writer, in eight days time, transcribe 13 sheets; how many such clerks are required to transcribe 405 sheets in 9 days? Answer 24. For if 8 be substituted for d, 15 for c, 405 for a, and 9 for b, the number $\frac{ad}{bc}$ will become $\frac{405\times 8}{9\times 15}$; that is, $\frac{3240}{135}$, or 24.

4°. The power of several agents being given, to determine the time x, wherein they will jointly perform a given effect. Suppose the power of the agents A, B, C, such as that in the times e, f, g, they would produce the effects a, b, c, respectively; and these, in the time x, would produce effects $\frac{ax}{e}, \frac{bx}{f}, \frac{cx}{g}$: consequently $\frac{ax}{e}+\frac{bx}{f}+\frac{cx}{g}=d$, and by reduction x is equal to $\frac{d}{\frac{a}{e}+\frac{b}{f}+\frac{c}{g}}$.

Suppose, e. gr. that three workmen could finish a certain work in such and such times, viz. A once in three weeks, B thrice in eight weeks, and C five times in twelve weeks; and it is required in what time they will finish it together: here the powers of the agents A, B, C, are such as in the times 3, 8, and 12, respectively produce effects 1, 3, 5; and it is inquired in what time they will produce the effect, 1. For a, b, c, d, e, f, g, write 1, 3, 5, 1, 3, 8, 12; and there will come out $x=\frac{1}{\frac{1}{3}+\frac{3}{8}+\frac{5}{12}}$, or $\frac{8}{9}$ of a week, that is, 6 days, 5 $\frac{1}{3}$ hours, the time they will finish it in together.

5°. Given the specific gravities of a mixture, and of the several ingredients thereof; to find the proportion of the ingredients therein. Suppose e the specific gravity of the mixture A + B, a that of A, and b that of B: since the absolute gravity, or weight, is compounded of the bulk of the body, and its specific gravity, aA will be the weight of A; bB that of B; and eA + eB, the weight of the aggregate A + B; consequently aA + bB = eA + eB: and therefore aA − eA = eB − bB, or $\overline{e-b}\times$B. Hence A : B :: $e-b$: $a-e$.

Thus, e. gr. Suppose the specific gravity of gold to be as 19, that of silver as 10 $\frac{1}{2}$, and that of king Hiero's crown as 17; then will 10, 3 (:: $e-b$: $a-e$ :: A : B) :: the bulk of gold in the crown, to the bulk of silver: or 190 : 31 (:: 19×10. 16 $\frac{1}{2}\times 3$ :: $a\times\overline{e-b}$. $b\times\overline{a-e}$) :: the weight of the gold in the crown to the weight of the silver, and 221 : 31 :: the weight of the crown to the weight of silver.

To bring geometrical problems to equations.—Geometrical questions, or those relating to continued quantities, are sometimes also brought to equations after the same manner as arithmetical ones: so that the first rule to be here prescribed, is, to observe every thing directed for the solution of numerical problems.

Suppose, e. gr. it were required to cut a right line, as A B (plate LXIV. *fig.* 1.) in extreme and mean proportion in C; that is, so as that BE, the square of the greater part, shall be equal to the rectangle B D, contained under the whole line and the less part.

Here, supposing A B = a, and C B = x; then will AC = $a-x$; and $xx=aa-ax$. An equation, which by reduction, gives $x=\overline{\sqrt{\frac{5}{4}}-1}\times a$. But it is very rare that geometrical problems are thus brought to equation, as being generally found to depend on various complex positions, and relations of lines; so that here some farther artifice, and certain special rules, will be required to bring them to algebraic terms. Indeed, it is very difficult to prescribe any thing precise in such cases; every person's own genius should be the rule of their procedure.

Something, however, shall be said in the general, for the sake of those who are not versed in such operations, and principally from Sir I. Newton.

Observe then, that problems concerning lines related to each other in any definite manner, may be variously stated, by supposing such or such quæsita, or things sought, to be required from such or such data: yet still, with whatever data and quæsita the question is proposed, its solution will arise after the very same manner, without the least alteration of any circumstance, except in the imaginary species of lines, or in the names whereby the data are distinguished from the quæsita.

Suppose, e. gr. the question were about an isosceles triangle, BCD (*fig.* 2.) inscribed in a circle, whose sides, BC, BD, and base CD, were to be compared with the diameter of the circle AB. Here the question may be either proposed, of investigating of the diameter from the given sides and base; or investigating the base from the sides and diameter given: or, lastly, of finding the sides from the base and diameter given; and propose it under which form you will, it will be brought to an equation by the same algebraic series.

Thus, if the diameter be sought, put AB = x, CD = a, and BC or BD = b: then drawing AC, as the triangles ABC and CBE are similar; AB : BC :: BC : BE, or $x:b::b:$ BE; wherefore BE = $\frac{bb}{x}$, and CE = $\frac{1}{2}$ CD or $\frac{1}{2}a$. And, by reason the angle CEB is a right angle, $CE^q+BE^q=BC^q$; that is, $\frac{1}{4}aa+\frac{b^4}{xx}=bb$; which equation being reduced, gives the diameter required, x. Again, if the base be sought, put AB = c, CD = x, and BC or BD = b: then drawing AC, as the triangles ABC and CBE are similar, AB : BC :: BC : BE, or $c:b::b:$ BE; wherefore BE = $\frac{bb}{c}$; and CE = $\frac{1}{2}$ CD, or $\frac{1}{2}x$: and by reason the angle CEB is a right angle, $CE^2+BE^2=BC^2$; that is, $\frac{1}{4}aa+\frac{b^4}{xx}=bb$; which equation being reduced, gives the diameter required, x. Again, if the base be sought, put AB = c, CD = x, and BC or BD = b: then drawing AC, as the triangles ABC and CBE are similar, AB : BC :: BC : BE, or $c:x::x:$ BE; wherefore, BE = $\frac{xx}{c}$; and CE = $\frac{1}{2}$ CD, or $\frac{1}{2}x$; and the angle CEB being right, $\overline{CE}^2+\overline{BE}^2=\overline{BC}^2$; that is, $\frac{1}{4}xx+\frac{b^4}{cc}=bb$; an equation which, reduced, gives the base sought, x.

Lastly, if the side BC, or BD, were sought, put AB = c, CD = a, and BC or BD = x: then drawing AC, the triangles ABC and CBE being similar, we have AB : BC :: BC : BE, or $c:x::x:$ BE; wherefore, BE = $\frac{xx}{c}$; and CE = $\frac{1}{2}$ CD, or $\frac{1}{2}a$; and the angle CEB being right, $\overline{CE}^2+\overline{BE}^2=\overline{BC}^2$; that is, $\frac{1}{4}aa+\frac{x^4}{cc}=xx$; an equation which, by reduction, gives x required.

Thus is the calculus for arriving at the equation, as well as the equation itself, the same in all cases; except that the same lines are designed by different letters, according as they are data, or quæsita. Indeed, as the data or quæsita differ, there arises a difference in the reduction of the equation found, but there is no difference in the equation itself. So that we need make no difference between given and sought quantities; but are at liberty to state the question with such data and quæsita, as we think most favourable to the solution of the question.

To find the area of a triangle whose three sides are given in numbers.

First, the sum and difference of any two numbers multiplied together will give the difference of their squares, and *vice versa*; thus $\overline{a+y}\times\overline{a-y}=a^2-y^2$; and thus again $c^2-d^2=\overline{c+d}\times\overline{c-d}$.

Secondly, let the triangle proposed be A B C, (*fig.* 3.) whereof let A B = a, BC = b, and C A = c; and let $a+b+c$ (or the sum of all the sides) = 2s; then, if 2a be subtracted from both sides, you will have $-a+b+c=2s-2a$; and for a like reason $a-b+c=2s-2b$, and $a+b-c=2s-2c$.

Thirdly, draw the perpendicular AD, and the two right-

right-angled triangles ADB and ADC furniſh the two following equations, $AD^2 + DB^2 = AB^2$, and $AD^2 + DC^2 = AC^2$.

Fourthly, make $AD = x$, $BD = y$, and conſequently $CD = b - y$, and the two equations in the laſt ſtep according to this notation will ſtand thus:

$x^2 + y^2 \quad * \quad * = aa$,

and $x^2 + y^2 - 2by + b^2 = cc$. Subtract the latter equation from the former, and you will have

$* \; * + 2by - b^2 = a^2 - c^2$; whence $2by = a^2 + b^2 - c^2$.

Fifthly, ſince, by the laſt ſtep $2by = a^2 + b^2 - c^2$, we have $-2by = -a^2 - b^2 + c^2$, and $2ab - 2by$, or $2b \times \overline{a-y} = -a^2 + 2ab - b^2 + c^2$; make $a - b = d$, and you will have $a^2 - 2ab + b^2 = d^2$, and $-a^2 + 2ab - b^2 = -d^2$, and $-aa + 2ab - b^2 + c^2 = c^2 - d^2$; therefore, $2b \times \overline{a-y} = c^2 - d^2 = \overline{c-d} \times \overline{c+d} = \overline{c-a+b} \times \overline{c+a-b} = \overline{2s-2a} \times \overline{2s-2b} = 4 \times \overline{s-a} \times \overline{s-b}$; therefore from firſt to laſt, $2b \times \overline{a-y} = 4 \times \overline{s-a} \times \overline{s-b}$, and $\frac{2b}{4} \times \overline{a-y}$ or $\frac{b}{2} \times \overline{a-y} = \overline{s-a} \times \overline{s-b}$.

Sixthly, ſince, again, by the fourth ſtep, $2by = a^2 + b^2 - c^2$, we have $2ab + 2by$, or $2b \times \overline{a+y} = a^2 - 2ab + b^2 - c^2$; make $a + b = d$, and you will have $a^2 + 2ab + b^2 = d^2$, and $a^2 + 2ab + b^2 - c^2 = d^2 - c^2 = \overline{d-c} \times \overline{d+c} = \overline{a+b-c} \times \overline{a+b+c} = \overline{2s-2c} \times 2s = 4 \times \overline{s-c} \times s$; therefore, from firſt to laſt we have $2b \times \overline{a+y} = 4 \times \overline{s-c} \times s$, and $\frac{b}{2} \times \overline{a+y} = \overline{s-c} \times s$.

Seventhly, multiply the equations found in the two laſt ſteps together, viz. $\frac{b}{2} \times \overline{a-y} = \overline{s-a} \times \overline{s-b}$, and $\frac{b}{2} \times \overline{a+y} = \overline{s-c} \times s$, and you will have (by the firſt) $\frac{b^2}{4} \times \overline{a^2 - y^2} = \overline{s-a} \times \overline{s-b} \times \overline{s-b} \times \overline{s-c} \times s$.

Eighthly, but by the fourth ſtep $a^2 = x^2 + y^2$, and $a^2 - y^2 = x^2$; therefore $\frac{b^2 x^2}{4} = \overline{s-a} \times \overline{s-b} \times \overline{s-c} \times s$.

Ninthly, extract the ſquare root of both ſides, and you will have $\frac{bx}{2}$, or $AD \times \frac{1}{2} BC$, or the area ſought, equal to the ſquare root of the product $\overline{s-a} \times \overline{s-b} \times \overline{s-c} \times s$. In words thus.

From half the ſum of the ſides ſubtract the three ſides ſeverally, and mark down the remainders; then, if theſe three remainders and that half ſum be multiplied together by a continual multiplication, the ſquare root of the product will be the area ſought.

Note, if the perpendicular falls without the triangle, the inveſtigation of this theorem will ſtill be the ſame, only now the ſign of y will be changed. For the nature, &c. of quadratic, cubic, &c. equations; ſee QUADRATIC, CUBIC, &c.

Conſtruction of EQUATIONS. See GEOMETRICAL *Conſtruction of Equations*.

EQUATION *of Time*, in aſtronomy, the reducing of the apparent, unequal time, or motion of the heavenly bodies to equable or mean time, or motion.

Since the diurnal motion of the earth about its axis is equable, every revolution will be performed in the ſame time, and therefore all the ſidereal days, and the hours of thoſe days, will be equal. And on the other hand, the ſolar days are all unequal, and that on two accounts; to wit, becauſe of the ecliptic figure of the earth's orbit, and becauſe of the obliquity of the ecliptic to the equator.

This will appear as follows: Let S (plate LXIV. *fig.* 2.) be the ſun, A B a part of the ecliptic, A the center of the earth, and M D a meridian, whoſe plane paſſes through the ſun. Now, in the time of one revolution about its axis, let the earth be carried about the ſun from A to B, and then the meridian will be in the poſition *m d*, parallel to the former M D. But it is plain, the meridian *m d* is not yet directed to the ſun, nor will, till by its angular motion it has attained the ſituation *e f*, deſcribing the angle $e B m = B S A$; whence it appears, that all the ſolar days are longer than the time of one revolution or ſidereal day.

If the earth revolved in the plane of the equator, and in a circle about the ſun, then would the angle A S B, and conſequently the angle $e B m$, be always of the ſame quantity; and therefore the time of deſcribing the ſaid angle $e B m$ would always be equal; and ſo all the ſolar days would be equal among themſelves. But neither of theſe two caſes have place in nature. For by the earth's theory, founded on the niceſt obſervations, the orbit is an ellipſis; and, therefore, her annual motion cannot be equable, or the angle A S B, deſcribed in the ſame ſpace of time, will not be equal; for in the aphelion the velocity of the earth will be leſs than in the perihelion; therefore, alſo, the arch A B will be leſs; and, conſequently, the ſimilar arch *e m*, and, therefore, alſo the time of deſcribing it: whence it appears, that the part of time to be added to the ſidereal day, to complete the ſolar day, is always variable.

The other, and the moſt conſiderable part of the equation of time, is that which ariſes from the plane of the earth's orbit or ecliptic being inclined to that of the equator or plane of the diurnal motion: to explain which, let ♈ ♋ ♎ (plate LXIV. *fig.* 3.) be a ſemicircle of the ecliptic, and ♈ H ♎ of the equinoctial, S the center of the ſun, and A that of the earth in the third quarter of the ecliptic, *b f* the meridian paſſing through the true ſun S, and its apparent place as I, in the firſt quarter of the ecliptic ♈ ♋.

Suppoſe now the motion of the earth in every reſpect equable; and firſt, that it ſet out from ♎, and proceeded in the equator in a given time to D, the ſun would apparently deſcribe in the ſame time the arch of the equator ♈ I. Again, ſuppoſe it ſet out from the ſame point, ♎, and ſpent the ſame time with the ſame equable velocity in the ecliptic, it would arrive at the point A; ſo that the arch ♎ A = ♎ D, and ♈ I = ♈ C; then it is evident, as the earth revolves about its axis from weſt to eaſt, the meridian of any place will firſt arrive at the ſun I in the ecliptic, and afterwards at the ſun C in the equinoctial; that is, the time of noon by the ſun in the ecliptic will be ſooner than that of noon by noon, which would happen by the ſun in the equinoctial; and that by the quantity of the arch *b* D turned into time.

Now the arch *b* D = B C is the difference of the ſun's longitude ♈ I, or ♈ C, and his right aſcenſion ♈ B; draw *g e* parallel to D C, and the angle *e* A *f* will be equal to the angle D S *h*, and the arch *e f* ſimilar to the arch D *h*; therefore, the time in which the meridian *b f* revolves into the ſituation *e g*, is that which is to be added to the ecliptic noon, to equate it with the time of the equinoctial noon, in the firſt and third quarters of the ecliptic. In the ſecond and fourth quarters, the ſaid equation is to be ſubtracted, as would eaſily appear by making the ſame conſtruction there.

Now, becauſe in different parts of the quadrant this arch D *b* or B C is of a different length, the equation of time will be a variable quantity; and, therefore, ſince the motion and time meaſured by the ſun in the equinoctial is always equal, there being nothing to make it otherwiſe, it follows, that the times, that is, the days, meaſured by the ſun in the ecliptic muſt be always unequal; or, in other words, the ſolar days are ſometimes ſhorter, ſometimes longer, than the equal time meaſured out in the equinoctial.

The true motion of the earth precedes the mean in the firſt ſemicircle of anomaly, and is preceded by the mean in the ſecond: therefore, while the earth is going from the aphelion to the perihelion, or while the ſun apparently moves from the apogæum to the perigæum, the apparent time will be before the mean; and in the other ſemi-circle of anomaly it will be after it. The difference of theſe motions, converted into time, is the equation of time in this reſpect, and it is to be ſubtracted from the apparent time to gain the mean, or added to the mean to gain the apparent, in the firſt ſemicircle of anomaly, and *vice verſa* in the latter.

Now both theſe parts of the equation of time are calculated by aſtronomers for every degree of anomaly, and for every degree of the ſun's longitude in the ecliptic, and diſpoſed in two ſeveral tables, with directions for adding and ſubtracting, as the caſe requires; ſo that at all

all times, the true or equal time may be had. And from thence it appears, that the apparent time, or that ſhewn by the ſun, namely, by a ſun-dial, is but four days in the whole year the ſame with the mean or equal time ſhewn by a good clock or watch, to wit, about the fifteenth of April, the ſixteenth of June, the thirty-firſt of Auguſt, and the twenty-fourth of December. Alſo about the firſt of November, the equation is greateſt of all in the year, being then about 16′ 13″; clocks being then ſo much ſlower than ſun-dials.

Mr. FLAMSTEAD's TABLE of the EQUATION of natural Days, with the Regulation of a Movement by the ſame.

Days.	Januar Faſter Min.	Sec.	Febr. Faſter Min.	Sec.	March Faſter Min.	Sec.	April Faſter Min.	Sec.	May Slower Min.	Sec.	June Slower Min.	Sec.	July Faſter Min.	Sec.	Auguſt Faſter Min.	Sec.	Sept. Slower Min.	Sec.	Octob. Slower Min.	Sec.	Nov. Slower Min.	Sec.	Dec. Slower Min.	Sec.
1	4	6	14	13	12	48	4	1	3	8	2	47	3	8	5	46	0	18	10	23	16	13	10	32
2	4	34	14	20	12	36	3	43	3	16	2	38	3	19	5	42	10	0	10	42	16	13	10	9
3	5	2	14	27	12	23	3	25	3	23	2	29	3	31	5	38	0	55	11	0	16	13	9	45
4	5	30	14	32	12	9	3	6	3	30	2	19	3	42	5	33	1	14	11	18	16	12	9	20
5	5	57	14	37	11	55	2	48	3	36	2	9	3	52	5	28	1	34	11	36	16	10	8	55
6	6	24	14	41	11	41	2	30	3	42	1	59	4	2	5	22	1	54	11	53	16	8	8	29
7	6	50	14	44	11	26	2	13	3	47	1	48	4	12	5	15	2	14	12	10	16	4	8	3
8	7	16	14	47	11	11	1	55	3	51	1	37	4	22	5	8	2	34	12	27	16	0	7	37
9	7	41	14	48	10	56	1	38	3	55	1	26	4	31	5	0	2	54	12	43	15	54	7	10
10	8	6	14	49	10	40	1	21	3	58	1	14	4	40	4	52	3	14	12	58	15	48	6	42
11	8	30	14	49	10	24	1	4	4	0	1	2	4	48	4	43	3	35	13	13	15	41	6	14
12	8	59	14	48	10	7	0	48	4	2	0	50	4	56	4	34	3	55	13	28	15	34	5	46
13	9	22	14	47	9	50	0	32	4	4	0	38	5	4	4	24	4	16	13	42	15	25	5	18
14	9	44	14	44	9	33	0	16	4	5	0	26	5	11	4	13	4	37	13	56	15	16	4	49
15	10	5	14	41	9	16	0**	1	4	5	0	13	5	17	4	2	4	58	14	9	15	6	4	19
16	10	26	14	37	8	58	0	14	4	5	0**	1	5	23	3	50	5	19	14	22	14	56	3	50
17	10	46	14	33	8	40	0	29	4	4	0	12	5	29	3	38	5	40	14	33	14	43	3	20
18	11	5	14	28	8	22	0	43	4	2	0	25	5	34	3	26	6	1	14	45	14	30	2	51
19	11	24	14	22	8	4	0	57	4	0	0	38	5	39	3	12	6	22	14	56	14	16	2	21
20	11	42	14	15	7	45	1	11	3	58	0	50	5	43	2	59	6	42	15	6	14	2	1	51
21	11	59	14	8	7	27	1	24	3	55	1	3	5	46	2	45	7	3	15	15	13	46	1	20
22	12	15	14	0	7	9	1	37	3	51	1	16	5	49	2	30	7	24	15	24	13	30	0	50
23	12	30	13	52	6	50	1	49	3	47	1	29	5	51	2	15	7	44	15	32	13	13	0**	20
24	12	45	13	43	6	31	2	1	3	42	1	42	5	53	2	0	8	5	15	40	12	56	0	10
25	12	59	13	33	6	13	2	12	3	37	1	55	5	54	1	44	8	25	15	46	12	38	0	40
26	13	12	13	22	5	54	2	23	3	31	2	7	5	55	1	28	8	45	15	52	12	18	1	10
27	13	24	13	12	5	35	2	33	3	25	2	20	5	55	1	11	9	5	15	58	11	58	1	40
28	13	36	13	0	5	16	2	43	3	18	2	32	5	54	0	54	9	25	16	2	11	38	2	10
29	13	46			4	57	2	52	3	11	2	44	5	53	0	36	9	45	16	6	11	17	2	39
30	13	56			4	39	3	0	3	3	2	56	5	51	0	19	10	4	16	9	13	55	3	8
31	14	5			4	20			2	55			5	49	0**	1			16	11			3	37

Equal time ſlower as far as the next two aſteriks.

Equal time faſter as far as the two aſteriks.

Equal time ſlower to the next aſteriks.

Equal time faſter to the next aſteriks.

Equal time faſter.

EQUATOR, in geography, a great circle of the terreſtrial globe, equidiſtant from its poles, and dividing it into two equal hemiſpheres; one north, and the other ſouth. See the article GLOBE.

It paſſes through the eaſt and weſt points of the horizon, and at the meridian is raiſed as much above the horizon as is the complement of the latitude of the place. From this circle, the latitude of places, whether north or ſouth, begin to be reckoned, in degrees of the meridian. See LATITUDE and MERIDIAN.

All people living on this circle, called by geographers and navigators the line, have their days and nights conſtantly equal.

It is in degrees of the equator that the longitude of places are reckoned; and as the natural day is meaſured by one revolution of the equator, it follows that one hour anſwers to $\frac{360}{24} = 15$ degrees: hence one degree of the equator will contain four minutes of time; fifteen minutes of a degree will make a minute of an hour; and, conſequently, four ſeconds anſwer to one minute of a degree.

EQUERRY, in the Britiſh cuſtoms, an officer of ſtate, under the maſter of the horſe.

There are five equerries, who ride abroad with his majeſty; for which purpoſe they give their attendance monthly, one at a time, and are allowed a table.

As to the equerries of the crown ſtable, they have this diſtinct appellation, as being employed in mounting, managing, and breaking the ſaddle-horſes for his majeſty's uſe, and holding his ſtirrup.

EQUESTRIAN STATUE ſignifies the ſtatue of a perſon mounted on horſeback.

EQUESTRIAN ORDER, among the Romans, ſignified their knights, or equites; as alſo their troopers, or horſemen in the field; the firſt of which orders ſtood in contradiſtinction to the ſenators, as the laſt did to the foot, military, or infantry: each of theſe diſtinctions was introduced into the ſtate by Romulus.

EQUIANGULAR, in geometry, an epithet given to figures whoſe angles are all equal: ſuch are a ſquare, an equilateral triangle, &c.

EQUICRURAL, in geometry, the ſame with iſoſceles. See the article ISOSCELES.

EQUICULUS, or EQUULEUS. See the article EQUULEUS.

EQUIDIFFERENT NUMBERS, in arithmetic, are of two kinds, 1. Continually equidifferent is when, in a ſeries of three numbers, there is the ſame difference between the firſt and ſecond, as there is between the ſecond and third; as 3, 6, 9. And, 2. Diſcretely equidifferent, is when in a ſeries of four numbers or quantities, there is the ſame difference between the firſt and ſecond, as there is between the third and fourth: ſuch are 3, 6, 7, 10.

EQUIDISTANT, an appellation given to things placed at equal diſtance from ſome fixed point, or place, to which they are referred.

EQUILATERAL, in general, ſomething that hath equal ſides, as an equilateral angle.

EQUILATERAL HYPERBOLA, one whoſe tranſverſe diameter is equal to its parameter; and ſo all the other diameters, equal to their parameters: in ſuch an hyperbola, the aſymptotes always cut one another at right angles in the center. Its moſt ſimple equation, with regard to the tranſverſe axis, is $y^2 = x^2 - a^2$; and, with regard to the conjugate, $y^2 = x^2 + a^2$, when a is the ſemitranſverſe, or ſemi-conjugate. The length of the curve cannot be found by means of the quadrature of any ſpace, of which a conic ſection is any part of the perimeter. See the article HYPERBOLA.

EQUI-

EQUILIBRIUM, in mechanics, is when the two ends of a lever or ballance hang ſo exactly even and level, that neither doth aſcend or deſcend, but keep in a poſition parallel to the horizon; which is occaſioned by their being both charged with an equal weight.

EQUIMULTIPLES, in arithmetic and geometry, are numbers or quantities multiplied by one and the ſame number or quantity. Hence, equimultiples are always in the ſame ratio to each other, as the ſimple quantities before multiplication: thus, if 6 and 8 are multiplied by 4, the equimultiples 24 and 32 will be to each other as 6 to 8.

EQUINOCTIAL, in aſtronomy, a great circle of the celeſtial globe, whoſe poles are the poles of the world.

It is ſo called, becauſe whenever the ſun comes to this circle, the days and nights are equal all over the globe; being the ſame with that which the ſun ſeems to deſcribe at the time of the two equinoxes of ſpring and autumn. See the article EQUINOX.

All ſtars, directly under this circle, have no declination, and always riſe due eaſt, and ſet full weſt. The hour circles are drawn at right angles to it, paſſing thro' every fifteenth degree; and the parallels to it are called parallels of declination. See the articles DECLINATION and CIRCLE.

EQUINOCTIAL	COLURE,	See	COLURE.
	DIAL,		DIAL.
	HOUR,		HOUR.
	LINE,		LINE.
	OCCIDENT,		OCCIDENT.
	ORIENT,		ORIENT.
	POINT, &c.		POINT, &c.

EQUINOX, the time when the ſun enters either of the equinoctial points, where the ecliptic interſects the equinoctial. See the preceding article.

It is ſo called, becauſe when the ſun is in theſe points, the days and nights are of an equal length all the world over. As the ſun is in one of them, in the ſpring, viz. March 20th, it is called the vernal equinox; and in the other, in autumn, viz. September 23d, it is called the autumnal equinox.

Preceſſion of the EQUINOXES. See the article PRECESSION.

EQUIPOLLENCE, in logic, is when there is an equivalence, or agreement, either as to the nature of things, or as to the grammatical ſenſe of any two propoſitions; that is, when two propoſitions ſignify one and the ſame thing, though they expreſs it after different manners.

EQUISETUM, horſetail, in botany, a genus of plants, and order of filices, or ferns; the fructifications of which are diſpoſed on an oblong ſpike, and are of an orbicular figure, dividing in various angles from the baſe. The plant itſelf conſiſts of jointed ſtalks, in ſome ſimple, in others branched; producing ſetæ, or ſmaller diviſions, of the ſame ſtructure with the larger ones.

EQUITY, in a general ſenſe, the virtue of treating all other men according to common reaſon and juſtice, or as we would be gladly treated ourſelves, when we underſtand aright what is our due. See the article JUSTICE.

EQUITY *of Redemption*, in our law, is applied to mortgages, as where money being due on a mortgage, the mortgagee is deſirous to bar the mortgager's equity of redemption, that is, his right to redeem the mortgage. In this caſe the mortgagee may oblige the mortgager, either to pay the money, or to be foreclоſed of his equity of redemption. The practice is to exhibit a bill, to which anſwer being put in, and a decree obtained, a maſter of that court certifies what is due for principal, intereſt, and coſts, which is to be paid within the time limited by the decree; and thereupon, the eſtate mortgaged is to be reconveyed to the mortgager, otherwiſe, for default of payment, the mortgager is decreed to be foreclоſed from all equity of redemption, and abſolutely to convey the mortgaged premiſes to the mortgagee. See MORTGAGE.

EQUITY alſo frequently ſignifies the court of chancery, where controverſies are determined according to the exact rules of equity and conſcience, by mitigating the rigour of the common law; though even by the common and ſtatute law there is alſo an equity. See the article CHANCERY.

EQUIVALENT, an appellation given to things which agree in nature, or other circumſtances, as force, nature, &c.

EQUIVOCAL TERMS, or *Words*, among logicians, are thoſe which have a doubtful, or double meaning.

According to Mr. Locke, the doubtfulneſs and uncertainty of words has its cauſe more in the ideas themſelves, than in any incapacity of the words to ſignify them; and might be avoided, would people always uſe the ſame term to denote the ſame idea, or collection of ideas: but, adds that great man, it is hard to find a diſcourſe on any ſubject where this is the caſe; a practice which can only be imputed to folly, or great diſhoneſty; ſince a man, in making up his accompts, might, with as much fairneſs, uſe the numerical character ſometimes for one, ſometimes for another collection of unities.

EQUIVOCAL ACTION is, where the effect is of a different kind from the cauſe producing it.

EQUIVOCAL CAUSE. See CAUSE.

EQUIVOCAL GENERATION, the production of animals, without the intercourſe between the ſexes, by the influence of the ſun or ſtars, &c.

The equivocal generation of plants, is their production without ſeed, in the ordinary courſe of nature. See the article GENERATION.

This kind of generation is now quite exploded by the learned.

EQUIVOCATION, in ethics, the crime of wilfully uſing equivocal terms.

EQUULEUS, or ECUULEUS, in antiquity, a kind of rack uſed for extorting a confeſſion, at firſt chiefly practiſed on ſlaves, but afterwards made uſe of againſt the chriſtians.

The equuleus was made of wood, having holes at certain diſtances, with a ſcrew, by which the criminal was ſtretched to the third, ſometimes to the fourth, or fifth holes, his arms and legs being faſtened on the equuleus with cords; and thus was hoiſted aloft, and extended in ſuch a manner, that all his bones were diſlocated. In this ſtate red-hot plates were applied to his body, and he was goaded in the ſides with an inſtrument called ungula.

EQUULEUS, in aſtronomy, a conſtellation of the northern hemiſphere, whoſe ſtars, according to Ptolemy, and Tycho's catalogues, are four, but in Mr. Flamſtead's ten.

EQUUS, the HORSE, in zoology. See HORSE.

EQUUS MARINUS, in ichthyology, the ſame with the morſe. See MORSE.

ERASED, in heraldry, the ſame with arrache. See the article ARRACHE.

ERECT FLOWERS, ſuch as grow upright without hanging or reclining the head. See the article FLOWER.

ERECT DIAL. See the article DIAL.

ERECT VISION. See the article VISION.

ERECTOR CLITORIS, in anatomy, one of the two muſcles of the clitoris that ſerve for its erection.

The erectores of the clitoris ariſe from the oſſa iſchii, and are inſerted into the corpora cavernoſa.

ERECTOR PENIS, one of the two muſcles of the penis, that ſerve for its erection.

Theſe ariſe on each ſide, from the oſſa iſchii between the tubercle of this bone and the beginning of the corpus cavernoſum, and each of them is inſerted into the corpus cavernoſum of its own ſide. Theſe muſcles, when they act together, preſs the veins of the back of the penis againſt the oſſa pubis, by which they prevent the reflux of blood from the penis; and conſequently, when at the ſame time the blood flows impetuouſly into the parts by the arteries, and cannot get back this way, the penis becomes erected.

ERIGERON, ſweet fleabane, in botany, a genus of plants, the compound flower of which is radiated; the partial hermaphrodite one infundibuliform; and the female flower is ligulated, linear, and ſubulated: the fruit has no pericarpium, the cup is connivent: the ſeeds of the hermaphrodite flower are oblong, ſmall, and crowned with long down.

This plant is a diuretic, and promotes the menſes: the ſmell of it drives away fleas, and kills lice and other like vermin.

ERMIN, *Ermineum*, in zoology, a creature whoſe ſkin is the ermin, ſo much eſteemed as a fine fur.

This creature is properly a ſpecies of weaſel, and is called by Mr. Ray, and other authors, muſtela candida, the white weaſel. It is in all reſpects like the common weaſel, and is all over of a pure ſnow-white, except the tip of the tail, which is of as beautiful a black; and it has a little yellowiſh grey about the eyes, and a mark, or ſpot, of the ſame colour, on the head, another on the ſhoulders, and a third near the tail. Its colour is, however, very different in degree and elegance, according to the ſeaſon of the year. It is frequent about rivers, and in meadows, in thoſe countries which produce it, and feeds on moles, mice, and other ſmall animals.

ERMIN, in heraldry, is always argent and ſable, that is, a white field, or fur, with black ſpots. Theſe ſpots are not of any determinate number, but may be more or leſs, at the pleaſure of the painter, as the ſkins are thought not to be naturally ſo ſpotted; but ſerving for lining the garments of great perſons, the furriers were wont, in order to add to their beauty, to ſow bits of the black tails of the creatures that produced them, upon the white of their skin, to render them the more conſpicuous, which alteration was introduced into armory. (See plate LXII. *fig.* 3.)

ERMIN, or EARS OF CORN, an order of knights in France, inſtituted by Francis the laſt of that name, duke of Brittany.

ERMINE', or croſs ermine, is one compoſed of four ermin ſpots, placed as repreſented in *fig.* 4.

It is to be obſerved, that the colours in theſe arms, are not to be expreſſed, becauſe neither this croſs, nor theſe arms, can be of any other colour but white and black.

ERMINES are, by ſome Engliſh writers, held to be the reverſe of ermine, that is, white ſpots on a black field, and yet the French uſe no ſuch word, but call this black powdered with white *contre ermin*, which is very proper, as it denotes the reverſe of ermin. See the article ERMIN.

ERMINITES ſhould ſignify little ermines, but it is otherwiſe; for it expreſſes a white field powdered with black, only that every ſuch ſpot hath a little red hair on each.

Erminites alſo ſignify a yellow field powdered with black, which the French expreſs much better by *or ſemée d'ermine de ſable*.

EROSION, among phyſicians, denotes much the ſame with corroſion, only in a ſtronger degree. See the articles CORROSION and CORROSIVES.

ERRATA, a liſt of the errors or faults in the impreſſion of a book, generally placed at the beginning thereof.

ERRATIC, in general, ſomething that wanders, or is not regular: hence it is, the planets are called erratic ſtars; as thoſe fevers, which obſerve no regular periods, are denominated erratic fevers.

ERRHINES, ἐρρῖνα, in pharmacy, medicines which, when ſnuffed up the noſe, promote a diſcharge of mucus from that part.

The excretion of the mucous lymph is excellently promoted by errhines and ſternutatories, the former of which ſtimulate the pituitary coats but gently, whereas the latter more forcibly ſtimulate them to an extretory motion. See the article STERNUTATORY.

ERROUR, ERROR, in philoſophy, a miſtake of our judgment, giving aſſent to that which is not true.

Mr. Locke reduces the cauſes of error to theſe four; firſt, want of proofs; ſecondly, want of ability to uſe them; and, thirdly, want of will to uſe them; and fourthly, wrong meaſures of probability.

ERUCA, the white rocket, in botany, a ſpecies of braſſica. See the article BRASSICA.

ERUCA, wild rocket, in botany, a genus of plants, whoſe characters are:

The pod is full of roundiſh ſeeds, and the plant has a particular taſte, and a particular fœtid ſmell above all others.

This rocket has a long white root, with many fibres at the bottom; from which ariſe a great many ſtriated ſtalks a foot or two high, full of narrow, long, and deeply laciniated leaves. The flowers are pretty large and yellow, of four leaves a-piece, which are ſucceeded by long, narrow, angular pods, full of ſmall, hot, bitteriſh ſeed: The whole plant has an ungrateful, fœtid ſmell. It grows frequently upon old walls, in great plenty, flowering great part of the ſummer.

This plant is of a ſtate altogether acrid and burning, mixed at laſt with a little bitterneſs; it gives a pretty deep tincture of red to the blue paper, and its ſmell reſembles that of fœtid oils rectified over quicklime; which makes us believe, that it contains a ſalt very acrid, which in ſome meaſure reſembles the ſal ammoniac, mixed with a great deal of fœtid oil and earth.

Thus it is no wonder, that the plant of which we are ſpeaking, ſhould be aperitive, inciſive, and diuretic. Matthiolus affirms, that, being boiled with a little ſugar, it is good for the cough in children, which is generally occaſioned by glutinous matters, irritated in the bronchia and veſicles of the lungs.

ERUCTATIONS, in medicine, are the effects of flatulent foods, and the crudities thence ariſing. See FLATULENCY.

ERUDITION, *eruditio*, denotes an extenſive acquaintance with books, eſpecially ſuch as treat of the Belles Lettres.

ERUPTION, in medicine, a ſudden and copious excretion of humours, as pus or blood: it ſignifies alſo the ſame with exanthema, any breaking out, as the puſtules of the plague, ſmall-pox, meaſles, &c.

ERYNGIUM, ERINGO, in botany, a genus of plants, the general corolla of which is uniform and roundiſh; the partial one conſiſts of five oblong petals, knotted together by a longitudinal line. The fruit is of an oval figure, and diviſible in two parts: the ſeeds are oblong and roundiſh.

The root of eryngium is attenuant and deobſtruent, and is therefore eſteemed a good hepatic, uterine, and nephritic. Its whole virtue conſiſts in the external or cortical part.

ERYSIMUM, hedge muſtard, in botany, a genus of plants, the corolla whereof conſiſts of four oblong, cruciform petals, with a very obtuſe point: the fruit is a long, linear, four-cornered pod, conſiſting of two valves, and divided into two cells: the ſeeds are numerous, ſmall, and roundiſh.

This plant is recommended in paralytic and epileptic caſes; it expels poiſon, deſtroys worms, ſtrengthens the ſtomach, and cures ulcers of the mouth.

ERYSIPELAS, otherwiſe called St. Anthony's fire, is that ſpecies of inflammation, which ariſing in the ſkin, and its ſubjacent fat, ſometimes ſpreads itſelf very far, and is accompanied with redneſs, heat, and pain. The part affected, when preſſed with the finger, becomes remarkably white; but, ſoon after its removal, reſumes its former redneſs.

The word is Greek, ἐρυσιπελας, and derived from ἐρυθρὸς, red, and πελὸς, livid; becauſe of the colours it induces on the affected part.

Though inflammations of this kind generally ariſe on the arms and legs, yet they ſometimes happen on the neck, the head, the ſhoulders, noſe, and other parts. Upon the firſt approach of this diſorder, the patient is almoſt always ſeized with a ſhivering and coldneſs, which are ſoon ſucceeded by a degree of heat, equal to that perceived in burning fevers: for this reaſon, it is often called *ignis ſacer*, both by ancient and modern authors.

Great attention is to be given to that fever which is accompanied with an eryſipelas; for in this, beſides the pain, thirſt, and reſtleſſneſs, which the patient ſuffers, the puſtules on various parts of the body ſometimes run into gangrenes.

Wherefore, the firſt thing to be done is to draw blood pretty plentifully; and then to purge once or more with gentle cathartics, as infuſion of ſena with manna, for ſuch only are proper in fevers. And indeed there is no acute fever that bears repeated purging better than this, eſpecially when the inflammatory tumour has ſeized the head: for the humour ſpreads very faſt, and ſoon gains the neighbouring parts.

But it is dangerous to apply hot fomentations, in order

to diſcuſs the morbific matter; and much more ſo to repel it with cooling ointments or liniments: but if the ſkin in any part be gangrened, that part is to be fomented with a decoction of bitter herbs, mixed with camphorated ſpirit of wine; and afterward a cataplaſm of oatmeal boiled in ſtrong beer is to be laid on warm, and to be renewed as often as is found neceſſary.

And to give this caution once for all, not only in acute diſeaſes, but in ſeveral chronical, which are attended with puſtules that ſuppurate, it is ſafer and better, unleſs the ſkin is the ſole ſeat of the diſorder, to encourage the eruption by gentle means, or at leaſt to ſuffer it to come forth for ſome time, that is, as far as the patient can bear the uneaſineſs, than either to repel or purge off the humour by other outlets: for there is in every vicious humour ſomewhat peculiar to itſelf; and, as they generally come forth by way of criſis, how much ſoever they may be diminiſhed, yet they are rarely evacuated out of the body, with relief to the ſick, by any other paſſages than thoſe pointed out by nature. *Mead's Monita & Præcepta.*

ERYTHROIDES, in anatomy, the firſt of the proper tunics or coats which cover the teſticles. See TESTICLE.

ERYTHRONIUM, dog's tooth-violet, in botany, a genus of plants, the flower of which conſiſts of ſix oblong and lanceolated petals; and the fruit is a ſubgloboſe capſule, with three cells, in which are contained numerous ovato-acuminated ſeeds.

The root of this plant is recommended againſt the cholic, epilepſy, and worms: it is alſo reckoned a provocative to venery.

ESCALADE, or SCALADE, in the art of war. See the article SCALADE.

ESCAPE, in law, a violent or privy evaſion out of ſome lawful reſtraint, without being delivered by due courſe of law.

ESCAPE-WARRANT, a proceſs which iſſues out againſt a perſon committed in the King's-bench or Fleet-priſons, that, without being duly diſcharged, takes upon him to go at large.

Upon this warrant, which is obtained on oath, a perſon may be apprehended on a Sunday.

ESCHALOT, *Cepa Aſcalonica*, a ſpecies of onion cultivated in gardens for its uſe in cookery. See ONION.

ESCHEAT, in law, ſignifies any lands or tenements that caſually fall to a lord within his manor, by way of forfeiture, or by the death of his tenant, without any heirs general or ſpecial.

ESCHRAKITES, in matters of religion, a ſect of Mahometans, who believe that man's ſovereign good conſiſts in the contemplation of God. They avoid all manner of vice, and appear always in good humour, deſpiſing the ſenſual paradiſe of Mahomet. The moſt able preachers, in the royal moſques, are of this ſect.

ESCLATTE, in heraldry, ſignifies a thing forcibly broken, or rather a ſhield that has been broken and ſhattered with the ſtroke of a battle-ax.

ESCORT, in the art of war, the ſame with convoy. See the article CONVOY.

ESCULENT, an appellation given to ſuch plants, or the roots of them, as may be eaten: ſuch are beets, carrots, artichokes, leeks, onions, parſnips, potatoes, radiſhes, ſcorzonera, &c.

ESCULUS, the horſe-cheſnut, a genus of trees, belonging to the heptandria-monogynia claſs of plants: its flower conſiſts of five roundiſh petals; and the fruit is a roundiſh, echinated, and coriaceous capſule, with only one cell, in which are contained two roundiſh ſeeds, tho' ſometimes only one.

ESCUTCHEON, or SCUTCHEON, in heraldry, is derived from the French *eſcuſſon*, and that from the Latin *ſcutum*, and ſignifies the ſhield whereon coats of arms are repreſented.

Moſt nations, of the remoteſt antiquity, were wont to have their ſhields diſtinguiſhed by certain marks painted on them; and to have ſuch on their ſhields was a token of honour, none being permitted to have them till they had performed ſome honourable action.

The eſcutcheon, as uſed at preſent, is ſquare, only rounded off at the bottom.

As to the bearings on ſhields, they might at firſt be arbitrary, according to the fancy of the bearer; but, in proceſs of time, they came to be the gift of kings and generals, as the reward of honourable actions.

ESCUTCHEON *of Pretence*, that on which a man carries his wife's coat of arms, being an heireſs, and having iſſue by her. It is placed over the coat of the huſband, who thereby ſhows forth his pretenſions to her lands.

ESDRAS, the name of two apocryphal books, uſually bound up with the Scriptures. They were always excluded the Jewiſh canon, and are too abſurd to be admitted as canonical by the papiſts themſelves. The firſt book is chiefly hiſtorical, giving an account of the return of the Jews from the Babyloniſh captivity, and the building of the ſecond temple; the ſecond is written in the prophetical way, pretending to viſions and revelations, but ſuch as are extremely ridiculous.

ESLIRASS, in law, perſons particularly appointed or choſen to impannel juries.

ESNECY, in law, a private prerogative allowed to the eldeſt coparcener, where an eſtate is deſcended to daughters for want of an heir male, to chooſe firſt, after the eſtate of inheritance is divided.

ESPALIERS, in gardening, are rows of trees planted about a whole garden or plantation, or in hedges, ſo as to incloſe quarters or ſeparate parts of a garden; and are trained up regularly to a lattice of wood-work in a cloſe hedge, for the defence of tender plants againſt the injuries of wind and weather. They are of admirable uſe and beauty in a kitchen garden, ſerving not only to ſhelter the tender plants, but ſcreen them from the ſight of perſons in the walks.

The trees chiefly planted for eſpaliers, are apples, pears, and ſome plums; but the two former are moſtly uſed: ſome plant eſpaliers of apples grafted upon paradiſe ſtocks; but theſe, being of a ſhort duration, are not ſo proper for this purpoſe; therefore I ſhould rather adviſe the having them upon crab ſtocks, or (if in ſmall gardens, where the trees cannot be allowed to grow ſo high) upon what the gardeners call the Dutch ſtock; which will cauſe them to bear much ſooner, and prevent their growing too luxuriant.

In chuſing the trees for an eſpalier, endeavour, as near as poſſible, to plant the ſeveral ſorts which are nearly of the ſame growth in one line, that the eſpalier may be the more regular, and of an equal height, which greatly adds to their beauty; for if you plant trees which ſhoot very unequally in the ſame line, it will be impoſſible to make the eſpalier regular: beſides, the diſtance the trees are to be planted muſt be directed hereby; for ſome trees, viz. thoſe of a larger growth, ſhould be planted twenty-five or thirty feet aſunder; whereas thoſe of ſmaller growth need not be above ſixteen or eighteen feet diſtance from each other.

The width of the walks between theſe eſpaliers ſhould (in a large garden) be fourteen or ſixteen feet at leaſt; and, if they are deſigned to be carried up pretty high, the diſtance ſhould be greater, that each ſide may receive the advantage of the ſun and air, which is abſolutely neceſſary, if you would have the fruit well taſted: and if your ground is ſo ſituated, that you are at full liberty which way to make the eſpaliers, I would adviſe the placing the lines from the eaſt a little inclining to the ſouth, and toward the weſt a little inclining to the north, that the ſun may ſhine between the rows in the morning and evening, when it is low; for in the middle of the day, when the ſun is advanced far above the horizon, it will ſhine over the tops of the eſpaliers, and reach the ſurface of the earth about their roots; which is a matter of more conſequence than many people are aware of.

The ſorts of apples proper for eſpaliers are the golden pippin, nonpareil, rennette griſe, aromatic pippin, Holland pippin, French pippin, Wheeler's ruſſet, Pile's ruſſet, with ſeveral others.

The ſorts of pears proper for an eſpalier are ſummer and autumn fruits; for ſome of the winter pears ſeldom ſucceed well in an eſpalier. Theſe trees, if deſigned for a ſtrong moiſt ſoil, ſhould be upon quince ſtocks; but if for a dry ſoil, upon free ſtocks. Their diſtance of planting muſt alſo be regulated by the growth of the trees, which are more unequal in pears than apples, and ſhould therefore be more carefully examined before they are planted

planted. As for thoſe pears upon free ſtocks, the diſtance ſhould never be leſs than twenty-five feet for moderate-growing trees; but, for vigorous ſhooters, the ſpace of thirty or five and thirty feet is little enough, eſpecially if the ſoil be ſtrong, in which caſe they ſhould be planted at a greater diſtance. The particular ſorts of pears I would recommend for an eſpalier, are the jargonelle, blanguette, poir ſans peau, ſummer boncretien, Hambden's burgamot, poir du prince, autumn burgamot, l'ambrette, gros rouſſelet, chaumontelle, beurre du roy, le marquis, creſſane, with many others of leſs note, always remembering that thoſe pears which are of the melting kind, will do better in eſpaliers than the breaking pears, which ſeldom ripen well on eſpaliers: you ſhould alſo be careful of the ſtocks theſe are grafted on; for if the breaking pears are grafted on quince ſtocks, the fruit will be ſtony.

I ſhall now give directions for making the eſpalier, to which the trees are to be trained: but this I would not have done until the third year after the trees are planted; for, while they are young, it will be ſufficient to drive a few ſhort ſtakes into the ground on each ſide of the trees, to which the branches ſhould be faſtened in an horizontal poſition, as they are produced; which ſtakes may be placed nearer, or at a farther diſtance, according as the ſhoots produced may require, and will be ſufficient for the three firſt years; for ſhould you frame the eſpalier the firſt year the trees are planted, the poles would rot before the eſpalier is covered. The cheapeſt method to make theſe eſpaliers is with aſh poles, of which you ſhould have two ſorts; one of the largeſt ſize, which contains thirteen poles in a bundle, and the other ſize thoſe of half a hundred; the firſt or largeſt ſize poles ſhould be cut about ſeven feet and an half long; theſe are intended for upright ſtakes, and muſt be ſharpened at the largeſt end, that they may, with more eaſe, be driven into the ground; theſe ſhould be placed at a foot diſtance from each other in a direct line, and of an equal height, about ſix feet above ground; then you ſhould nail a row of ſtraight ſlender poles along upon the tops of the upright ſtakes, which will keep them exactly even, and continue to croſs the ſtakes with the ſmaller poles, and the tops which were cut off from the larger ones, at about nine inches diſtance, row from row, from the top to the bottom of the ſtakes. Theſe rows of poles ſhould be faſtened with wire, and the largeſt end of the poles ſhould be nailed to the upright ſtakes, which will ſecure the eſpalier almoſt as long as the poles will endure; whereas, if your faſtening is not ſtrong, the poles will be continually diſplaced with every ſtrong wind. When your eſpalier is thus framed, you muſt faſten the branches of the trees thereto, either with ſmall oſier twigs, or ſome ſuch binding, obſerving to train them in an horizontal poſition, and at equal diſtances; being careful not to croſs any of the branches, nor to lay them in too thick: the diſtance I would allow for the branches of pears and apples, ſhould be proportioned according to the ſize of their fruit; ſuch of them whoſe fruit is large, as the ſummer boncretien, monſieur John, and beurre du roy pears, and the rennet guiſe, Holland pippin, French pippin, and other large apples, ſhould have their branches ſix or eight inches diſtance at leaſt; and to thoſe of leſſer growth four or five inches will be ſufficient.

But, beſides this ſort of eſpalier made with poles, there is another ſort that is by many people preferred; which is framed with ſquare timbers cut to any ſize, according to the ſtrength thereof, or the expence the owner is willing to go to; theſe, though they appear more ſightly, when well fixed and painted, are not of longer duration than one of the former, provided it is well made, and the poles are ſtrong which are ſet upright; nor will they anſwer the purpoſe better, though they are vaſtly more expenſive; for the greateſt beauty conſiſts in the diſpoſing the branches of the tree, which, eſpecially in ſummer, when the leaves are on, will entirely hide from the ſight the frame of the eſpalier: therefore all expence in erecting theſe is needleſs, farther than making proviſion to ſecure the branches of the trees in a regular order.

Fruit-trees thus planted, and well managed, are much preferable to thoſe trained up in any other figure, upon ſeveral accounts: as, firſt, theſe take up very little room in a garden, ſo as to be hurtful to the plants which grow

in the quarters; and, ſecondly, the fruit upon theſe are better taſted than thoſe which grow upon dwarfs, the ſun and air having freer acceſs to every part of the tree, whereby the dampneſs ariſing from the ground is ſooner diſſipated; which is of ſingular advantage to fruit-trees. *Miller's Gard. Dict.*

ESPLANADE, in fortification, the ſloping of the parapet of the covert-way towards the campaign.

ESPOUSALS, in law, ſignify a contract or promiſe made between a man and a woman, to marry each other.

ESQUIRE, *Armiger*, was anciently the perſon that attended a knight in time of war, and carried his ſhield.

ESSAY, in coinage, See the article ASSAY.

ESSAY, in literature, a peculiar kind of compoſition, the character of which is to be free, eaſy, and natural; not tied to ſtrict order or method, nor worked up and finiſhed like a formal ſyſtem.

ESSAY-HATCH is the miner's term for a little trench or hole, which they dig to ſearch for ſhoad or ore.

ESSENCE is that which conſtitutes the peculiar nature of any thing, and makes it to be what it is.

In philoſophy, the eſſence of a thing is that which is the primary conception which one has of it, and is diſtinguiſhed from its act, which is called its exiſtence. Thus the eſſence of a rectilinear triangle conſiſts in its being bounded by three ſtraight lines; of a circle, in that its radii or ſemi-diameters are all equal; and the eſſence of a ſquare is, that it hath four right angles and four equal right-lined ſides.

ESSENCE, in chemiſtry, is the moſt pure, balſamic, and ſubtile parts, which have been extracted from any body by means of fire.

ESSENES, or ESSENIANS, in Jewiſh antiquity, one of the three ancient ſects among that people, who outdid the Phariſees in their moſt rigorous obſervances. They allowed a future ſtate, but denied a reſurrection from the dead. Their way of life was very ſingular: they did not marry, but adopted the children of others, whom they bred up in the inſtitutions of their ſect: they deſpiſed riches, and had all things in common; and never changed their cloaths, till they were entirely worn out. When initiated, they were ſtrictly bound not to communicate the myſteries of their ſect to others; and if any of their members were found guilty of enormous crimes, they were expelled.

Pliny tells us, that they dwelt on the weſt ſide of the lake of Aſphaltites; that they were a ſolitary kind of men, living without women or money, and feeding upon the fruit of the palm-tree: he adds, that they were conſtantly recruited by new comers, whom the ſurges of ill fortune had made weary of the world; in which manner the ſect was kept up for ſeveral thouſands of years, without any being born among them. The reaſon why we find no mention made of them in the New Teſtament, may be their recluſe and retired way of life, no leſs than their great ſimplicity and honeſty, whereby they lay open to no cenſure or reproof.

ESSENTIA, ESSENCE. See the article ESSENCE.

ESSENTIAL, ſomething neceſſarily belonging to the eſſence or nature of a thing, from which it cannot be conceived diſtinct: thus the primary qualities of bodies, as extenſion, figure, number, &c. are eſſential or inſeparable from them in all their changes and alterations. See the article QUALITY.

ESSOIN, in law, an excuſe for a perſon ſummoned to appear and anſwer to an action on account of ſickneſs or other juſt cauſe of his abſence.

ESSOIN-DAY is regularly the firſt day of every term, though the fourth day after is alſo allowed by way of indulgence.

ESSORANT, in heraldry, denotes a bird ſtanding on the ground with its wings expanded, as if it had been wet, and were drying itſelf.

ESTABLISHMENT *of Dower*, in law, an aſſurance of dower made to the wife by the huſband, or ſome friend of his, on marriage.

ESTATE, in law, ſignifies the title or intereſt that a perſon has in lands, tenements, or other effects; comprehending the whole in which a perſon hath any property, and will paſs the ſame.

ESTATES, in a political ſenſe, is uſed either to denote the dominions of ſome prince, or the general claſſes into which the people are divided.

ESTATES-GENERAL, in the polity of Holland. See STATES-GENERAL.

ESTETE, in heraldry, denotes the heads of beaſts torn off by main force.

ESTHER, a canonical book of the Old Teſtament, containing the hiſtory of a Jewiſh virgin, dwelling with her uncle Mordecai at Shuſhan, in the reign of Ahaſuerus, one of the kings of Perſia.

ESTOILEE, or CROSS ESTOILEE, in heraldry, a ſtar with only four long rays in form of a croſs; and accordingly, broad in the center, and terminating in ſharp points.

ESTOPPEL, in law, an impediment or bar to an action, which ariſes from a perſon's own fact; or rather, where he is forbid by law to ſpeak againſt his deed, which he may not do, even to plead the truth.

ESTOVERS, in law, is moſt generally taken for certain allowances of wood made to tenants, as houſe-bote, hedge-bote, and plough-bote; which three are comprehended under reaſonable eſtovers.

ESTRANGEL, ESTRANGELUS CHARACTER, in the Syriac grammar, a particular ſpecies or form of Syriac letters, ſerving as the majuſculæ letters of that language, and by ſeveral ſuppoſed to be the true ancient Chaldee character.

ESTRAY, in law, any beaſt, not wild, that is found within a lordſhip, and owned by no-body: in which caſe, being cried according to law in the two next market towns adjacent, and not claimed in a year and a day by the owner, it becomes the property of the lord of the manor or liberty wherein it was found.

ESTREAT, in law, a true copy, note, or duplicate of an original writing or record, eſpecially fines, amercements, penalties, &c. ſet down and impoſed in the rolls of a court, to be levied by the bailiff, or other officer.

ESTREPEMENT, in law, any ſpoil made by tenants for life on any lands, &c. to the prejudice of the reverſioner: it is alſo taken to ſignify the making land barren, by continual ploughing and ſowing, and thereby drawing out the heart of the ground without manuring, or rather good huſbandry, by which means it is impaired.

It may likewiſe be applied to the cutting down of trees, or lopping them farther than the law allows.

ESURINE SALTS, ſuch as are of a corroding, fretting, and eating nature; abounding chiefly in places near the ſea-ſide, and where great quantities of coals are burnt, as appears from the ſpeedy ruſting of iron-bars in the windows of houſes built in ſuch places.

ETAPPE, a term uſed, in the French armies, for the proviſions and forage allowed an army in their route through a kingdom, whether going into winter quarters, or returning to take the field. Hence, etapier is the undertaker or perſon who contracts with the country or territory for furniſhing the ſaid proviſions.

ETCHING, a method of engraving on copper, in which the lines or ſtrokes, inſtead of being cut with a tool or graver, are eaten in with aquafortis.

Etching is of a later invention, though not very modern, than engraving with the tool; of which it was at firſt only an imitation, that was practiſed by painters and other artiſts who could much ſooner form their hand to, and attain a faculty of, working in this way than with the graver. But being then nevertheleſs conſidered as a counterfeit kind of engraving, and therefore inferior to the other, it was cultivated in a very confined manner: the cloſeneſs of the reſemblance of the work to that performed by the tool, being made the teſt of its merit; and conſequently the principal object of aim in thoſe who purſued it. This ſervile confinement of the art of etching to the imitation of the original kind of engraving was a great cauſe of retarding its advance towards perfection: as many of the moſt able maſters cramped their talents with the obſervance of it: which may be ſeen in the inſtances of Sadelers, Swanneberg, Vilamene, and particularly Le Boſſe; who, in his treatiſe on engraving, has laid down as a principle, that the perfection of this kind conſiſts in the cloſe ſimilitude of the work with that done by the tool. This abſurd prepoſſeſſion has been ſince worn out: and the method of working with aquafortis has been ſo far improved, that inſtead of being now deemed a ſpurious kind of engraving, it evidently appears the foundation of an excellence in many modern works, that could never have been produced without it: ſince, though the neatneſs and uniformity of the hatches, which attend the uſe of the tool, is more advantageous with reſpect to portraits; yet the liberty and facility of the other manner give a much greater opportunity to exerciſe the force of genius and fancy in hiſtory painting; where the effect of the whole, and not the minute exactneſs in finiſhing all the parts, conſtitutes the principal value. There are two methods practiſed of engraving in this way; the one with a hard varniſh or ground; the other with a ſoft. The firſt was formerly much uſed, being better accommodated to the intention of imitating the engraving with the tool; as the firmneſs of the body of the varniſh gave more opportunity of retouching the lines, or enlarging them with the oval pointed needles, called by the French *echoppes*, as was practiſed by Le Boſſe and others for that purpoſe. The latter has now almoſt wholly ſuperſeded the uſe of the other by the free and ſupple manner of working it admits of; which gives a power of expreſſion incompatible with the greater inflexibility of the hard varniſh, that confines the lines and hatches to ſuch a regularity and ſameneſs, as give a ſtiffneſs of manner and coldneſs of effect to the work.

The mixture of the uſe of the tool and aquafortis, which are now both employed together in many caſes, has however given that perfection to engraving which it bears at preſent. The truth and ſpirit of the outline that the method of working with aquafortis affords, and the variety of ſhades which the different kinds of black producible in this way, as well as other means of expreſſing the peculiar appearance and character of particular ſubjects, furniſh what was defective in the ſole uſe of the tool; while, on the other hand, the exactneſs and regularity of the lines, which are required for finiſhing many kinds of deſigns, are ſupplied by the graver: and by a judicious application of both, that complete finiſhing is obtained, which either of them alone muſt neceſſarily want.

The manner by which this art is performed, is the covering the ſurface of the plate with a proper varniſh, or ground, as it is called, which is capable of reſiſting aquafortis; and then ſcoring or ſcratching away, by inſtruments reſembling needles, the parts of this varniſh or ground, in the places where the ſtrokes or hatches of the engraving are intended to be: when, the plate being covered with aquafortis, the parts that are laid naked and expoſed by removing the ground or varniſh, are corroded or eaten away by it, while the reſt, being ſecured and defended, remain untouched.

There are two methods of etching, as hath been already obſerved, the difference of which from each other conſiſts, as well in the difference of the varniſh or ground, as in that of the aquafortis, adapted to each kind: but the general methods of performing them is alike in both. Theſe varniſhes, or grounds, are diſtinguiſhed by the names of hard and ſoft: for, in their conſiſtence, or the reſiſtance they give to the needles, lies their eſſential variation from each other. The hard varniſh, it is with good reaſons conjectured, was not the firſt in uſe: but ſoon took place of the other; and was, for ſome time, the moſt received in practice, on the account of its admitting the work to be made more like that of the graver: the ſoft has however ſince, in its turn, prevailed to the excluſion of it in ſome degree, except in the caſe of particular ſubjects; but not ſo entirely as to take away the expedience of ſhewing how it is performed. The manner of etching with the ſoft varniſh is now, however, one of the moſt important objects of the art of engraving, and it is at preſent in univerſal uſe, ſometimes alone, but more frequently intermixed with the work of the tool; and, in ſome caſes, with great advantage, even where the whole is intended to paſs for being performed by the graver.

Preparation of the ſoft varniſh, according to Mr. Lawrence, an eminent Engliſh engraver at Paris.

"Take of virgin's wax and aſphaltum, each two ounces, of black pitch and Burgundy pitch, each half an

an ounce. Melt the wax and pitch in a new earthen-ware glazed pot; and add to them, by degrees, the aſphaltum finely powdered. Let the whole boil till ſuch time as that, taking a drop upon a plate, it will break when it is cold, on bending it double three or four times betwixt the fingers. The varniſh being then enough boiled, muſt be taken off the fire; and, letting it cool a little, muſt be poured into warm water, that it may work the more eaſily with the hands, ſo as to be formed into balls; which muſt be rolled up in taffety for uſe."

It muſt be obſerved, firſt, that the fire be not too violent, for fear of burning the ingredients; a ſlight ſimmering will be ſufficient: ſecondly, that while the aſphaltum is putting in, and even after it is mixed with them, the ingredients ſhould be ſtirred continually with the ſpatula; and thirdly, that the water, into which this compoſition is thrown, ſhould be nearly of the ſame degree of warmth with it, to prevent a kind of cracking that happens when the water is too cold.

The varniſh ought always to be harder in ſummer than in winter; and it will become ſo if it be ſuffered to boil longer, or if a greater proportion of the aſphaltum or brown reſin be uſed. The experiment abovementioned, of the drop ſuffered to cool, will determine the degree of hardneſs or ſoftneſs, that may be ſuitable to the ſeaſon when it is to be uſed.

Preparation of the hard varniſh uſed by Callot, commonly called the Florence varniſh.

"Take four ounces of fat oil very clear, and made of good linſeed oil, like that uſed by painters: heat it in a new pot of glazed earthen-ware, and afterwards put it to four ounces of grains of maſtick well powdered; and ſtir the mixture briskly, till the whole be well melted together; then paſs the whole maſs, through a piece of fine linen, into a glaſs bottle with a long neck, that can be ſtopped very ſecurely; and keep it for the uſe that will be below explained."

Method of applying the ſoft varniſh to the plate; and of blackening it.

The plate being well poliſhed and burniſhed, according to the directions given under the article of COPPER-PLATE, as alſo cleanſed from all greaſineſs by chalk or Spaniſh white, put it upon a chafing-diſh, in which there is a moderate fire; obſerving to hold it ſo, that it may not burn; to do which more commodiouſly, a prop is uſed; and ſometimes two, or even four, as will be obſerved. Theſe props ſhould be fixed to the edge of the plate, in ſome place where there is to be no engraving; and the plate being thus ſupported, muſt be left over the fire till it be ſo hot, that the varniſh being brought in contact with it, may melt, and run through the taffety which is wrapped round it: then take ſome of the ſoft varniſh, well wrapped up in taffety, that is free from all greaſe and dirt, as alſo ſtrong and ſound in every part; for indeed it ought to be new, that there may be no weak or worn place in it where the varniſh may run through in too great plenty; and rub the plate, fixed as before deſcribed over the fire, with it, till it grow hot: in doing which, it ſhould be gently paſſed from one ſide to the other in a right line, ſo as to form ſeveral rows, till ſuch time as the plate be every where moderately covered: after this, with a ſort of ball made of cotton tied up in taffety, beat every part of the plate gently, while the varniſh be yet in a fluid ſtate; and to unite it ſtill more, and give it a finer grain, it is proper to take the plate from the fire in an inſtant, and continue ſtriking it on every part with the ball, till it attain a harder conſiſtence in cooling. This muſt not, however, be prolonged till the varniſh be too cold; for then the ball would be apt to make it riſe from the plate.

When the plate is thus uniformly and thinly covered with the varniſh, it muſt be blackened by a piece of flambeau, or of a large wax candle, which affords a copious ſmoke; and ſometimes two, or even four, ſuch candles are uſed together, for the ſake of diſpatch; that the varniſh may not grow cold, if that were poſſible, during the operation. The plate muſt then be heated again, in order to the varniſh being blackened, that it may be in a melted ſtate when that operation is performed; but great care muſt be taken not to burn it; which, when it happens, may be eaſily perceived by the varniſh ſmoking and running into little lumps, as if it had contracted ſome foulneſs. The following expedient is made uſe of, for the more commodiouſly blackening the varniſh; being particularly neceſſary where the plates are large. Fix a ſtrong hook in the beams of the boards of the roofing of the room, through which paſs four pieces of cord of equal length, at the end of which are fixed four iron rings of about four inches diameter. The four props, which hold the corners of the plate, muſt be faſtened to theſe rings; and the plate, being thus ſuſpended in the air, with the varniſhed ſide downwards, may be blackened with great convenience: but this is not, however, abſolutely requiſite, but in the caſe of large plates that could not, without difficulty, be held up, unleſs this, or ſome other ſuch contrivance, were made uſe of.

It is proper to be very cautious in keeping the flambeau or candle at a due diſtance from the plate, for fear the wick may touch the varniſh, which would both ſully and mark it. If it appear that the black have not penetrated the varniſh, the plate muſt be again placed, for ſome little time, over the chafing-diſh; and it would be found, that in proportion as the plate grows hot, the varniſh will melt and incorporate with the black, which lay above it; in ſuch manner, that the whole will be equally pervaded by it.

Above all things, the greateſt caution ſhould be uſed in this operation, to keep all the time a moderate fire; and to move frequently the plate, and change the place of all the parts of it, that the varniſh may be alike melted every where, and be kept from burning. Care muſt alſo be taken, that during this time, and even till the varniſh be entirely cold, no filth, ſparks, or duſt, fly on it; for they would then ſtick faſt, and ſpoil the work.

Method of applying the hard varniſh on the plate, and of blackening and drying it.

The plate being perfectly cleanſed, and freed from greaſineſs, by the means before directed, it muſt be put on a chafing diſh, containing a ſmall fire; and when it is become moderately hot, it muſt be taken off again, in order to receive the varniſh, which muſt be thus laid on. Take a proper quantity of the varniſh; and putting it on the end of the finger, with a ſtick, or other ſmall inſtrument, touch the plate with it gently, in order that it may be ſpread in ſmall ſpots of the ſame ſize, at as equal diſtances as poſſible, over every part: and if the plate cool too much before the whole be finiſhed, heat it again as at firſt; carefully preſerving it from any duſt or foulneſs whatever, that may be liable to fall upon it: when this is done, having made the fleſhy part of the hand, below the little finger, thoroughly clean, beat gently with it on the plate, till all the ſpots of the varniſh are driven together, and cover equally and uniformly the whole extent of the poliſh ſurface.

After this beating the varniſh, the ſame part of the palm muſt be paſſed over it, in a ſliding direction, as if to clean it; in order to lay the varniſh yet more ſmoothly and equally. But the greateſt caution muſt be obſerved, on two accounts; the one, that the varniſh lie very thin on the plate; the other, that there be no ſweat on the hand, becauſe the moiſture would ſtick to the varniſh, and when it is to undergo the effect of the fire, would make, in boiling, little holes in it, that are almoſt inviſible; and which, without great care, when the aquafortis comes to exerciſe its force on the work that has been engraved, would, at the ſame time, exert its power on the copper, in theſe little holes.

The above are the directions given by M. Le Boſſe for performing this operation: but as ſpreading the varniſh on the plate with the hand is ſubject to great inconveniences, as he himſelf has remarked, in the inſtances of burning the hands, and which is ſcarcely poſſible to be avoided; and alſo the producing little imperceptible holes in the varniſh, which ſuffer the aquafortis to reach the plate in wrong places, and eat ſpots in many parts of the copper: to avoid theſe accidents, it is better therefore to ſpread the varniſh with a little ball, or puff, made of the cotton and taffety, as is done in the caſe of the ſoft varniſh.

The varniſh being then equally ſpread in this manner, the way to blacken it is, to take a large candle of good tallow, which is well lighted, and does not emit any ſparks; and to fix the plate over it, with the varniſhed ſurface downwards; ſupporting it by reſting one of the corners againſt a wall, and holding the other in the hand, and obſerving alſo that the fingers do not touch any part of the varniſh. The candle, by this means, being kept perpendicularly under it, the flame will riſe againſt the varniſh, and may be ſuffered to approach it as near as poſſible, provided the ſnuff do not touch it; and in this manner it muſt be moved under every part of the varniſh, till ſuch time as the whole ſhall be made ſufficiently black; but the candle ſhould be ſnuffed when there is occaſion, in order that it may afford its ſmoke more copiouſly. This being finiſhed, the varniſh muſt be baked or dried, in the following manner, care being taken in the mean time, to place it where it may be ſafely preſerved from all dirt.

The plate muſt be placed over a pan of burning coals, and continued there till the ſmoak from the varniſh begins to decreaſe, when the plate muſt be removed from the fire, and ſuffered to cool gradually.

The plate being thus prepared, the deſign muſt be drawn on it with proper needles; but if by ſome accident the varniſh ſhould happen to be ſcratched on any part of the plate, it muſt be repaired with a pencil dipped in Venetian varniſh, tempered with a little lamp-black, by which means the places that were accidentally ſcratched will be defended from the action of the aquafortis.

The next operation is that of corroding the plate with aquafortis, in order to which a border of ſoft ſealing-wax muſt be faſtened round the plate, about an inch high, in the form of a little wall or rampart; obſerving that the plate be well dried at the fire before this border be put round it. At one of the corners of this border a gutter is uſually made, which ſerves for pouring commodiouſly the aquafortis over the plate. The plate being thus bordered, take a due quantity of the refiners aquafortis, mix it with half its quantity of common water, and pour it gently through the trough or gutter made in the waxen border, till it riſe above a finger's breadth above the ſurface of the plate: when, if all things have been rightly conducted, it will be ſeen that the aquafortis will ſoon exert its action in the hatches which have been ſtrongly touched; but thoſe more weakly engraved will appear at firſt clear, and of the colour of the copper. The menſtruum muſt therefore be ſuffered to continue on the plate till its effects become viſible on the more tender parts, when the aquafortis ſhould be poured off, the plate waſhed with clean water, and dried before the fire: then take a ſmall pencil and dip it into a mixture of oil and tallow, and cover with it the lighter parts of the plate. This being done, the aquafortis muſt be again poured on, and ſuffered to continue a longer or ſhorter time, according to the ſtrength of the menſtruum, or the nature of the engraving, when it muſt be again poured off as before, and the plate immediately waſhed with water.

It may not be improper to obſerve, that, when the aquafortis is on the plate, the feathered part of a quill ſhould be uſed to cleanſe away the foulneſs of the verdigriſe that gathers in the hatches when the aquafortis operates on them, and to give it more room to exert its action; for by moving the aquafortis to and fro on the plate by the feathered part of the quill, and bruſhing away the black ſaline matter, where it appears to be formed, the hatches will be cleanſed, and the aquafortis exert its whole force equally on every part.

The plate being thus ſufficiently corroded by the aquafortis, and well waſhed with water, it muſt be warmed at the fire, and the border of wax removed; after which it muſt be made hotter till the mixture or compoſition, as well as the varniſh, melt, when it muſt be well wiped with a clean linen cloth, and afterwards rubbed heartily in every part with oil of olives; when it will be ready to be retouched and finiſhed by the graver. See the article ENGRAVING.

ETERNITY, an attribute of God, expreſſing his infinite or endleſs duration. See the article GOD.

ETHICS, or MORALITY, the ſcience of manners or duty, which it traces from man's nature and condition, and ſhews to terminate in his happineſs; or, in other words, it is the knowledge of our duty and felicity, or the art of being virtuous and happy.

ETHIOPIA, or ÆTHIOPIA, a very extenſive country of Africa, comprehending Abyſſinia, Nubia, and Abex; it is bounded by Egypt, and the deſart of Barca on the north; by the Red-ſea, and Indian ocean on the eaſt; by Anian, and the unknown parts of Africa on the ſouth; and by other unknown countries on the weſt.

ETHIOPIC YEAR. See the article YEAR.

ETHMOIDAL, in anatomy, is applied to one of the common ſutures of the ſkull, which goes round the os ethmoides, from which it derives its name, and which ſeparates it from the bones in contact with it.

ETHMOIDES, is an epithet applied to a bone at the root of the noſe, called alſo os ethmoides. See CRANIUM.

The word is Greek, ηθμοειδης, which is derived from ηθμος, a ſtrainer, and ειδος, form or likeneſs.

ETHNOPHRONES, in church hiſtory, hereties of the ſeventh century, who, profeſſing Chriſtianity, joined thereto all the ceremonies and follies of paganiſm, ſuch as judicial aſtrology, divinations of all kinds, &c. and who obſerved all the feaſts, times, and ſeaſons of the Gentiles.

ETHOPOEIA, or ETHOLOGY, in rhetoric, a draught, or deſcription, expreſſing the manners, paſſions, genius, tempers, aims, &c. of any perſon.

ETYMOLOGY, that part of grammar which explains the derivation of words, in order to arrive at their firſt and primary ſignification.

The word is formed of the Greek, ετυμος, true, and λογος, to ſay. Hence Cicero calls it *notatio* and *verilogium*. Quintilian calls it *originatio*.

A judicious enquiry into etymologies is of conſiderable uſe. The etymologiſt, by ſeeking the true and original reaſon of the ideas affixed to each word and expreſſion, may often furniſh an argument of antiquity for a language from the traces remaining thereof, compared with the ancient uſes. Beſides, etymologies are neceſſary for the thorough underſtanding of a language; for the force of a word is generally better conceived when a perſon knows its origin.

It is objected, however, that the art is altogether arbitrary; but the ſcience is certainly real, and as regular as divers others, and has its ſhare of difficulty: for it is no eaſy matter to go back into the Gauliſh and Britiſh ages, to follow, as it were, by the track, the various imperceptible alterations a language has undergone from the earlieſt ages.

An etymologiſt has need of all the light he can come at to bring down words variouſly diſguiſed in their paſſage, and remark all the changes that have befallen them: and as thoſe alterations have ſometimes been owing to caprice, it is eaſy to take a mere conjecture for a regular analogy; ſo that it is no wonder the public ſhould be prejudiced againſt a ſcience which ſeems to ſtand on ſo precarious a footing. Quintilian has ſhewn that the ancient etymologiſts, notwithſtanding all their learning, often fell, no leſs than the moderns, into very ridiculous deviations.

EVACUANTS, in medicine, are properly ſuch things as diminiſh the animal fluids by throwing out ſome morbid or redundant humour; or ſuch as thin, attenuate, and promote the motion and circulation thereof.

The word is Latin, from *evacuo*, to empty or cleanſe.

EVACUATION, in phyſic, the art of diminiſhing, emptying, or attenuating the humours of the body.

EVANGELISTS, at preſent, is confined to the writers of the four goſpels, St. Matthew, St. Mark, St. Luke, and St. John. The apoſtle Paul, enumerating the ſeveral orders of Chriſtians, according to the gifts beſtowed on them, reckons evangeliſts in the third place, after apoſtles and prophets, and before paſtors and teachers.

The word is formed from the Greek ευαγγελος, which is derived from ευ, well, and αγγελος, an angel, or meſſenger.

EVANID, a name given by ſome authors to ſuch colours as are of no long duration, as thoſe in the rainbow, in clouds before and after ſun-ſet, &c.

Evanid colours are alſo called fantaſtical and emphatical colours.

EVANTES, in antiquity, the prieſteſſes of Bacchus; thus called, by reaſon that in celebrating the orgia, they ran about as if diſtracted, crying, *evan, evan, ohé evan.*

EVAPORATION, in philoſophy, is the act by which the moiſture in any body is exhaled or evaporated, either by the heat of the ſun, or by means of fire.

The word is Latin *evaporatio*, and derived from *e*, out of, and *vapor*, a vapour.

EVAPORATION, in chemiſtry, is that operation whereby the more aqueous and volatile parts of fluids are evaporated or drove away in vapours, in order to render the remaining part of a higher conſiſtence than before.

EVASION, among lawyers, denotes a cunning or ſubtle endeavouring to ſet aſide, or eſcape the puniſhment of, the law.

EVATES, a branch or diviſion of the druids, or ancient Celtic philoſophers. Strabo divides the Britiſh and Gauliſh philoſophers into three ſects, bards, evates, and druids; but Marcellus and Hornius reduce them all to two ſects, viz. the bards and druids. See the articles BARDS and DRUIDS.

EUBAGES, an order of prieſts, or philoſophers, among the ancient Celtæ, or Gauls: ſome will have the eubages to be the ſame with the druids, and ſaronidæ of Diodorus; and others, that they were the ſame with what Strabo calls evates.

EUCHARIST, the ſacrament of the Lord's ſupper.

The word is Greek *ευχαριστια*, derived from *ευ*, well, and *χαρις*, favour or thanks.

In the beginning of Chriſtianity the whole church met together at the Lord's table, generally at their public aſſemblies, on Sundays always, beſides other days, eſpecially Saturday; on which day all the churches in the world, except Rome and Alexandria, uſed to celebrate their ſacrament. At firſt they adminiſtered the euchariſt every day; afterwards four times a week: but as the power of religion declined, it fell to thrice a year, as Chriſtmas, Eaſter, and Whitſuntide.

EUDISTS, a congregation of miſſionary prieſts, in France, aſſociated under the name and title of Jeſus and Mary.

EUDOXIANS, in church-hiſtory, a branch of Arians. See ARIANS.

EVE, the ſame with vigil. See VIGIL.

EVECTION *of the Moon*, the ſame with libration. See the article LIBRATION.

EVERARD's *Sliding-Rule*. See SLIDING-RULE.

EVER-GREEN, in gardening, a ſpecies of perennials, which continue their verdure, leaves, &c. all the year: ſuch are hollies, phillyria's, lauruſtinus's, bays, pines, firs, cedars of Lebanon, &c.

EVERLASTING-FLOWER, in botany, a name given to the amaranthoides.

EVERLASTING-PEA, a genus of plants, otherwiſe called lathyrus.

EVESDROPPERS, in law, perſons who ſtand under the eves, walls, or windows of a houſe by day or by night, to liſten after news, and carry it to others, thereby raiſing ſtrife and contention in the neighbourhood. They are puniſhable in the court-leet, or quarter-ſeſſions.

EUGENIA, the ſilver-tree, in botany, a genus of plants, the corolla of which conſiſts of four oblong, obtuſe, concave petals, twice as large as the cup: the fruit is a quadrangular, coronated drupe, containing only one cell: the ſeed is a roundiſh, ſmooth nut.

EVICTION, in law, ſignifies a recovery of lands, or tenements by law.

EVIDENCE. See CERTITUDE.

EVIDENCE, in law, is the teſtimony a perſon gives in a court upon any fact of which he has a perſonal knowledge.

EVIL, *Malum*, in philoſophy, &c. is either moral or natural.

Moral evil is the diſagreement between the actions of a moral agent, and the rule of thoſe actions, whatever it be.

Moral good and evil coincide with right and wrong, ſince that cannot be good which is wrong, nor that evil which is right.

Natural EVIL, whatever deſtroys, or any way diſturbs the perfection of natural beings: ſuch are blindneſs, diſeaſes, death, &c.

King's EVIL, in medicine, the ſame with the ſcrophula. See the article SCROPHULA.

EUMENIDES, furies, in antiquity. See the article FURIES.

EUNOMIANS, in church hiſtory, Chriſtian heretics in the fourth century. They were a branch of Arians, and took their name from Eunomius, biſhop of Cyzicus, who was inſtructed by Ætius in the points which were then controverted in the church, after having at firſt followed the profeſſion of arms. Eunomius ſo well anſwered the deſigns of his maſter, and declaimed ſo vehemently againſt the divinity of the Word, that the people had recourſe to the authority of the prince, and had him baniſhed; but the Arians obtained his recal, and elected him biſhop of Cyzicus. The manners and doctrines of the Eunomians were the ſame with thoſe of the Arians.

EUNUCHS, in church hiſtory, a ſect of heretics in the third century, who were mad enough to caſtrate, not only thoſe of their own perſuaſion, but even all others that they could lay hold of: they took their riſe from the example of Origen, who, miſunderſtanding the following words of our Saviour, — "And eunuchs who made themſelves eunuchs for the kingdom of heaven," caſtrated himſelf.

EVOLUTE, EVOLUTA, in the higher geometry, a curve firſt propoſed by Mr. Huygens, and ſince much ſtudied by the later mathematicians.

The evolute is a curve, ſuppoſed to be evolved or opened; and which, in opening, deſcribes other curves.

If a thread FCM (plate LXIV. *fig.* 4.) be wrapped or wound about the curve BCF, and then unwound again, the point M will deſcribe the curve AMM, which Mr. Huygens, the inventor, calls a curve deſcribed from evolution; and the curve BCF is the evolute, the part MC of the thread being called the radius of the evolute. 1. When the point B falls in A, the radius MC of the evolute is equal to the arch BC; but, if not, to AB + the arch BC. 2. The radius of the evolute CM is perpendicular to the curve AM. 3. Becauſe the radius MC of the evolute continually touches it, it is evident, from the generation of the curve deſcribed from the evolution, that it may be deſcribed through innumerable points, if the tangents in the parts of the evolute are produced until they become equal to their correſponding arches. 4. The evolute of the common parabola is a parabola of the ſecond kind, whoſe parameter is $\frac{27}{16}$ of the common parabola. 5. The evolute of a cycloid is another cycloid equal and ſimilar thereto. 6. All the arches of evolute curves are rectifiable, if the radii of the evolute can be expreſſed geometrically.

EVOLUTION, in arithmetic and algebra, implies the extraction of the roots of powers. See EXTRACTION.

The word is Latin, *evolutio*, formed of the prepoſition *e*, out; and *volvo*, I roll, or wind: q. d. an unwinding, or unrolling.

EVOLUTION, in the art of war, the motion made by a body of troops, when they are obliged to change their form and diſpoſition, in order to preſerve a poſt, occupy another, to attack an enemy with more advantage, or to be in a condition of defending themſelves the better.

Naval EVOLUTIONS, the divers movements performed by fleets or ſquadrons at ſea, in ranging or forming into ſuch lines or poſitions as may be thought moſt proper or expedient, either by engaging, defending, or retreating, to the greateſt advantage. This term ſeems to have been firſt applied to the manœuvres of fleets by P. L'Hoſte.

The different expeditions an admiral may be ordered upon, as well as the various circumſtances that occur in conducting a fleet, firſt gave riſe to the ſeveral lines or orders of which it is formed, whoſe motions form what is called evolutions. See the articles LINE, DIVISION, and SQUADRON.

Thoſe who have any knowledge of the marine will undoubtedly allow, that the art of naval evolution is abſolutely

lutely neceſſary; ſince this art conſiſts only in the manner of regulating the ſeveral movements of a naval armament. Without this art it reſembles that of the moſt barbarous nations who have not the leaſt knowledge of war, who act without any other rule or order than what their wild ungoverned imaginations ſuggeſt to them, or chance throws in their way. Without a proper knowledge of the art of evolutions, an admiral will diſpoſe of his fleet very imperfectly, whether in oppoſing the enemy, cutting them off, doubling upon, avoiding or chacing them to the greateſt advantage; for all theſe things require that an admiral ſhould move each part of his fleet, as the mind moves the different members of the human body.

EUONYMUS, the ſpindle-tree, in botany, a genus of plants, the corolla of which conſiſts of four ovated, plane, and patent petals, longer than the cup: the fruit is a ſucculent, coloured capſule, of a quadragonal figure, formed of four valves, terminating in four points, and forming four cells: the ſeeds are ſingle, of an oval figure, and covered with a calyptra.

EUPATORIUM, hemp-agrimony, in botany, a genus of plants, the compound corolla of which is uniform and tubuloſe; the hermaphrodite flowers are equal; the partial flower is infundibuliform: the fruit is naked, only covered by the cup: the ſeeds are oblong, and crowned with a plumoſe down.

EUPHEMISM, *ευφημισμος*, in rhetoric, a figure which expreſſes things in themſelves diſagreeable and ſhocking; in terms implying the contrary quality.

EUPHONY, *ευφωνια*, in grammar, an eaſineſs, ſmoothneſs, and elegance in pronunciation.

Euphony is properly a figure, whereby we ſuppreſs a letter that is too harſh, and convert it into a ſmoother, contrary to the ordinary rules: of this there are abundance of examples in all languages.

EUPHORBIUM, a gummy reſinous concrete juice, exuding from an oriental, prickly, lacteſcent ſhrub of the ſame name.

There are many different ſpecies of the Euphorbium plant, natives of Africa, and preſerved in Europe in the hot-houſes of the curious. Whether the officinal gummy reſin of that name is extracted from one particular ſpecies, or from ſeveral promiſcuouſly, is uncertain. It is commonly ſuppoſed to be the produce, chiefly of that called by Breynius *Euphorbium cerei effigie, &c.* Euphorbium reſembling the cereus or torch-thiſtle, with thicker ſtalks armed with long ſpines: what Ray calls the true Euphorbium of the ancients is the ſpecies deſcribed in the *Hortus Malabaricus*, there named Schadidacalli, and by Breynius *Euphorbium Indicum, &c.* that is, Indian Euphorbium, reſembling the opuntia or prickly pear, with a triangular jointed ſtalk.

The juice is extracted by wounding the ſtem in different parts, pieces of ſheep-ſkin being previouſly tied round near the bottom, to prevent its running down upon the ground: the inciſions are made with a long handled inſtrument, that the operator may receive no injury from the cauſtic liquor ſpurting upon the face, &c. The juice concretes into roundiſh, ſemi-tranſparent whitiſh tears, which for the moſt part are internally hollow: theſe are the Euphorbium brought to us. We commonly find bits of the ſtalk, prickles, and ſeeds of the plant intermixed, and not unfrequently ſmall ſtones and ſand. The whitiſh or pale yellowiſh tears are preferred, as being the freſheſt; the browner or darker-coloured they appear, the longer they have been kept.

Euphorbium is in taſte extremely acrimonious: the ſlighteſt touch burns and corrodes the tongue: received in ſmall quantity into the noſe, it occaſions violent ſneezing: the utmoſt caution is requiſite in pulverizing it, to guard the eyes, noſe, and mouth, from the pernicious effects of the fine duſt that flies off.

The acrimony of Euphorbium ſeems to reſide in the more ſubtile parts of the reſin, which are extracted wholly by ſpirit of wine, and almoſt wholly by water, the reſin and gum being nearly in equal proportions.

The extreme acrimony of this drug renders it abſolutely unfit for any internal uſe: ſeveral correctors have indeed been propoſed for abating its virulence, but the beſt of them are not to be truſted to. It is employed only, and that but ſeldom, for external purpoſes; in ſtimulating unguents and plaſters for paralytic limbs, carious bones, and beginning ſchirrous tumours. Some have ventured on a minute portion of it, mixed with other powders, as an errhine, in obſtructions of the noſtrils, and mucous diſorders of the head; a practice by no means adviſeable, as we are in no want of medicines for theſe purpoſes, equally effectual, and far more ſafe.

EUPHRASIA, eye-bright, in botany, a genus of plants, the corolla of which conſiſts of a ſingle ringent petal; the tube is of the length of the cup; the upper-lip is concave and emarginated; the lower one is patent, and divided into three ſegments: the fruit is an ovato-oblong, compreſſed capſule, forming two cells: the ſeeds are numerous, very ſmall, and of a roundiſh figure.

This plant is an ophthalmic and cephalic, and good for a weak memory.

EUROPE, the leaſt of the four grand diviſions of the earth, is ſituated between the 36th and 72d deg. north latitude; and between the 10th degrees weſt long. and 65th eaſt long. being about 3000 miles long from north to ſouth, and 2500 miles broad from eaſt to weſt. It is bounded by the Frozen ocean on the north; by Aſia on the eaſt; by the Mediterranean, which ſeparates it from Africa, on the ſouth; and by the Atlantic ocean on the weſt.

Europe is commonly ſubdivided into three grand diviſions, north, middle, and ſouth. The north or upper diviſion comprehends Ruſſia or Muſcovy, Sweden, Denmark, and Norway, and the iſlands of Britain, Iceland, Greenland, and thoſe of the Baltic. The middle diviſion contains Poland, Germany, and the hereditary dominions of the houſe of Auſtria, the Low Countries, or Netherlands, and France. The ſouthern diviſion comprehends Turky in Europe, the ancient Greece chiefly, Switzerland, Italy, Spain, and Portugal, and the iſlands of Sicily, Sardinia, Corſica, Majorca, Minorca, Ivica, and thoſe of the Archipelago.

EURYTHMY, in architecture, ſculpture, painting, &c. is a kind of majeſtic appearance, an inexpreſſible elegance and eaſineſs in the compoſition of all the members of a body, building, or picture, that reſults from their fine proportion and correſpondence with each other.

The word is Greek, *ευ*, eaſily, and *ρυθμος*, number, order.

EUSEBIANS, a name given to the Arians. See the article ARIANS.

EUSTATHIANS, the ſame with the catholics of Antioch, in the fourth century, ſo called from their refuſing to acknowledge any other biſhop beſide St. Euſtathius, who was depoſed by the Arians.

EUSTYLE, in architecture, is a ſort of building in which the pillars are placed at the moſt convenient diſtance one from another, the intercolumniations being all juſt two diameters and a quarter of the column, except thoſe in the middle of the face, before and behind, which are three diameters diſtant.

The word is Greek *ευστυλος*, and derived from *ευ*, proper, and *στυλος*, a column.

EUTYCHIANS, in church hiſtory, heretics in the fifth century, who embraced the errors of the monk Eutyches, maintaining that there was only one nature in Chriſt. The divine nature, according to them, had ſo entirely ſwallowed up the human, that the latter could not be diſtinguiſhed; inſomuch that Jeſus was merely God, and had nothing of humanity but the appearance. This herely was condemned in a council held at Conſtantinople in 448, which ſentence was confirmed by the general council of Chalcedon, in 451.

EWE, the Engliſh name of a female ſheep. See the article SHEEP.

EWRY, in the Britiſh cuſtoms, an office in the king's houſhold, which has the care of the table linen, of laying the cloth, and ſerving up water, in ſilver ewers, after dinner.

EXACERBATION, the ſame with paroxyſm. See the article PAROXYSM.

EXACTION,

A New & Accurate MAP of EUROPE, from the Sieur Robert's ATLAS, with Improvements

NORTHERN OCEAN
Arctic Circle
WESTERN OCEAN
ENGLISH CHANNEL
BAY OF BISCAY
MEDITERRANEAN SEA
BLACK SEA
CASPIAN SEA
WHITE SEA
Iceland
Faro Is.
Shetland Is.
Orkney Is.
Western Isles
IRELAND
Dublin
Edinborough
Stockholm
Finland
St. Petersburg
Moscow
Archangel
Wardhus
Tornea
Torneo
Lapland
SWEDEN
RUSSIA
NORTH SEA or GERMAN OCEAN
DENMARK
PRUSSIA
Warsaw
POLAND
GERMANY
Leipsic
Dresden
Berlin
Hamburg
Amsterdam
Rotterdam
Paris
FRANCE
SWITZERLAND
Vienna
Buda
HUNGARY
LITTLE TARTARY
Azof
Astrachan
TURKEY IN EUROPE
Constantinople
Adrianople
Belgrade
Venice
Rome
Naples
Corsica
Minorca
Majorca
Sicily
SPAIN
PORTUGAL
Lisbon
Madrid
Cadiz
Gibraltar
Str. of Gibraltar
Algiers
Tunis
Tripoli
Barbary
Morocco
Fez
Mequinez
Tafilet
Tugurt
Candia
Cyprus
Rhodes
Smyrna
Aleppo
Damascus
Jerusalem
Natolia
Adana
EUROPE
TURKEY IN ASIA

5 IA 59

EXACTION, in law, a wrong done by an officer, or a perſon in pretended authority, in taking a reward or fee that is not allowed by law.

EXÆRESIS, in ſurgery, is the removing any thing hurtful or ſuperfluous out of the body.

The word is Greek, from ἐξ, out of, and αἱρεω, to take.

EXAGGERATION, in rhetoric, is a kind of hyperbole, whereby things are augmented or amplified, by ſaying more than the truth, either as to good or bad.

The word is Latin, *exaggeratio*, and derived from *ex* and *agger*, a bank.

EXALTATION, in aſtrology, is a dignity which a planet acquires in certain ſigns or parts of the zodiac, which dignity is ſuppoſed to give it an extraordinary efficacy and influence. Thus the 15° of Cancer is the exaltation of Jupiter, according to Albumazar; that of the ſun is the 19° of Aries, and that of the moon is in Taurus.

EXAMINATION, in ſea affairs, a ſort of naval catechiſm, compoſed of various queſtions put by a committee of veteran ſea-captains to the midſhipmen, to diſcover whether they are ſufficiently qualified in the knowledge of their profeſſion to become a lieutenant.

EXAMINERS, in chancery, two officers of that court, who examine, upon oath, witneſſes produced in cauſes depending there, by either the complainant or defendant, where the witneſſes live in London, or near it. Sometimes parties themſelves, by particular order, are examined.

EXANTHEMA, in medicine, is a puſtule or eruption on the ſkin, as the meaſles, ſmall-pox, &c. and is generally attended with a fever, and terminates in a raſh.

The word is Greek, ἐξανθημα, which is derived from ἐξ, out of, and ἀνθεω, to flower.

EXARCH, ἐξαρχος, in antiquity, an officer ſent by the emperors of the Eaſt, into Italy, in quality of vicar, or rather præfect, to defend that part of Italy which ſtill continued under their obedience, and particularly the city of Ravenna, againſt the Lombaids.

EXCELLENCY, a title anciently given to kings and emperors, but now to ambaſſadors, and other perſons, who are not qualified for that of highneſs, and yet are to be elevated above the other inferior dignities.

EXCENTRIC, or ECCENTRIC, in geometry, are circles that have not the ſame center.

The word is Latin, *excentricus*, and is derived from *ex*, out of, and *centrum*, a center.

The excentric circle in the Ptolemaic ſyſtem is alſo called deferent, becauſe it ſeems to carry the planet round in its circumference. The orbit of the ſun is excentric with regard to the terreſtrial globe; that is, it does not revolve round the ſame center.

EXCENTRIC, in the new aſtronomy; inſtead of the excentric circles in the Ptolemaic ſyſtem, the moderns have ſuppoſed oval or elliptic ones, in order to explain the apparent irregularity of the planets, and their different diſtances with regard to the earth.

EXCENTRIC *Equation*, in the old aſtronomy, is an angle made by a line drawn from the center of the earth, and another drawn from the center of the excentric to the body or place of any planet; it is the ſame with the proſtaphæreſis, and is equal to the difference, accounted in an arch of the ecliptic, between the ſun's or planet's real and apparent place.

EXCENTRIC *Place of a Planet* is the true point of the orbit upon which the circle of inclination coming from the place of a planet in its orbit, falls thereon at right-angles. Mars is very excentric with regard to the ſun.

Anomaly of the EXCENTRIC. See the article ANOMALY.

EXCENTRICITY, or ECCENTRICITY, in the Ptolemaic aſtronomy, is that part of the linea apſidum lying between the center of the earth and of the excentric; or it is that circle which the ſun is ſuppoſed to move in about our earth, and which has not the earth exactly for its center. And this the ancients found muſt be ſuppoſed, becauſe the ſun ſometimes appears large, and then it is neareſt to us; and ſometimes ſmaller, and then it is farther off.

EXCENTRICITY *of the Earth*, in the new aſtronomy, is the diſtance between the focus and the center of the earth's elliptic orbit.

Mr. Whiſton, in his *Prælect. Aſtron.* page 90, ſhews the method of finding this from the apparent motion of the ſun, compared with the two extremes of the apſides; for ſince the true velocity of the earth in her aphelion and perihelion is in a reciprocal ratio of her diſtances from the ſun; and that the apparent and angular velocity is in a duplicate ratio of her diſtances reciprocally; from the apparent difference of theſe two velocities, the difference of the diſtances, or the double excentricity, will eaſily be known. The excentricity of the whole diſtance is, at a mean, about a ſixtieth part, or more accurately .01786.

EXCEPTION, in law, denotes a ſtop or ſtay to an action, and is either dilatory or peremptory, in proceedings at common law; but in chancery it is what the plaintiff alleges againſt the ſufficiency of an anſwer, &c.

EXCEPTION *to Evidence* is where a demurrer is offered in any civil cauſe, for the inſufficiency of the evidence given, and the court does not agree to it; in ſuch caſe, the court, upon requeſt, is to ſeal a bill of exceptions to the evidence, which may be heard on a writ of error.

EXCEPTIONS *in Deeds and Writings*, is the ſaving a particular thing out of a general one granted by deed; as a room, ſhop, or cellar, out of a houſe; a field, or timber trees, out of land, &c.

EXCERPTA, in matters of literature. See EXTRACT.

EXCESS, in arithmetic and geometry, is the difference between any two unequal numbers or quantities, or that which is left after the leſſer is taken from or out of the greater. See SUBTRACTION.

EXCHANGE, in a general ſenſe, implies a contract or agreement whereby one thing is given or exchanged for another.

EXCHANGE, in commerce, is the trade of money carried on between one place and another, by means of bills of exchange.

The things neceſſary to be conſidered in exchange are; 1. The real monies of each country or trading town. 2. Their imaginary monies. 3. The par of exchange.

1. By real money is meant a certain quantity of metal coined by the authority of a ſtate, and current at a certain value, by virtue of that authority.

2. By imaginary money we are to underſtand all denominations uſed to expreſs ſuch ſums as have no real ſpecies, or coin, of the value of any of theſe denominations.

1. The real monies of England.

Gold coins.	£.	s.	d.
A guinea, valued at	1	1	0
A half guinea	0	10	6
A quarter guinea	0	5	3
Silver coins.			
A crown, valued at	0	5	0
A half crown	0	2	6
A ſhilling	0	1	0
A ſixpence	0	0	6

Copper coins.

The half-penny, and the farthing, four of which make a penny.

Imaginary monies.

The pound, equal to twenty ſhillings.
The mark, equal to thirteen ſhillings and four pence.
The angel, equal to ten ſhillings.
The noble, equal to ſix ſhillings and eight pence.
The penny, equal to four farthings.

2. The real monies of Holland.

Gold coins.	Florins
A ducat, or ducatoon, valued at	20
A ſovereign	15
A roſe noble	11

Silver and copper coins.	Stivers
A ducatoon, valued at	63
A dric gulden	60
A rix-dollar	50
A crown	40
A dollar	30
A guld florin	28
A ſchilling or ſhilling	06
A ſtiver	01

Imaginary monies.

The guilder, or florin, of twenty ſtivers, or 240 groots.

The pound Flemiſh, of twenty ſhillings, or ſix guilders.

The groot, or penny Flemiſh, of half a ſtiver, or eight pfennicks.

The pfennick, or pfenning, or denier, $\frac{1}{16}$ of a ſtiver.

At Amſterdam, Rotterdam, Middleburg, &c. they keep their accounts either in guilders, ſtivers, and pfennicks, or pounds, ſhillings, and pence Flemiſh; which are divided as ours, viz. their pound into twenty ſhillings, and their ſhilling into twelve pence.

They exchange with London upon the pound ſterling, giving for it, when at par, 10 guilders; or, which is the ſame thing, thirty-three ſhillings and four pence Flemiſh.

The courſe of exchange runs between thirty and thirty-eight ſhillings Flemiſh per pound ſterling.

In Hamburgh and Antwerp too, they keep their accounts and exchange with London, in the ſame manner as with Holland.

London exchanges alſo with Denmark, Norway, Sweden, Muſcovy, Germany, Switzerland, Savoy, &c. but it is commonly done by the way of Hamburgh, Amſterdam, or Antwerp.

3. The real monies of France.

Gold coins.	Livres
Double louis d'or	22
Louis d'or	11
Half louis d'or	05 $\frac{1}{2}$

Silver coins.

Ecu or crown	3
Half ecu	1 $\frac{1}{2}$

They have alſo a $\frac{1}{3}$ ecu and $\frac{1}{10}$ ecu.

Braſs coin.

The only braſs coin is the ſol, twenty of which make a livre.

Copper coins.

The liard or farthing, four of which make a ſol.

The denier, twelve of which make a ſol.

The double, which was coined for a double denier, but paſſes now for a liard.

Imaginary monies.

The piſtole equal to ten livres.

The livre equal to twenty ſols, or $\frac{1}{3}$ of an ecu.

At Paris, Lyons, Rouen, &c. they keep their accounts in livres, ſols, and deniers; and exchange upon the ecu, or crown; the par of which, in ſterling money, is four ſhillings and ſixpence.

But it is to be obſerved, that the kings of France often raiſe the ſpecies of the kingdom, to rates conſiderably higher than thoſe for which they were at firſt coined, and conſequently far above their intrinſic value: ſo that a crown in ſpecie will paſs at four, five, or ſix livres. And three ſuch livres are ſtill named an ecu, or crown, though of a far leſs value than the ecu blanc, or white crown, that is, a crown in ſpecie. Hence it happens that the exchange is very variable, and falls low in proportion to the riſing of the French money above the intrinſic worth of the ſpecies.

The courſe runs between twenty-five and forty pence ſterling per crown, or between twenty and thirty livres per pound ſterling.

N. B. The French add the term tournois to their money, to diſtinguiſh it from the money of other nations, in the ſame manner as the Engliſh add the word ſterling to theirs.

The money of Spain is of two ſorts, viz. of plate and of bullion; the plate-money is of good ſilver, never changes its price, and is reckoned more than twenty per cent. better than the money of bullion, which is a mixture of ſilver and braſs, and as often varying in its price. In many places they buy and ſell in rials of bullion, but when they ſtate the accounts in their books, they commonly reduce them, by an allowance of ſo much per cent. to rials of plate.

4. The real and imaginary monies of Spain.

Gold coins.	Mervadies
A piſtole valued at four peſos, or pieces of eight, or at	1088
An half piſtole, at two peſos, or	544

Silver coins.

A peſo, or piece of eight, $\frac{8}{8}$ at	272
A rial, at	34

A mervadie is a ſmall piece of braſs or copper, five of which and about $\frac{1}{17}$, are, in value, equal to an Engliſh penny.

The imaginary ducat, in exchange, is valued at 375 mervadies, but in buying and ſelling it is only accounted 374.

In Madrid, Seville, &c. they keep their accounts in rials and mervadies, and exchange upon the piece of eight, the par of which, with London, is four ſhillings and ſixpence; but the courſe of exchange runs between fifty-two pence and ſeventy-two pence ſterling.

5. The real monies of Portugal.

	Rees.
Broad ducat of gold, valued at	1000
Double piſtole	4000
Piſtole	2000
Half-piſtole, or mil-ree	1000
Stamped patacoon	600
Current patacoon	500
Stamped cruſade	500
Current cruſade	400
Stamped piſo	480
Teſton	100

There are alſo the fractions of a teſton, at 80, 60, 40, 20, and 10 rees, which are of a mixed metal, compoſed of ſilver and braſs.

There are ſeveral other ſpecies in Portugal; ſuch as the moidore, a gold coin, valued at twenty ſeven ſhillings ſterling; the John, or Joannes, which is alſo gold, worth thirty-ſix ſhillings; the half Joannes and quarter Joannes; as alſo the double Joannes, valued at three pound twelve ſterling, &c.

In Liſbon, Oporto, &c. they keep their accounts in rees, and exchange in the half piſtole, or mil-ree; the par of which is about ſix ſhillings and eight-pence half-penny ſterling; but the courſe of exchange runs commonly betwixt fifty and eighty-pence ſterling per mil-ree.

6. The ſpecies or coins of Italy are very numerous, and would require more room than can be ſpared in this place: paſſing, therefore, the real monies, we ſhall only ſhew the manner of exchange between London and Genoa, Leghorn, Milan, Venice, and Rome.

At Genoa, they keep their accounts in lires, ſoldi, and deniers; reckoning twelve deniers to a ſoldi, and twenty ſoldi to a lire; and exchange upon the peyzo, of five lires, whoſe par is about four ſhillings and ſixpence ſterling: and the courſe of exchange is from forty-ſix to ſeventy-ſix and ſeventy eight pence per peyzo.

At Milan they keep their accounts in the ſame manner, but exchange upon the ducat, of five lires fifteen ſoldi. The courſe of exchange runs from fifty-five to ſixty-ſeven pence ſterling per ducat.

At Venice, merchants keep their accounts in lires, ſoldi, and pichioli; reckoning twelve pichioli to the ſoldi, and twenty ſoldi to the lire. But the bank reckons by ducats and groſſes. The ducat conſiſts of twenty-four groſſes. They exchange upon the ducat; the par of which is four ſhillings and eight-pence halfpenny ſterling, and the courſe is from fifty-two to ſixty-nine pence ſterling per ducat bancho.

Rome exchanges with London upon the ſcudi, whoſe par is about five ſhillings and ſixpence ſterling, and the courſe is from fifty-five to ſixty-five pence ſterling per ſcudi.

7. In

7. In the plantations of America, they reckon their monies, and keep their accounts, the ſame way as they do in Britain. But their money is of far leſs value: for bills upon London from any of the Caribbee-Iſlands are uſually charged with 25 per cent. in favour of London; that is, if St. Chriſtopher's, Montſerrat, Antigua, &c. ſhould draw upon London 100 l. the merchants of London charge the drawer with 125 l. for the ſaid 100; and for Jamaica, Virginia, Maryland, Penſilvania, New-England, &c. the difference is commonly greater.

London exchanges alſo with Ireland; but the courſe of exchange varies according to the demand of money or bills; it is commonly between four and fifteen per cent. loſs to Ireland, or in favour of London.

The end and deſign of Exchange is, to avoid the risk, and ſave the expence of transferring money.

The conſequence is, that bills of exchange repreſent money ſo effectually, that there is no difference between the one and the other. An example will ſet theſe propoſitions in a clearer light.

Let us ſuppoſe Peter of London debtor to Paul of Paris for goods received, and, at the ſame time, that Anthony of Paris has bought of James of London goods of an equal value: if the two creditors, Paul of Paris and James of London, exchange their debtors, a tranſfer of money is needleſs. Let Peter of London pay to James of London the ſum he owes to Paul of Paris, and let James for the ſaid ſum transfer to him, by an order in writing, that which he has at Paris in the hands of Anthony. Peter, the proprietor of this order, will transfer it to Paul his creditor at Paris, and Paul, on preſenting it to Anthony, will receive caſh for it.

If no merchant of Paris had owed money in London, Peter would have been under the neceſſity of ſending over money to Paris to pay his debt: or, if James had ſold, at Paris, only to half the value that Peter was indebted there, the half of Peter's debt would have been acquitted, the other half by ſending over the ſpecie.

It is evident, therefore, that exchange ſuppoſes reciprocal debts, that without them it could not exiſt, and that it conſiſts in the exchange of the debtors.

The example propoſed proves alſo, that the object, end, and deſign of exchange, is to ſpare the hazard and expence of transferring money. Let us ſuppoſe the debt between the two 100 l. and value the risk and charges on merchandiſe in trade at 40 l. it is plain each muſt pay 110 l. inſtead of 100 l. without an exchange of debtors.

The conſequence is alſo completely demonſtrated by this example, for the bill of Exchange drawn by James of London, or Anthony of Paris, was ſo effectually the ſign of money, that Paul of Paris, to whom it was ſent, has actually received 100 l. on preſenting it.

For underſtanding the par of exchange, it muſt be obſerved, that it has been found convenient, in the fabrication of monies, to mix a certain quantity of baſer metal, called alloy, with the pure gold and ſilver; and the proportion of alloy is different in different kingdoms: and accordingly, the coins are ſaid to be of a different degree of fineneſs; and two coins, though of a different weight, that have an equal quantity of pure gold or ſilver, are ſaid to be at par. And upon a computation it has been found, that the quantity of pure ſilver in an Engliſh crown is as 9 to 10; and therefore the par of the French crown is, in ſterling-money, four ſhillings and ſixpence. In like manner are other coins to be compared, in order to have their par determined.

The cauſes of the alteration of the par of exchange, are the alteration of public credit, and the abundance, or ſcarcity of credits of one country upon another.

A variation in the current coin is an example of the variation which the loſs of public credit makes in the par of exchange: although, at the very inſtant this change was made in the current coin, a new real par of exchange commenced, yet, the public credit declining, on account of the uncertainty of the property and the ſpecie not circulating, what repreſents the ſpecie muſt of courſe be under its value.

The ſecond cauſe of the alteration of the par of exchange, is the abundance or ſcarcity of credits of one country upon another; and this abundance or ſcarcity proceed in general from two cauſes.

One is the neceſſity that obliges the body politic of a ſtate to tranſport large ſums into foreign countries, as in caſe of a war.

The other lies in the proportion of the current mutual debts of private perſons in each ſtate.

The private perſons of two nations may contract two kinds of reciprocal debts.

The inequality of reciprocal ſales will form a firſt kind of debts.

If one of the two nations has a great deal of money at lower intereſt than the other, the rich private perſons in the former nation will buy up all the public ſecurities of the other, becauſe they will receive more intereſt for their money: the product of this intereſt, which muſt be paid every year, forms a ſecond ſpecies of debts: this may be looked upon as the product of a commerce, becauſe the national funds are negotiated; and, if you obſerve attentively, this is not a matter of ſpeculation only; in this caſe and ſeveral others, money is the merchandiſe, and thus theſe two debts belong properly to what is called the balance of trade, and will occaſion an abundance or ſcarcity of the credits of one country upon another.

When two nations would ſettle the balance of their commerce, that is, pay their reciprocal debts, they have recourſe to the exchange of debtors; but if the reciprocal debts are not equal, the exchange of debtors will only pay a part of theſe debts, the ſurpluſage or balance of trade muſt be paid in ſpecie.

The deſign and intention of exchange is to ſave the expence and hazard of tranſporting money; conſequently, every private perſon, before he determines on this method of trade, will ſeek credits on the country where he ſtands indebted.

Theſe credits will be dear in proportion to the difficulty of acquiring them, and conſequently, to have the preference, we are obliged to pay above their real value; if the credits are eaſy to come at, we ſhall pay under their value.

Let us ſuppoſe the merchants of Paris owe the manufacturers of Rouen 20,000 livres, and that the manufacturers of Rouen owe the bankers of Paris 10,000 livres; to ſatisfy theſe demands, we muſt make a bill of exchange for the 10,000 livres, the reciprocal debts between Paris and Rouen, and ſend the other 10,000 livres from Paris to Rouen.

Let us rate the charge and hazard of ſending this ſum at five livres per m. Every merchant in Paris will try to ſave this expence, and will ſeek to purchaſe a credit of a 1000 livres on Rouen; but as theſe credits are ſcarce, and difficult to procure, he will gladly give 1004 livres for a draught of 1000 livres on Rouen, and ſave one livre per m. thus the ſcarcity of bills of exchange on Rouen will lower the price of this exchange four livres per m. under par.

EXCHANGE ſignifies alſo a place in moſt conſiderable trading cities, wherein the merchants, negociants, agents, bankers, brokers, interpreters, and other perſons concerned in commerce, meet on certain days, and at certain times, in order to confer and treat together of matters relating to exchanges, aſſurances, freightments, and other mercantile negociations both by ſea and land.

Theſe aſſemblies are held with ſo much exactneſs, that the abſence of a merchant, &c. makes him ſuſpected of drawing to a failure or bankruptcy, as not being able to ſtand the change.

EXCHANGERS are ſuch as return money by bills of exchanger

EXCHEQUER, in the Britiſh juriſprudence, an ancient court of record, in which all cauſes concerning the revenues and rights of the crown are heard and determined, and where the crown revenues are received.

It took this name from the cloth that covered the table of the court, which was party-coloured, or chequered.

Black Book of the EXCHEQUER, a book containing a deſcription of the court of England in 1175, and its officers, with their ranks, wages, privileges, perquiſites, &c.

&c. alſo the revenues of the crown, both in money and cattle.

EXCISE, a certain duty or impoſt, charged upon liquors, as beer, ale, cyder, perry, malt, &c. and ſeveral other commodities, within the kingdom of Great Britain, and town of Berwick upon Tweed.

The exciſe is one of the moſt conſiderable branches of the king's revenues. It was formerly farmed out, but is now managed for the king by commiſſioners in both kingdoms, who receive the whole product of the exciſe, and pay it into the exchequer. Theſe commiſſioners are nine in number in England, and four in Scotland. The former have a ſalary of 1000 l. a year, the latter 500 l. They are obliged by oath to take no fee or reward, but from the king himſelf; and from them there lies an appeal to five other commiſſioners, called commiſſioners of appeals.

EXCLAMATION, in rhetoric, is an elevation of the voice which expreſſes the vehemence of any paſſion, as ſurpriſe, joy, admiration, indignation, grief, fear, deſire, &c. In Engliſh the interjections o! oh! alas! &c. are generally uſed in exclamation, in Latin oh! heu! ah! vah! &c.

The word is Latin, and derived from *exclamo*, to cry out.

EXCOMMUNICATION, an eccleſiaſtical penalty or cenſure, whereby ſuch perſons as are guilty of any notorious crime or offence are ſeparated from the communion of the church, and deprived of all ſpiritual advantages.

EXCOMMUNICATO CAPIENDO, a writ iſſued from the chancery upon the biſhop's certifying an excommunication.

EXCORIATION, in medicine and ſurgery, the galling or rubbing off of the cuticle, eſpecially of the parts between the thighs and about the anus.

EXCORTICATION, the ſame with barking of trees. See the article BARKING.

EXCREMENT, whatever is diſcharged out of the body of animals, after digeſtion, or whatever is otherwiſe ſuperfluous or noxious in them. Urine and the fæces are the groſs excrements that are diſcharged out of the bladder or belly. Phyſicians likewiſe call excrement the various humours that are ſecreted from the blood through the various ſtrainers in the body, and which ſerve for ſeveral uſes, ſuch as the ſaliva, ſweat, bile, the pancreatic juice, lymph, the ſemen, nails, the hair, the horns and hoofs of animals.

The word is Latin *excrementum*, which is derived from *excreo*, to ſpit or ſpawl.

EXCRESCENCE, in ſurgery, is any ſuperfluous matter that grows preternaturally upon the human or any other body, as wens, warts, or any ſort of ſwelling, particularly a fleſhy tumour.

The word is Latin, *excreſcentia*, which is derived from *excreſco*, to ſhoot or grow out.

EXCRETION, in medicine, is the act of ſeparating excrements, or excrementitious humours, from the aliments or blood.

The word is Latin, *excretio*, which is derived from *ex*, out of, and *creo*, to chooſe.

EXCRETORY, in anatomy, is a term applied to certain little ducts or veſſels which make part of the ſtructure of the glands, being the ſmall tubes through which the humours ſeparated into the glands are diſcharged out of them into ſome convenient receptacle or emunctory.

EXCURSION, in aſtronomy, is uſed in a ſynonimous ſenſe with elongation. See ELONGATION.

EXECRATION, *execratio*, in antiquity, a kind of puniſhment, conſiſting of direful curſes and marks of infamy.

EXECUTION, in a general ſenſe, the act of accompliſhing, finiſhing, or atchieving any thing that is to be done.

EXECUTION, in law, the completing or finiſhing ſome act, as of judgment, deed, &c. and it uſually ſignifies the obtaining poſſeſſion of any thing recovered by judgment of law.

Military EXECUTION, the pillaging or plundering of a country by the enemy's army.

EXECUTOR, in law, a perſon appointed by another's laſt will and teſtament to have the execution of the ſame after his deceaſe, and the diſpoſing of the teſtator's goods and effects according to the intent of the will.

The law accounts an executor one perſon with the party whoſe executor he is; having all the advantages of action, and being ſubject to the ſame actions as the deceaſed.

Hence, as an executor derives his power wholly from the will, he may releaſe a debt, or do any thing as executor, before probate of the will, provided he afterwards proves it: however, to maintain actions for debts, he muſt ſhew the teſtament proved. He may immediately take the goods, or give power to another to ſeize them for him.

A perſon capable of making an executor, either makes one, two, three, or more; and he may appoint that one ſhall be his executor for one year, and another for another. If he appoints executors only for a certain number of years, after they are elapſed, the ordinary may grant adminiſtration of the goods; as he may do, till the power of executors take place. It is alſo obſervable, that where there is no executor, there is properly no will; and where there is no will there can be no executors; but this only regards goods; for where lands in fee are deviſed, it is a good will, though no executor be named therein.

An executor may either accept or refuſe the executorſhip; but after he has accepted the office, he ſhall not refuſe the ſame, nor take it up after refuſal. If any one of the ſeveral executors prove the will, it will ſerve for all; ſo that the reſt may at any time after join with him and intermeddle with the eſtate. When any action is brought, it muſt be in the name of all the executors, notwithſtanding ſome of them may not act; but in any action commenced againſt them, he only that adminiſters is to be ſued. The poſſeſſion of one executor is held to be poſſeſſion of them all; and moſt acts done by or to one, are deemed done by or to all of them.

EXECUTORY, in law, is where an eſtate in fee, that is made by deed or fine, is to be executed afterwards by entry, livery, or writ. Leaſes for years, annuities, conditions, &c. are termed inheritances executory.

EXECUTORY DEVISE, is when the fee by deviſe is veſted in any perſon, and is to be veſted in another upon contingency. In all caſes of executory deviſes, the eſtates deſcend until the contingencies happen.

EXEDRA, in church hiſtory, a name ſometimes given to the ambo. See the article AMBO.

EXEDRÆ, in antiquity, a general name for ſuch buildings as were diſtinct from the main body of the churches, and yet within the limits of the church taken in its largeſt ſenſe.

EXEMPLIFICATION OF LETTERS PATENT, a tranſcript or duplicate of them, made from the inrollment thereof, and ſealed with the great ſeal.

EXEMPTION, in law, a privilege to be free from ſome ſervice or appearance.

EXERCISE is ſuch an agitation of the body as produces ſalutary effects in the animal œconomy.

Exerciſe, Dr. Cheyne obſerves, is indiſpenſably neceſſary to preſerve the body in due plight; without exerciſe the juices will thicken, the nerves relax, the joints ſtiffen; and, on theſe diſorders, chronical diſeaſes and a crazy old age will enſue. The body may be conſidered as a ſyſtem of tubes and glands admirably adapted throughout, as a proper engine for the ſoul to work with. Exerciſe ferments the humours, caſts them into their proper channel, throws off redundancies, and helps nature in thoſe ſecret diſtributions without which the body cannot ſubſiſt in its vigour, nor the ſoul act with chearfulneſs. Had not exerciſe been abſolutely neceſſary for our well-being, nature would not have given ſuch an activity to the limbs of the body, and ſuch a pliancy to every part, as neceſſarily produce thoſe compreſſions, extenſions, dilatations, and all other kinds of motions neceſſary for the preſervation of ſuch a ſyſtem of tubes and glands. And, that we might not want inducements to ſuch an exerciſe of the body, riches and honour, even food and raiment, are not to be come at, without the toil of the hands, and ſweat of the brow.

He farther obſerves, that thoſe organs of the body which

which are moſt uſed, always become the ſtrongeſt. Thus the legs, feet, and thighs of chairmen, the arms and hands of watermen, the backs and ſhoulders of porters, grow thick and ſtrong by uſe. Of all the kinds of exerciſe there is none which conduces ſo much to the health, and is every way accommodated to the body, as that of riding, which is leſs laborious and expenſive of ſpirits than any other. Dr. Sydenham is very laviſh in its praiſes. Dr. Mead too recommends it in the concluſion of his *Monita & Præcepta*.

EXERCISE, in military affairs, is the ranging a body of ſoldiers in form of battle, and making them perform the ſeveral motions and military evolutions with different management of their arms, in order to make them expert therein.

EXERCISES are alſo underſtood of what young gentlemen learn in the academies and riding ſchools, ſuch as fencing, dancing, riding the great horſe, &c.

EXERGUM, among antiquarians, a little ſpace around or without the figures of a medal, left for the inſcription, cypher, device, date, &c.

EXFOLIATION, in ſurgery, the ſcaling of a bone, or its ſeparating into laminæ or leaves.

The word is Latin, *exfoliatio*, and derived from *ex*, and *folium*, a leaf.

EX GRAVI QUERELA, in law, is a writ that lies for the perſon to whom any lands or tenements in fee are deviſed by will, and the heir of the deviſor enters thereon, and detains them from the deviſee.

EXHALATION, in philoſophy, is applied to thoſe dry corpuſcles, as alſo to the pinguious, oleaginous, ſulphureous particles or effluvia, that are ſeparated from hard, earthly, fatty, bodies, particularly the earth itſelf, either by the heat of the ſun, the agitation of the air, or ſome other cauſes; and being emitted upwards, to a certain height in the atmoſphere, there mix with the vapours, which properly are thoſe moiſt fumes that are raiſed from water and other liquid bodies, and help to form clouds, which return back in dew, miſt, rain, ſnow, hail, &c.

The word is Latin, *exhalatio*, which is derived from *exhalo*, to breathe, or ſteam out.

The nitrous and ſulphureous exhalations are the chief matter of which thunder, lightning, dew, and other meteors are generated in the air. According to Sir Iſaac Newton, true and permanent air is formed from the exhalations raiſed from the hardeſt and moſt compact bodies.

EXHAUSTED RECEIVER, a glaſs, or other veſſel, out of which the air hath been drawn by means of the air-pump. See the article AIR-PUMP.

EXHAUSTIONS, in mathematics, is a method in frequent uſe among the ancient mathematicians, Euclid, Archimedes, &c. that proves the equality of two magnitudes, by a deduction ad abſurdum, in ſuppoſing that, if one be greater or leſs than the other, there would follow an abſurdity: this is founded on what Euclid ſays in his tenth book, namely, "That thoſe quantities whoſe difference is leſs than any aſſignable one, are equal;" for if they were unequal, be the difference never ſo ſmall, yet it may be ſo multiplied, as to become greater than either of them; if not ſo, then it is really nothing. This he aſſumes in the proof of the firſt propoſition of book ten, which is, "That if from the greater of two quantities you take more than its half, and from the remainder more than its half, and ſo continually, there will at length remain a quantity leſs than either of thoſe propoſed."

On this foundation they demonſtrate, that if a regular polygon of infinite ſides be inſcribed in, or circumſcribed about a circle, the ſpace that is the difference between the circle and the polygon will, by degrees, be quite exhauſted, and the circle be equal to the polygon.

EXHIBIT, in law, is where a deed, or other writing, being produced in a chancery ſuit, to be proved by witneſſes, the examiner, or commiſſioner appointed after the examination of any ſuch, certifies on the back of the deed, or writing, that the ſame was ſhewn to the witneſs, at the time of his examination, and by him ſworn to.

EXHIBITION, a benefaction ſettled for the benefit of ſcholars in the univerſities, that are not on the foundation.

EXHIBITION was anciently an allowance for meat and drink, ſuch as the religious appropriators made to the poor depending vicar.

EXHORTATION, in rhetoric, differs only from ſuaſion, as being more directly addreſſed to the paſſions.

EXIGENT, in law, a writ which lies where the defendant in a perſonal action cannot be found, nor any effects of his within the county, by which he may be attached or diſtrained.

EXIGENTERS, four officers in the court of Common-Pleas, who make all exigents and proclamations in all actions where proceſs of outlawry lies.

EXILIUM, in law, ſignifies a ſpoiling; but ſeems to be reſtrained to the injury done to tenants by altering their tenure, ejecting them, &c.

EXISTENCE, that whereby a thing has an actual eſſence, or is ſaid to exiſt, or be.

The word is Latin, and derived from *exiſto*, to be, or exiſt.

It has been a ſubject of great diſpute, whether eternal bodies have any exiſtence but in the mind; that is, whether they really exiſt, or exiſt in idea only. The former opinion is ſupported by Mr. Locke, and the latter by Dr. Berkeley.

Thoſe who deſire to ſee the arguments brought by thoſe learned authors, we refer to Locke's Eſſay on Human Underſtanding, and Berkeley's Princip. of Human Knowledge.

EXIT, *Exitus*, in law, properly ſignifies iſſue, or offſpring; but is alſo applied to iſſues, annual rents, and profits of lands.

EXIT, in a theatrical ſenſe, the action of a player in going off the ſtage, after he has played his part.

EXODIUM, in the ancient Greek drama, one of the four parts or diviſions of tragedy, being ſo much of the piece as included the cataſtrophe and unravelling of the plot, and anſwering nearly to our fourth and fifth acts. See EPILOGUE.

EXODIUM, ἔξοδιον, in the Septuagint, ſignifies the end or concluſion of a feaſt.

EXODUS, a canonical book of the Old Teſtament, being the ſecond of the Pentateuch, or five books of Moſes.

It is ſo called from the Greek ἔξοδος, going out, or departure of the children of Iſrael from the land of Egypt; the hiſtory of which is delivered in this book, together with the many miracles wrought on that occaſion.

EX OFFICIO, among lawyers, ſignifies the power a perſon has, by virtue of his office, to do certain acts without being applied to.

EXOMPHALUS, in ſurgery, is a hernia, or kind of rupture, that exhibits a preternatural tumor or protuberance at the navel.

The word is Greek, ἐξομφαλος, and derived from ἐξ, and ομφαλος, the navel.

This rupture is owing to a protruſion of the inteſtine, or omentum, or both of them, at the navel, and rarely happens to be the ſubject of an operation; for though the caſe is common, yet moſt of them are gradually formed from very ſmall beginnings, and if they do not return into the abdomen upon lying down, in all probability they adhere without any great inconvenience to the patient, until ſome time or other an inflammation falls upon the inteſtines, which ſoon brings on a mortification and death; unleſs, by great chance, the mortified part ſeparates from the ſound one, leaving its extremity to perform the office of an anus: in this emergency, however, I think it adviſable to attempt the reduction, if called in at the beginning, though the univerſal adheſion of the ſac and its contents are a great obſtacle to the ſucceſs: the inſtance in which it is moſt likely to anſwer, is, when the rupture is owing to any ſtrain, or ſudden jerk, and is attended with thoſe diſorders which follow upon the ſtrangulation of a gut.

In this caſe, having tried all other means in vain, the operation is abſolutely neceſſary; which may be thus performed: make the inciſion ſomewhat above the tumor, on the left ſide of the navel, through the membrana adi-

pósa; and then emptying the ſac of its water, or mortified omentum, dilate the ring with the ſame crooked knife, conducted on your finger; after this, return the inteſtines and omentum into the abdomen, and dreſs the wound without making any ligature, but of the ſkin only. *Sharp's Surgery.*

EXORCISM, a ceremony conſiſting of prayers and conjurations to drive the devil out of perſons poſſeſſed, or for the removal of any danger or diſeaſes from man or beaſt, and to deſtroy vermin and noxious animals.

The word is Greek, ἐξορκισμὸς, and derived from ἐξ, out of, and ὁρκὸς, an oath, or religious ceremony.

The uſe of exorciſm is almoſt as ancient as the church: it makes a conſiderable part of the ſuperſtition of the Romiſh church, for which ſhe hath appointed many ridiculous ceremonies in her rituals. The Romaniſts not only exorciſe demoniacs, but likewiſe houſes and other places which are haunted, as it is called; and this is done in the ſame manner as the exorciſm of perſons.

The ancient heathens practiſed exorciſms, but they were performed by the old women only, who, gadding from houſe to houſe, uſed to ſprinkle them with luſtral water, and lay the ſpirits by certain forms, ſome very whimſical and ridiculous ceremonies. The modern heathens of the Eaſt and Weſt Indies have alſo ſeveral ceremonies among them for caſting out devils and hobgoblins.

EXORDIUM, in rhetoric, is the introduction, preamble, or beginning of any diſcourſe, ſerving to prepare the audience for what is to follow.

The word is Latin; and derived from *ex*, out of, and *ordior*, to begin.

It is a fault into which the ancients have very often fallen, to make an exordium that has no relation to the ſubject in hand: in this the Greeks took more liberty than the Latins. The exordium ſhould be laboured with great care, whence Tully calls it *difficillima pars orationis*. It ſhould be ſimple, and free from too bold metaphors: the ſtile ſhould not be too much raiſed, nor ſhould it run into bombaſt. It was forbidden to make exordiums in the Areopagus at Athens, as it is an indirect and imperceptible manner of prepoſſeſſing the audience. There are two kinds of exordiums, the one juſt and formal, the other vehement and abrupt. In the firſt, the audience is prepared and conducted by due and eaſy ſteps; in the ſecond, the orator breaks out upon his audience at once, as if ſeized with ſome ſudden paſſion. Such is that exordium of Iſaiah, "Hear, O Heavens; and give ear, O Earth!" Abrupt exordiums are the moſt proper on occaſions of extraordinary joy, indignation, &c.

EXOSTOSIS is a preternatural excreſcence of a bone, as often happens in venereal caſes; or rather a protuberance cauſed by a bone's being out of its natural poſition.

The word is Greek, ἐξοστωσις, and derived from ἐξ, off, or out of, and ὀστεον, a bone.

EXOTIC is a term chiefly applied to plants which are foreign, and not of our own growth, particularly thoſe brought from the Eaſt and Weſt Indies: whence the uſe of hot-beds, green-houſes, &c. in order to make them thrive.

The word is Greek, ἐξωτικὸς, and derived from ἐξω, from without, or abroad.

Dr. Liſter, in the Philoſophical Tranſactions, gives an account of exotic diſeaſes, as 1. The plague, which is properly a diſeaſe of Aſia, where it is epidemic. 2. The ſmall-pox, not known in Europe, or even Aſia Minor, or Africa, till a ſpice trade was opened to the remoteſt parts of the Indies, where it rages more cruelly than among us. 3. The griping of the guts, which he takes to be peculiar to the Weſt-Indies, and yearly received from thence; which he ſays is quite different from the tormina ventris of the ancients, and is ſcarce ever known in the midland countries, or far in the north of England.

EXPANSION is the opening and ſtretching out of any body; but generally it ſignifies ſuch an alteration as is made by rarefaction, and the quantity of this Dr. Halley gives in the Philoſophical Tranſactions, N°. 197. The law of the expanſion of air is this, that the ſpaces into which air of a given quantity is compreſſed, are reciprocally proportionable to the compreſſing weights.

The word is Latin, *expanſio*, and derived from *ex*, out of, and *pando*, to ſtretch.

Dr. Gregory proves, in his Aſtronomy, that a globe of air, of but one inch in diameter, if it had ſo great an expanſion as it will have at a ſemi-diameter's diſtance of the earth from it, would fill all the planetary regions far beyond the ſphere of Saturn.

EX PARTE, a term uſed in the court of chancery, where a commiſſion is taken out and executed by one ſide or party only, upon the other party's neglecting or refuſing to join therein.

When both the parties proceed together, it is called a joint commiſſion.

EXPECTANT, in law, ſignifies having relation to, or depending on: thus, where land is given to a man and his wife, and to their heirs, they have a fee ſimple eſtate; but if it be given to them and the heirs of their bodies begotten, they have an eſtate tail, and a fee expectant, which is oppoſed to fee ſimple.

EXPECTORANTS, *Expectorantia*, in medicine, are ſuch things as promote a diſcharge of whatever is offenſive to the lungs and aſpera arteria.

The word is Latin, *expectorans*, and derived from *ex* and *pectus*, the breaſt.

EXPECTORATION, in medicine, is the act of evacuating or bringing up phlegm, or other matter, from the lungs, by coughing, ſpitting, &c.

The word is Latin, *expectoratio*, and derived from *ex* and *pectus*, the breaſt.

EXPEDITATION, in the foreſt law, is the cutting out the balls of dogs fore-feet, in order to preſerve the king's game.

The word is Latin *expeditatio*, and derived from *ex* and *pes*, a foot.

EXPENDITORS, the perſons who diſburſe or expend the money collected by the tax for repairs of ſewers, after the ſame is paid into their hands by the collectors, as ordered by the commiſſioners, and for which they are to render accounts when required.

EXPERIENCE, a kind of knowledge acquired by long uſe, without any teacher. Mr. Locke ſays, that men receive all the materials of knowledge from experience and obſervation. See the article IDEA.

Experience then conſiſts in the ideas of things we have ſeen or read, which the judgment has reflected on, to form itſelf a rule or method.

EXPERIMENT, in philoſophy, is the trial of the reſult or effect of the applications and motions of certain natural bodies, in order to diſcover ſomething of their motions and relations, whereby to aſcertain ſome of their phœnomena, or cauſes.

Torricellian EXPERIMENT. See the article TORRICELLIAN.

EXPERIMENTAL PHILOSOPHY, that philoſophy which proceeds on experiments, which deduces the laws of nature, and the properties and powers of bodies, and their actions upon each other, from ſenſible experiments and obſervations. The buſineſs of experimental philoſophy is to enquire into and to inveſtigate the reaſons and cauſes of the various appearances or phœnomena of nature, and to make the truth or probability thereof obvious and evident to the ſenſes, by plain, undeniable, and adequate experiments, repreſenting the ſeveral parts of the grand machinery and agency of nature.

In our enquiries into nature, we are to be conducted by thoſe rules and maxims which are found to be genuine, and conſonant to a juſt method of phyſical reaſoning; and theſe rules of philoſophizing are by the greateſt maſter in ſcience, ſir Iſaac Newton, reckoned four, which are as follows:

1. More cauſes of natural things are not to be admitted, than are both true, and ſufficient to explain the phœnomena; for nature does nothing in vain, but is ſimple, and delights not in ſuperfluous cauſes of things.

2. And, therefore, of natural effects of the ſame kind, the ſame cauſes are to be aſſigned, as far as it can be done: as of reſpiration in man and beaſts, of the deſcent of ſtones in Europe and America, of light in a culinary fire and in the ſun, and of the reflection of light in the earth and in the planets.

3. The qualities of natural bodies which cannot be increaſed

creaſed or diminiſhed, and agree to all bodies in which experiments can be made, are to be reckoned as the qualities of all bodies whatſoever: thus, becauſe extenſion, diviſibility, hardneſs, impenetrability, mobility, the vis inertiæ, and gravity, are found in all bodies which fall under our cognizance or inſpection, we may juſtly conclude they belong to all bodies whatſoever, and are therefore to be eſteemed the original and univerſal properties of all natural bodies.

4. In experimental philoſophy, propoſitions collected from the phœnomena by induction, are to be deemed (notwithſtanding contrary hypotheſes) either exactly or very nearly true, till other phœnomena occur, by which they may be rendered either more accurate, or liable to exception. This ought to be done, leſt arguments of induction ſhould be deſtroyed by hypotheſes.

Theſe four rules of philoſophizing are premiſed by Sir Iſaac Newton to his third book of the Principia; and more particularly explained by him in his Optics, where he exhibits the method of proceeding in philoſophy, the firſt part of which is as follows.

As in mathematics, ſo in natural hiſtory, the inveſtigation of difficult things, by way of analyſis, ought always to precede the method of compoſition. This analyſis conſiſts in making experiments and obſervations, and in drawing general concluſions from them by induction (i. e. reaſoning from the analogy of things by natural conſequence) and admitting no objections againſt the concluſions, but what are taken from experiments or certain truths: and although the arguing from experiments and obſervation, by induction, be no demonſtration of general concluſions, yet it is the beſt way of arguing which the nature of things admits of, and may be looked on as ſo much the ſtronger, by how much the induction is more general; and if no exception occur from phœnomena, the concluſion may be pronounced generally; but if at any time afterwards, any exception ſhall occur from experiments, it may then be pronounced with ſuch exceptions: by this way of analyſis we may proceed from compounds to ingredients, and from motions to the cauſes producing them; and, in general, from effects to their cauſes; and from particular cauſes to more general ones, till the argument ends in the moſt general: this is the method of analyſis: and that of ſyntheſis, or compoſition, conſiſts in aſſuming cauſes, diſcovered and eſtabliſhed as principles, and by them explaining the phœnomena proceeding from them, and proving the explanations.

EXPERIMENTUM CRUCIS, a capital, leading, or deciſive experiment; thus termed, either on account of its being like a croſs, or direction poſt, placed in the meeting of ſeveral roads, guiding men to the true knowlege of the nature of that thing they are enquiring after; or, on account of its being a kind of torture, whereby the nature of the thing is as it were extorted by force.

EXPIATION, a religious act, by which ſatisfaction, atonement, or amends is made for the commiſſion of ſome crime, the guilt done away, and the obligation to puniſhment cancelled.

Great Day of EXPIATION, an annual ſolemnity of the Jews, upon the tenth day of the month Tiſri, which anſwers to our September.

EXPIATION, in a figurative ſenſe, is applied by divines to the pardons procured to mens ſins, by the merits of Chriſt's death.

EXPIRATION, in phyſic, that part of reſpiration whereby the air is expelled, or driven out of the lungs. See RESPIRATION.

EXPIRATION is alſo uſed for the end of any term agreed upon. It likewiſe ſignifies death.

EXPLOSION is properly applied to the going off of gunpowder, and the report made thereby; but it is frequently uſed to expreſs ſuch ſudden actions of bodies as have ſome reſemblance thereto; ſuch as the ſudden effervеſcence, ebullition, and expanſion that ariſe from the mixture of ſome contrary liquors; as ſpirit of nitre and ſpirit of wine; oil of vitriol and oil of turpentine; oil of vitriol and ſal ammoniac, &c

The word is Latin, *exploſio*, and derived from *explodo*, to drive out.

EXPONENT, in algebra, is a number placed over any power, or involved quantity, to ſhew to what height the root is raiſed, in order to contract the work. Thus, $x^4 = xxxx$. Here 4 is the exponent of the power x, and ſhews that it is involved to the fourth power.

The word is derived from the Latin *expono*, to ſhew, or expound.

EXPONENT *of a Ratio* is the quotient ariſing from the diviſion of the antecedent by the conſequent.

Thus the ratio of 3 to 3 is $1\frac{1}{1}$, and the ratio of 2 to 3 is $\frac{2}{3}$. If the conſequent be unity, the antecedent itſelf is the exponent of the ratio: and, therefore, the exponent of a ratio is to unity, as the antecedent is to the conſequent.

Though the quotient, reſulting from the diviſion of the antecedent by the conſequent, is generally taken for the exponent of the ratio; yet, in reality, the exponent of a ratio ought to be a logarithm. And this ſeems to be more agreeable to Euclid's definition of duplicate and triplicate ratios, than quotients: for 1, 3, and 9, are continual proportionals; now, if $\frac{1}{3}$ be the exponent of the ratio of 1 to 3, and $\frac{1}{9}$, or $\frac{1}{3^2}$, the exponent of the ratio of 3 to 9, and $\frac{1}{2}$ the exponent of the ratio of 1 to 9; and ſince Euclid ſays, "If three quantities are proportional, the ratio of the firſt to the third is ſaid to be the duplicate of the ratio of the firſt to the ſecond, and of the ſecond to the third;" therefore $\frac{1}{2}$ muſt be the double of $\frac{1}{3}$, which is very falſe. But the logarithm of the ratio of 1 to 9, that is, the logarithm of 9 is the double of the ratio of 1 to 3, or 3 to 9, that is, the logarithm of 3. From whence it appears, that logarithms are more properly the exponents of ratios, than numerical quotients; and of this opinion ſeem Dr. Halley, Mr. Cotes, and others.

EXPONENT, in arithmetic, is uſed in the ſame ſenſe as index or logarithm. See INDEX and LOGARITHM.

EXPONENTIAL CALCULUS, the manner of finding the fluxions, and of ſumming up the fluxions of exponential quantities.

The fluxions of exponential quantities may be readily and eaſily found by the help of the logarithmic ſeries; and, in order to this, it is neceſſary to premiſe, that the fluxion of any logarithm is equal to the fluxion of the abſolute number or quantity whoſe logarithm it is, divided by the ſame number. Thus, if $x+1$ repreſent any given quantity, the fluxion of the logarithm of this quantity will be $\frac{\dot{x}}{x+1}$. And the fluxion of the logarithm of $xx+yy$, which is expreſſed after this manner, $\dot{L} : xx+yy$, is $\frac{2x\dot{x}+2y\dot{y}}{xx+yy}$. And by the ſame method may the fluxion to the logarithm of any power of a given quantity be determined.

Therefore the fluxions of the logarithms of any powers of the ſame quantity are to one another, as the exponents of thoſe powers: that is, $\dot{L} : 1+x : \dot{L} : 1+x :: 1 : n$. For $\dot{L} : 1+x = \frac{\dot{x}}{1+x}$, and $\dot{L} : 1+x = \frac{n\dot{x}}{1+x}$. But as $\frac{\dot{x}}{1+x} : \frac{n\dot{x}}{1+x} :: 1 : n$.

Hence we are taught how to find the fluxion of exponential quantities, in the following manner:

Let it be required to find the fluxion of a^x, where a is ſuppoſed to be a conſtant quantity.—Put $a^x = y$, then will $\dot{y}$ be equal to the fluxion of a^x; and, becauſe $a^x = y$, therefore $\dot{L} : a^x = \dot{L} : y$; wherefore $\dot{x}\dot{L} : a = \dot{L} : y$, and conſequently $\dot{x}\dot{L} : a + \dot{x}\dot{L} : a = \dot{L} : y$; but $\dot{L} : a = \frac{\dot{a}}{x} = 1$, becauſe the quantity a is a conſtant quantity, and therefore its fluxion nothing: and $\dot{L} : y = \frac{\dot{y}}{y}$; therefore $\dot{x}\dot{L} : a = \frac{\dot{y}}{y}$; and $y\dot{L} : a\dot{x} = \dot{y} = a^x$, and conſequently $a^x \dot{L} : a\dot{x}$, is the fluxion of a^x required.

EXPONENTIAL CURVE is that whoſe nature is expreſſed by an exponential equation.

EXPONENTIAL EQUATION is that wherein there is an exponential quantity, $a^x = y$.

EXPONENTIAL QUANTITY is a quantity whoſe power or exponent is a variable or flowing quantity.

Exponential quantities are of ſeveral powers or degrees, according as the exponents themſelves are more or leſs involved. If the exponent be a ſimple quantity, as z^y, it is called an exponential of the firſt or loweſt degree; but when the exponent itſelf is an exponential of the firſt degree, as z^{y^x}, it is called an exponential of the ſecond degree. In like manner, if the exponential itſelf be an exponential of the ſecond degree, as $z^{y^{x^o}}$, it is called an exponential of the third degree, &c.

EXPORTATION, the ſhipping and carrying out of the kingdom wares and commodities for other countries.

Exportation is part of foreign commerce, diſtinguiſhed by the appellation active or ſelling part, in oppoſition to importation, which is called the paſſive, or buying part. Belloni obſerves, that commerce, when active, muſt produce a vaſt flow of riches, the balance being always received in money; whereas, if it be paſſive, the moſt immenſe treaſures will be ſoon exhauſted, as the balance of trade muſt be continually made good out of the remaining coin. Hence, plenty of money in any place, implies, that the quantity of goods exported far exceeds that of goods imported; and wherever we ſee money ſcarce, we may conclude that greater quantities of goods have been imported than exported. See the articles COMMERCE, MONEY, and EXCHANGE.

EXPOSITOR, or EXPOSITORY, a title given to ſmall dictionaries, ſerving to explain the hard words of a language.

EX POST FACTO, in law, ſomething done after another: thus, an eſtate granted may be good by matter ex poſt facto, that was not ſo at firſt, as in caſe of election.

EXPOSTULATION, in rhetoric, a warm addreſs to a perſon, who has done another an injury, repreſenting the wrong in the ſtrongeſt terms, and demanding redreſs.

EXPOSURE, or EXPOSITION, in gardening, is the aſpect or ſituation of a garden, or wall, with reſpect to the ſun or winds: they are, therefore, as various as the points of the compaſs; being either direct, as eaſt, weſt, north, or ſouth; or declining, as ſouth-eaſt, north-weſt, &c. The gardeners do not give thoſe names to the places where the ſun is, but to thoſe whereon he ſhines. A wall ſtanding to the north, and facing the ſouth, is ſaid to have a ſouth aſpect or expoſure: and a wall which faces the riſing ſun is ſaid to have an eaſtern expoſure; and ſo of the others. If the ſun at his riſing, and during the firſt half of the day, continue to ſhine upon one ſide of a garden or wall, that is an eaſtern expoſure: that ſide which the ſun ſhines upon the latter half part of the day has a weſtern expoſure. That part where it ſhines longeſt in the day, from nine till four, is the ſouth aſpect; and that part on which it ſhines leaſt, has a north expoſure.

The eaſtern and ſouthern expoſures are, by common conſent of all gardeners, the two principal, and have a conſiderable advantage above the reſt. The eaſtern, commencing differently at different ſeaſons of the year, and ending about noon, ſubjects the trees, &c. to the north-eaſt winds, which wither the leaves, blow down the fruit, &c. Yet Mr. Laurence judges the eaſt better than the weſt wall for all kinds of fruit, becauſe the early rays of the ſun ſooner take off the cold chilly dews of the night. The weſtern, accounted half an hour after eleven till ſun-ſet, is more backward than an eaſtern one by eight or ten days; but it has this advantage, that it receives little damage from the froſts, which melt before the ſun comes to ſhine upon the fruit, and fall off like dew without doing any prejudice: but it is incommoded with the north-weſt winds in the ſpring, as alſo with the autumnal winds, which blow down a deal of fruit. The weſtern expoſure is better than the north, which is the worſt of all.

EXPRESSED OILS, in chemiſtry, are ſuch as are obtained from bodies only by preſſing.

EXPRESSION, in chemiſtry, or pharmacy, denotes the act of preſſing out the juices, or oils of vegetables, which is one of the three ways of obtaining them; the other two are by infuſion and decoction. Oils obtained by means of fire are called ſtillatitious.

EXPRESSION, in rhetoric, is the elocution, diction, or choice of words neceſſary to render any diſcourſe eloquent.

As the principal end of ſpeaking is to be underſtood, the firſt thing we ſhould endeavour to obtain is a richneſs of expreſſion, or habit of ſpeaking ſo well, that our thoughts may be underſtood. As we are ſurrounded from our cradle by ignorant and vulgar people, who ſcarce know their mother-tongue, we are forced to ſtudy for that which nature ought to have taught us. It is much eaſier to imitate the ſublimity of Seneca or Lucan, than the unaffected ſimplicity of Terence. Thoſe that are capable of writing like Terence, may reach Lucan's grandeur if they pleaſe; but a man who has always uſed himſelf to the ſwelling ſtile, will never imitate Terence happily. Of this opinion is Cicero, and alſo Horace, who, in ſpeaking of the natural ſtile of converſation, ſays, "I will make verſes compoſed of known expreſſions, ſo that in reading them, every one ſhall hope to do the like." So much force is there in order and connexion, and ſo much elegance in ſtile taken from the common language, compoſed only of pure and proper expreſſions. In ſhort, beautiful expreſſion is the natural and true light of our thoughts; it is to this we owe all thoſe excellencies in diſcourſe, which give things a kind of vocal life and ſpirit.

EXPRESSION, in painting, is the repreſentation of an object according to its natural character and the painter's invention or plan.

In portraits it muſt be ſeen whether the perſon is grave, gay, a man of buſineſs or wit, plain, gentle, &c. each character muſt have an attitude, the ornaments, and back-ground proper to it; and all about it muſt be expreſſive of the man, and have a reſemblance as well as the features of the face.

If the perſon has any particularities as to the poſition of the head, eyes, or mouth, if not unbecoming, they muſt be ſtrongly expreſſed. Theſe are a ſort of moving features, and are as much a part of the man as the fixed ones; ſome things raiſe a low ſubject, and contribute more to a ſurpriſing likeneſs than any thing elſe. Van Dyck in a picture has given a briſk touch upon the under-lip, which makes the poſition of the mouth very particular, and doubtleſs was an air which don Diego de Guſman, whoſe portrait it is, was accuſtomed to give himſelf, which an inferior painter would not have obſerved, or not dared to have marked, at leaſt ſo ſtrongly; but this, as it gives a marvellous ſpirit and ſmartneſs, undoubtedly gave a proportionate reſemblance.

If there be any thing particular in the hiſtory of the perſon which is proper to be expreſſed, it is a great improvement to the portrait, to them that know that circumſtance. There is one inſtance of this in a picture Van Dyck made of John Lyvens, who is drawn as if liſtening to ſomething; which refers to a remarkable ſtory in that man's life. The print is in the book of Van Dyck's heads; which book, and the heads of the artiſts in the lives of Giorgio Vaſari, are worth conſidering, with regard to the variety of attitudes, as well as upon other accounts.

Robes, or other marks of dignity, or of a profeſſion, employment, or amuſement, a book, a ſhip, a favourite dog, or the like, are hiſtorical expreſſions common in portraits.

There are ſeveral kinds of artificial expreſſions practiſed by painters, becauſe of the diſadvantage of their art in that particular, in compariſon of words.

To expreſs the ſenſe of the wrath of God with which our Bleſſed Lord's mind was filled when in his agony, and the apprehenſion he was then in of his own approaching crucifixion, Frederico Barocci has drawn him not only with the angel holding the cup to him, but in the back-ground you ſee the croſs and flames of fire.

In the cartoon where the people of Lycaonia are going to ſacrifice to St. Paul and Barnabas, the occaſion of all that is finely expreſſed.

The man who was healed of his lameneſs is one of the forwardeſt to expreſs his ſenſe of the divine power which appeared in thoſe apoſtles; and not only a crutch

is under his feet on the ground, but an old man takes up the lappet of his garment, and looks upon the limb which he remembered to have been crippled, and expreſſes great devotion and admiration; which ſentiments are alſo ſeen in others with a mixture of joy. When our Saviour committed the care of his church to St. Peter, the words he uſed on that occaſion are related by Raphael, who has made him pointing to a flock of ſheep, and St. Peter to have juſt received two keys. When the ſtory of Joſeph's interpretation of Pharaoh's dream was to be related, Raphael has painted thoſe dreams in two circles over the figures; which he has alſo done, when Joſeph relates his own to his brethren. His manner of expreſſing God's dividing the light from darkneſs, and the creation of the ſun and moon, is altogether ſublime. The prints of thoſe laſt mentioned pictures are to be found in Raphael's bible, but the paintings are in the Vatican.

The hyperbolical artifice of Timanthes to expreſs the vaſtneſs of the Cyclops is well known, and was greatly admired by the ancients; he made ſeveral ſatyrs about him as he was aſleep; ſome were running away as frighted, others gazing at a diſtance, and one was meaſuring his thumb with his thyrſus, but ſeeming to do it with great caution, leſt he ſhould awake.

This expreſſion was copied by Giulio Romano with very little variation. Correggio, in his picture of Danae, has finely expreſſed the ſenſe of that ſtory; for, upon falling of the golden ſhower, Cupid draws off her linen-covering, and two lovers are trying upon a touch-ſtone a dart tipped with gold.

Nicholas Pouſſin expreſſes a voice, in the baptiſm of our Saviour, by making the people look up, and about, as it is natural when men hear any ſuch, and know not whence it comes, eſpecially if it be otherwiſe extraordinary, as in this caſe.

Another way practiſed by painters to expreſs what could not otherwiſe be done, is by figures repreſentative of certain things. This they learned from the ancients, examples of which we have in the Antonine pillar, where to expreſs the rain that fell, when the Roman army was preſerved by the prayers of the Theban legion, the figure of Jupiter Pluvius is introduced. Raphael, in the paſſage of Jordan, has repreſented that river by an old man dividing the waters, which are rolled and tumbled very remarkably.

The true airs of the heads of that great maſter Raphael are only to be found in what his own inimitable hand has executed, of which there are many originals in ſeveral collections in England; particularly in thoſe of the duke of Devonſhire and the earl of Pembroke; but the queen's palace is now the great ſchool of Raphael.

Beſides him none of the old maſters are remarkable for expreſſion, unleſs for particular ſubjects; as Michael Angelo for infernal, or terrible airs; and amongſt others, the drawing he made for the cartoon in his Laſt Judgment, is admirable in this kind; others in later times have ſucceeded well in this part of the art, particularly Domenichi and Rembrandt; and herein, next to Raphael, perhaps no man has a better title to the preference than Van Dyck; no not Titian himſelf, much leſs Rubens.

But there is no better ſchool than nature for expreſſion. A painter therefore ſhould, on all occaſions, obſerve how men look and act, when pleaſed, grieved, angry, &c.

Love is expreſſed by a clear, fair, and pleaſant countenance, without clouds, wrinkles, or unpleaſant bendings; giving the forehead an ample height and breadth, with a majeſtic grace; a full eye, with a fine ſhadow at the bottom of the eye-lid, and a little at the corner; a proportionable noſe; noſtrils not too wide; a clear cheek, made by ſhadowing it on one ſide; and a ſmiling mouth, made by a thin upper-lip, and ſhadowing the mouth-line at the corners.

Fear is expreſſed by making the eyes look hollow, heavy, and downwards, thin fallen cheeks, a cloſe mouth, and careleſs ſtaring hair about the ears.

Envy is beſt expreſſed by only the hanging of the cheeks, and a pale countenance; and ſometimes by grinding of the teeth.

Let every paſſion be repreſented according to its outward appearance in thoſe in whom it reigns.

If you aim at any exquiſiteneſs in this art, you muſt endeavour to chooſe out the beſt actions for every purpoſe, in reſtraining the luxurious fancy of nature by a deliberate diſcretion, by the benefit of which you will finiſh your deſign; always expreſſing in each member a certain hidden reſemblance of the principal motions which affect the eye and ſoul of the ſpectators.

To expreſs a paſſion truly, you ought to give every thing its proper motion, or that which beſt ſuits your intention; which is nothing elſe but the agreement of proportion with the action or paſſion intended, wherein conſiſts the whole life of the art, for hereby an evident difference is made between the living and the dead; the fierce and the gentle; the wiſe and the ſimple; the ſad and the merry: and in a word, diſcovers all the ſeveral paſſions and geſtures which the body of a man is capable of.

But before theſe things can be exactly done in a picture, you muſt firſt intenſely conſider the life, that you may come as near it as poſſible; to which adding art, you will meet with no motions ſo potent, which you will not be able artificially to imitate.

Theſe things will be the more exactly accompliſhed, by viewing and continually practiſing what you have ſeen; ſo as lively to expreſs all geſtures, actions, and paſſions, incident to natural bodies.

EXTASY, a tranſport which ſuſpends the function of the ſenſes, by the intenſe contemplation of ſome extraordinary or ſupernatural object, or when God impreſſes on the imagination the extraordinary ideas of any thing he would reveal.

EXTENSION, in philoſophy, is the quality or property of any thing extended that occupies ſpace. The eſſence of body or quality conſiſts in extenſion, of which there are three ſorts, length, breadth, and depth.

The word is Latin, *extenſio*, and derived from *ex*, and *tendo*, to ſtretch out, or extend.

EXTENSOR, an appellation given to ſeveral muſcles, from their extending or ſtretching the parts to which they belong: ſuch are, 1. The common extenſor of the fingers, which has its origin at the external condyle of the humerus, and the poſterior part of the radius and ulna: it afterwards divides into four tendons, which paſs under the ligament of the carpus, and terminate in the poſterior ſurface of all the phalanges of the fingers, where they are gibbous. 2. The extenſor of the thumb, called alſo bicornis and tricornis, ariſes in the poſterior and middle part of the radius and ulna, and terminates in two or three tendons in the firſt, ſecond, and third phalanx of the thumb. 3. The proper extenſors of each finger, which are a part of it, or at leaſt have their origin with the common extenſor. 4. The long extenſor of the toes, which has its origin in the upper part of the tibia, and in the anterior part of the ligament, between the tibia and fibula: it afterwards divides into five tendons, four of which are inſerted into the four phalanges of the toes, and the fifth into the outer metatarſal bone. 5. The ſhort extenſor of the toes ariſes from the upper part of the calcaneum, and dividing into tendons, is inſerted into the toes.

Beſides theſe, there are proper extenſors of the toes; alſo the long and ſhort extenſors of the great toe, and the common extenſor of the back and loins, which is divided into three. If theſe act only on one ſide, they draw the parts obliquely ſideways.

EXTENT, in law, is uſed in a double ſenſe; ſometimes it ſignifies a writ or command to the ſheriff for the valuing of lands or tenements; and ſometimes the act of the ſheriff, or other commiſſioner, upon this writ: but moſt commonly it denotes an eſtimate or valuation of lands; and hence come our extended or rack-rents.

EXTERMINATION *of Quantities*, in algebra. See EQUATION.

EXTERNAL *Angles* are the angles on the outſide of any right lined figure, when all the ſides are ſeverally produced, and they are all, taken together, equal to four right angles. See the article ANGLE.

EXTINGUISHMENT, in law, is a conſolidation

or union, as where one has due to him a yearly rent out of lands, and afterwards purchaſes the lands out of which the rent ariſes; in this caſe, both the property and the rent being united in one poſſeſſor, the rent is ſaid to be extinguiſhed. Likewiſe, where a perſon has a leaſe for years, and he afterwards buys the property of what is leaſed, the leaſe becomes thereby extinguiſhed.

EXTORTION, in law, is an illegal manner of wreſting any thing from a man either by force, menace, or authority. It is alſo the exaction of unlawful uſury, winning by unlawful games, and taking more than is due under pretence of right, as exceſſive tolls in millers, &c.

EXTRA-JUDICIAL is when judgment is given in any cauſe that is not depending in that court where ſuch judgment is given, or wherein the judge has no juriſdiction.

EXTRACT, in pharmacy, is the purer part of vegetables, or other natural bodies, that has been ſeparated from the more groſs parts, and diſſolved in ſome proper menſtruum by means of digeſtion, and reduced to a thick and moiſt conſiſtence, by diſtillation or evaporation of the menſtruum.

EXTRACT, in matters of literature, is ſomething copied or collected from a book or paper.

EXTRACTION, in chemiſtry, the operation whereby eſſences, tinctures, &c. are extracted, or drawn from natural bodies.

EXTRACTION, in ſurgery, ſignifies the extracting any foreign matter out of the body, by the help of inſtruments.

EXTRACTION *of Roots*, the method of finding the root of given numbers or quantities. See ROOT.

The ſquare, cube, and other powers of a number, or root, are formed by multiplying the given number into itſelf a greater or leſs number of times, as the power required is higher or lower. See POWER.

This multiplication compounds the powers; and the extraction of the root decompounds them again, or reduces them to their firſt principles or roots. So that the extraction of the root is to the multiplication of the power, what the analyſis is to the ſyntheſis.

Thus, 4 multiplied by 4, produces 16, which is the ſquare of 4; and 16 multiplied by 4, makes 64, which is the cube of 4:—Such is the compoſition of powers.

Again, the ſquare root of 16 is 4, by reaſon 4 is the quotient of 16 divided by 4; and the cube root of 64 is likewiſe 4, by reaſon 4 is the quotient of 64 divided by the ſquare of 4:—Such is the extraction of roots.

Hence to extract the root out of a given power is the ſame thing as to find a number; E. gr. 4, which being multiplied a certain number of times into itſelf, produces the given power, e. gr. 16, or 64.

For the extraction of ſquare and cube roots, it is neceſſary to have the ſquares and cubes of all the digits in readineſs, as exhibited in the following table.

Roots.	1	2	3	4	5	6	7	8	9
Squares	1	4	9	16	25	36	49	64	81
Cubes.	1	8	27	64	125	216	343	512	729

To extract the ſquare root out of a given number.—1°. Divide the given number into claſſes, of two figures apiece; and include each claſs between two dots, commencing with the place of units, or the right hand figure: the root will conſiſt of ſo many parts or figures as you have claſſes.—By the way obſerve, it may happen that for the laſt claſs on the left hand there ſhall only be one figure left.

2°. Then the left hand claſs being the ſquare of the firſt figure of the root ſought, look in the table of roots for the ſquare roots anſwering to that number; or if that ſquare number be not preciſely there, to the next leſs number: this root write down for the firſt figure of the quotient, and ſubtract its ſquare from the left hand claſs.—To the remainder bring down the next claſs towards the right.

3°. Write down the double of the quotient figure under the left hand of the ſecond claſs, and ſeek how often this decuple is contained in the figure over it; the quotient gives the ſecond figure of the root.

4°. Write the ſame quotient under the right hand figure of the ſame claſs, and ſubtract the product of the whole number underwritten, multiplied by the firſt figure of the root, from the number over it, as in diviſion.

5°. This operation being repeated according to the third and fourth ſteps, i. e. the remainder being ſtill divided by the double of the root, as far as extracted; and from the remainder, the ſquare of the figure that laſt came out, with the decuple of the aforeſaid diviſor augmented thereby, being ſubtracted; you will have the root required.

Example. To extract the ſquare root of 99856. Point it after the following manner, 99856: then ſeek a number whoſe ſquare ſhall be equal to the firſt figure 9, viz. 3, and write it in the quotient; then having ſubtracted from 9, 3×3, or 9, there will remain 0; to which ſet down the figures as far as the next point, viz. 98, for the following operation.

Then taking no notice of the laſt figure 8, ſay, How many times is the double of 3 or 6, contained in the firſt figure 9? Anſwer, 1. Wherefore, having written 1 in the quotient, ſubtract the product of 1×61, or 61 from 98, and there will remain 37, to which connect the laſt figures 56, and you will have the number 3756, in which the work is next to be carried on; wherefore alſo, neglecting the laſt figure of this, viz. 6, ſay, How often is the double of 31, or 62, contained in 375 (which may be gueſſed at from the initial figures 6 and 37, by taking notice how many times 6 is contained in 37)? Anſwer, 6; and writing 6 in the quotient, ſubtract 6×626, or 3756, and there will remain ●; whence it appears, that the buſineſs is done, the root coming out 316.

```
99856 (316
 9
 ---
 098
  61
 ---
 3756
 3756
 ....
```

Otherwiſe, with the diviſors ſet down, it will ſtand thus:

```
99856 (316
 9
---
6) 098
    61
   ---
62) 3756
    3756
    ....
```

Again, if you were to extract the root out of 22178791: Firſt, having pointed it, ſeek a number, whoſe ſquare (if it cannot be exactly equalled) ſhall be the next leſs ſquare (or neareſt) to 22, the figures to the firſt point, and you will find it to be 4: for 5×5, or 25, is greater than 22, and 4×4 or 16, is leſs; wherefore 4 will be the firſt figure of the root. This therefore being writ in the quotient, from 22 take the ſquare 4×4, or 16, and to the remainder 6, adjoin the next figure 17, and you will have 617; from whoſe diviſion, by the double of 4, you are to obtain the ſecond figure of the root, viz. 7, as thus; neglecting the laſt figure 7, ſay, How many times 8 is contained in 61? Anſwer, 7; wherefore write 7 in the quotient, and from 617 take the product of 7 into 87 or 609, and there will remain 8; to which join the two next figures 87, and you will have 887; by the diviſion whereof by the double of 47, or 94, you are to obtain the third figure; in order to which ſay, How many times is 94 contained in 88? Anſwer, 0: wherefore write 0 in the quotient, and adjoin the two laſt figures 91, and you will have 88791, by whoſe diviſion by the double of 470, or 940, you are to obtain the laſt figure; thus, I ſay, How many times 940 in 8879? Anſwer, 9: wherefore write 9 in the quotient, and you will have the root 4709.

```
. . . .
22178791 (4709,43637, &c.
16
---
617
609
---
 88791
 84681
 -----
 411000
 376736
 -------
 3426400
 2825649
 -------
 60075100
 56513196
 --------
 356190400
 282566169
 ---------
  73624231
```

But ſince the product 9×9409, or 84681, ſubtracted from 88791, leaves 4110, the number 4709 is not the root of the number 22178791 preciſely, but a little leſs.

If then it be required to have the root approach nearer, carry on the operation in decimals, by adding to the remainder two cyphers in each operation. Thus the remainder 4110 having two cyphers added to it, becomes 411000; the diviſion whereof by the double of 4709, or 9418, you will have the firſt decimal figure 4. Then having writ 4 in the quotient, ſubtract 4×94184, or 376736, from 411000, and there will remain 34264. And ſo having added two more cyphers, the work may be carried on with pleaſure, the root at length coming out 4709,43637, &c.

But when the root is carried half-way or above, the reſt of the figures may be obtained by diviſion alone; as in this example, if you had a mind to extract the root to nine figures, after the five former 4709,4 are extracted, the four latter may be had, by dividing the remainder, viz. 342640, by the double of 4709,4.

After the ſame manner are roots extracted out of decimal numbers.—Thus, the root of 329,76 is 18,159; and the root of 3,2976 is 1,8159; and the root of 0,032976 is 0,18159, and ſo on. But the root of 3297,6 is 57,4247; and the root of 32,976 is 5,74247. And thus the root of 9,9856 is 3,16.

EXTRACTION *of the Cube Root* may be performed by the following method, which admits of two caſes.

Having pointed the number to be extracted, generally called the reſolvend, into claſſes of three figures a-piece, ſeek a cube number that comes the neareſt to the firſt period of the reſolvend, whether it be greater or leſs than that period.

Caſe 1. If the cube number ſo taken be leſs than the firſt period of the reſolvend, call its root leſs than juſt, and ſubtract that cube from the firſt period of the reſolvend.

Caſe 2. But if the cube be greater than the firſt period of the reſolvend, call its root more than juſt, and ſubtract the reſolvend from that cube, annexing cyphers to it.

To the firſt root, whether it be leſs or more than juſt, annex ſo many cyphers as there are remaining points over the whole number of the reſolvend, and multiply it by 3; then make the product a diviſor, by which you muſt divide the difference between the reſolvend and the foreſaid cube, then will that quotient be the reſolvend depreſſed to a ſquare; and therefore it muſt be pointed as ſuch, viz. into periods of two figures each. That being done, make the firſt root (without theſe cyphers that were annexed to it) a diviſor, enquiring how often it may be found in the firſt period of the new reſolvend (as before in extracting the ſquare root) with this conſideration, that if the root (now a diviſor) be leſs than juſt, you muſt annex the quotient figure to it; and then multiply the root ſo increaſed into the ſaid quotient figure; ſetting down the units place of their product under the pointed figure of that period, and ſubtracting it as in diviſion: and ſo on from one period to another as before. But if the ſaid root, now a diviſor, be more than juſt, then you muſt ſubtract the quotient figure from cyphers annexed, or ſuppoſed to be annexed to the ſaid diviſor, multiplying the root ſo reduced into the quotient figure, ſetting down their product as before, &c. An example or two will make the work plain and eaſy.

Example 1.

What is the cube-root of 146363183, the given reſolvend, to be pointed thus:

146363183 (5 the firſt root, leſs than juſt.
125 = the neareſt cube to 146.

500×3=1500) 21363183 (14242,12 new reſolvend.
1ſt. Div. 5) 14242,12 (527 the root required.
+ 2 104
2d. Div. 52) 3842
+ 7 3689
Root 527 (153) the remainder to be rejected.

Here the root 527 is the true root at the firſt operation, as may be eaſily tried from involving it.

That is, 527×527×527=146363183, the given reſolvend. But if it had not been the true root, then every thing that hath been here done muſt have been repeated, only inſtead of the firſt ſingle root (viz. 5) you muſt have taken the increaſed root, viz. 527; and this I call a ſecond operation, which would increaſe the laſt root to nine places of figures, viz. every operation triples the number of places in the laſt root.

N. B. It often happens that four and ſometimes five places of figures may be taken into the root, eſpecially when the ſecond place proves to be a cypher; that is, when the firſt cube comes very near to the firſt period of the reſolvend.

Example 2.

What is the c. rt. of 67507824239 (4000 root leſs than juſt.
Firſt neareſt cube = 64
Rt. 4000×3=12000) 3507824239 (292318,68
4)
+ 0 292318,68 (4071,8
1. Diviſor 40 2923
+ 7 2849
2. Diviſor 407) 7418
+ 1 4071
3. Diviſor 4071) 3347,68
+ ,8 3257,44, &c.
Root = 4071,8

In this example five figures are taken into the root, becauſe the ſecond place proved to be a cypher. And in theſe five the exceſs is not an unit in the laſt place; for if there were made a ſecond operation, the root would be 4071,78, as may be eaſily tried.

EXTRACTION of the ſquare roots of ſimple algebraic quantities.

The ſquare of aa is $+$ or $-a$; the ſquare-root of $9aa$ is $+$ or $-3a$; and that of $4aabb$ is $+$ or $-2ab$. This is plain; for the ſquare-root of any quantity, ſuppoſe of $4aabb$, is that which, being multiplied into itſelf, will produce $4aabb$. Now $-2ab$, multiplied into itſelf, will produce $4aabb$, as well as $+2ab$; and, therefore, one quantity is as much its ſquare-root as the other. When the ſquare-root of a quantity cannot be extracted, it is uſual to ſignify it by this mark $\surd$; thus $\surd 2aa$ ſignifies the ſquare-root of $2aa$; thus $\surd aa-4b$ is the ſquare-root of the whole quantity $aa-4b$; thus $\frac{\surd aa-4b}{2a}$ ſignifies a fraction, whoſe numerator is the ſquare-root of the whole quantity $aa-4b$, and whoſe denominator is $2a$; thus $\surd \frac{4ab-a^3}{12a}$ ſignifies the ſquare-root of the whole fraction $\frac{4ab-a^3}{12a}$; that is, the ſquare-root of both the numerator and denominator.

When the ſquare-root of a quantity cannot be extracted, the quantity may ſometimes, however, be reſolved into two factors, whereof the one is a ſquare, and the other is not: and whenever this is poſſible, the root of the ſquare may be extracted, and the radical ſign may be prefixed to the other factor: thus, $12aa = 4aa \times 3$; therefore $\surd 12aa = 2a \times \surd 3$.

EXTRACTION of the ſquare-roots of compound algebraic quantities.

The extraction of the ſquare-root of compound algebraic quantities is ſo very like that of whole numbers in common arithmetic, eſpecially in the caſe of ſeries, where it is chiefly required, that a bare inſpection of the work might be ſufficient: however, take the following directions, with an example.

Let it be required to extract the ſquare-root of $x^6+4x^5+10x^4+20x^3+25x^2+24x+16$. Here pointing every other place from the place of units, that is, from 16, I demand the ſquare-root of the member belonging to the firſt point to the left hand, that is, of x^6, and the anſwer is x^3, which I put down in the quotient; then I ſquare x^3, and ſubtract the product x^6 from x^6, and there remains nothing: then I bring down the two next members belonging to the next point; to wit, $4x^5+10x^4$, for a reſolvend, and divide it by $2x^3$, the double of the root in the quotient; that is, I divide $4x^5$ by $2x^3$, and the quotient is $2x^2$, which I put down in the quotient; as likewiſe after the diviſor $2x^3$; then I multiply the quantity $2x^3+2x^2$ by its laſt member $2x^2$, and the product $4x^5$
$+4x^4$

$+4x^4$ I ſubtract from the reſolvend $4x^5+10x^4$, and there remains $6x^4$; to this remainder I bring down the next two places, $20x^3+25x^2$, and ſo have a new reſolvend, which I divide by the double of the root already found, and do as before, till the whole be divided, as you may ſee in the work.

$$x^6+4x^5+10x^4+20x^3+25x^2+24x+16\,(x^3+2x^2+3x+4$$

x^6

$2x^3+2x^2)\ *+4x^5+10x^4$

$2x^2)\ \ 4x^5+4x^4$

$2x^3+4x^2+3x)\ *+6x^4+20x^3+25x^2$

$+3x)\ \ 6x^4+12x^3+9x^2$

$2x^3+4x^2+6x+4)\ *+8x^3+16x^2+24x+16$

$+4)\ \ 8x^3+16x^2+24x+16$

* * * *

Otherwiſe thus:

$$x^6+4x^5+10x^4+20x^3+25x^2+24x+16\,(x^3+2x^2+3x+4$$

x^6

$2x^3+2x^2)\ *$

$+2x^2)\ +4x^5+4x^4$

$2x^3+4x^2+3x)\ *\ \ 6x^4$

$+3x)\ \ 6x^4+12x^3+9x^2$

$2x^3+4x^2+6x+4)\ *+8x^3+16x^2$

$+4)\ \ 8x^3+16x^2+24x+16$

* * * *

Since the laſt member $+16$ was a ſquare, I might have begun the extraction at that end, and the root would have come out the ſame as before, but inverted.—16 is no ſquare number, ſince there is no root, either affirmative or negative, which, when multiplied into itſelf, will produce -16.

Let it be propoſed to extract the ſquare-root, or, at leaſt, to reduce the root to the ſimpleſt expreſſion of $12x^3-72x^2+108x$. This quantity, becauſe neither of the extremes are ſquares, muſt be reduced to a more convenient form, thus: If $12x^3$ be divided by $12x$, the quotient xx will be a ſquare number: therefore, I divide the whole by $12x$, and the quotient is $xx-6x+9$. Whence I conclude, *e converſo*, that if $xx-6x+9$, be multiplied into $12x$, the product will be the quantity propoſed: therefore $\sqrt{12x^3-72x^2+108x}$ is equal to $\sqrt{xx-6x+9}$ into $\sqrt{12x}$: but $\sqrt{x^2-6x+9}$, being extracted as above, is $x-3$, or $3-x$; and becauſe $12x=4\times 3x$, we have $\sqrt{12x}=2\times\sqrt{3x}$; therefore $\sqrt{12x^3-72x^2+108x}=x-3$ or $3-x$ into $2\times\sqrt{3x}=2x-6$, or $6-2x$ into $\sqrt{3x}$.

If the ſquare-root of the factor $xx-6x+9$ could not otherwiſe have been extracted, it might, however, have been obtained by an approximation, as in the following example:

To extract the ſquare-root of a binomial by an infinite ſeries. Though the ſquare-root of a binomial, as $a+b$, $1-z$, &c. cannot be expreſſed by any finite number of terms, yet by an infinite ſeries it may.

The ſquare-root of the binomial $1+x$, ſuppoſing x to be leſs than 1, is found by the following operation to be $1+\frac{1}{2}x-\frac{1}{8}x^2+\frac{1}{16}x^3-\frac{5}{128}x^4+$, &c. a ſeries, whoſe regularity is not immediately perceived; but it will appear in the courſe of this work, that theſe ſeries are as regular as any others whatſoever, and as eaſily computed.

$$1+x\quad *\ *\ *\ *\ *\ *\ *\ *$$

$2+\frac{x}{2})\ \frac{1}{*+x}\quad (1+\frac{x}{2}-\frac{x^2}{8}+\frac{x^3}{16}-\frac{5x^4}{128}+$ &c.

$+\frac{x}{2}\qquad x+\frac{x^2}{4}$

$2+x-\frac{x^2}{8})\ *-\frac{x^2}{4}$

$-\frac{x^2}{8}\qquad -\frac{x^2}{4}-\frac{x^3}{8}+\frac{x^4}{64}$

$2+x-\frac{x^2}{4}+\frac{x^3}{16})\ *+\frac{x^3}{8}-\frac{x^4}{64}$

$\frac{x^3}{16}\qquad \frac{x^3}{8}+\frac{x^4}{16}$

$2+x-\frac{x^2}{4}+\frac{x^3}{8}-\frac{5x^4}{128})\ *-\frac{5x^4}{64}$

$-\frac{5x^4}{128}\qquad -\frac{5x^4}{64}$

*

Since in theſe ſeries the powers of x aſcend or deſcend regularly, theſe roots may be extracted by the help of the coefficients only, and the powers may be ſupplied afterwards; but then due care muſt be taken to keep the terms diſtinct, ſo as to place all of the ſame kind orderly one under another, that no confuſion may ariſe in the operation. See BINOMIAL *Theorem*.

EXTRACTION of the cube root of algebraical quantities.—The method of extracting the cube root of algebraical quantities differs ſo little from that already delivered for extracting it numerically, that we preſume it will be needleſs to give any examples; we ſhall therefore only add the following theorem to ſhew the reaſon of theſe operations.

Suppoſe it were required to find the value of $x^3=G$. Put $r+y=G$, ſuppoſing r leſs than the true root; involve $r+y$ to the third power, and we ſhall have $r^3+3rry+3rry+y^3=x^3=G$; and $3rry+3ryy+y^3=G-r^3$; and $ry+y^2+\frac{y^3}{3r}=D$. Let $\frac{y^3}{3r}$ be rejected as of ſmall value; then it will be $ry+y^2=D$, which gives this theorem $\frac{D}{r+y}=y$. By this theorem, the examples given in extracting the cube-root numerically are performed.

EXTRAVASATION, in medicine, is applied to the blood, or any ſort of fluid, when got out of the veſſels in which it ought to be contained.

The word is Latin, *extravaſatio*, and derived from *extra*, out of, and *vas*, a veſſel.

EXTREME *and Mean Proportion*, in geometry, is when a line AB (plate LXIV. *fig.* 5.) is ſo divided in C, that the rectangle under the whole line AB, and the leſſer ſegment CB, is equal to the ſquare of the greater ſegment AC. The inveſtigation of which is as follows; let the given line $AB=a$, and for the greater ſegment put x, the leſſer will be $a-x$; then by the hypotheſis $a\times a-x=xx$, conſequently $aa=ax+xx$; and by compleating the ſquare, &c. we ſhall have $x=\sqrt{\frac{1}{4}aa}-\frac{1}{2}a$. Euclid, in lib. 2. prop. 11, gives the ſynthetical demonſtration of this: but this cannot be done exactly in any numbers; but if you would have it tolerably near, add together the ſquare of any number, and the ſquare of its half, and extract as near as you can the ſquare-root of the ſum; from whence, taking all the whole number, the remainder is the greateſt part.

EXTREMES, in logic, are thoſe terms in the concluſion of any ſyllogiſm that have a relation to ſome other term as a mean.

EXTRINSIC, among metaphyſicians, is taken in various ſenſes; ſometimes it ſignifies a thing not belonging to the eſſence of another; in which ſenſe the efficient cauſe and end of a thing are ſaid to be extrinſic. Sometimes it ſignifies a thing's not being contained within the capacity of another, in which ſenſe thoſe cauſes are called extrinſic, which introduce ſomething into a ſubject from without, as where a fire introduces heat. Sometimes it implies a thing added or applied to another, in which ſenſe accidents and adherents are ſaid to be extrinſic to the ſubjects to which they adhere. Sometimes the viſion is ſaid to be extrinſic from ſome form which does not exiſt in that thing, but is adjacent to it, or by ſome means or other without it. See the article INTRINSIC.

EXULCERATION, the ſame as ulcer; but it is generally applied to thoſe eroſions that begin to form an ulcer.

The word is Latin, *exulceratio*, and derived from *ex*, and *ulcer*, a bile.

EXUVIÆ, among naturaliſts, denote the caſt-off parts or coverings of animals, as the ſkins of ſerpents, caterpillars, and other inſects.

EXUVIÆ is alſo uſed for the remains of ſea-animals found foſſile, and more properly called extraneous, or marine foſſils.

EYE, in anatomy, the organ of ſight, or the inſtrument which repreſents viſible objects to the mind.

The whole body of the eye is a kind of teleſcope of infinite perfection, which tranſmits images in an exact and complete manner even to the bottom of it. This bottom is inveſted with textures of nerves, on which

the image is imprinted, and by that means the ſenſation is produced, of which one of theſe textures is the immediate organ.

In order to give a clearer idea of the ſtructure of the eye, and the mechaniſm of viſion, let us have recourſe to the camera obſcura, or dark chamber, which the eye in ſome meaſure reſembles.

Shut up a room ſo cloſe as to deprive it entirely of light. Then make a hole in one of the window ſhutters, and oppoſite this hole, at the diſtance of ſeveral feet, place a cloth or ſome white paſte board, on which all the objects without will be painted in the moſt lively and natural colours, though abſolutely reverſed. If theſe images are deſired to be repreſented in a more exact and more beautiful manner, let a lens be applied to the hole of the window-ſhutter, which, by collecting the rays, will form an image more compact and diſtinct. See CAMERA OBSCURA.

All that is wanting to render the camera obſcura, with regard to ſimple objects, an artificial eye, is the figure of a globe, and having the lens placed within the globe.

In the natural eye the globe or caſe is formed by ſupple membranes, and the lens by tranſparent bodies, and humours equally tranſparent.

The brain and nerves are compoſed, firſt, of a ſoft ſubſtance ſomewhat reſembling new cheeſe; and ſecondly of two integuments of a competent ſolidity, called the dura and pia mater, each of which is manifeſtly double; theſe three ſubſtances form all the nerves.

The principal nerves of the eye, called the optic nerves, A B (plate LXIV. *fig.* 6.) make their exit from the cranium, one on each ſide. They derive their origin from thoſe parts of the medullary center of the brain, called the beds of the optic nerves.

Then the two nerves K, K, tend towards the fore-part of the head, approaching again one towards the other, and unite as it were in a ſingle nerve A, without any croſſing or confuſion: they afterwards ſeparate one from the other, being ſtill incloſed in the pia mater, and inveſted with the anterior lobes of the brain; and after about ſeven lines diſtant from their ſeparation, they each of them enter into a bony cavity that leads to the orbit, the receptacle furniſhed by the brain for the eye: there they receive from the dura mater the ſheath common to all the nerves. This ſheath confines the nerve, and hinders it from becoming too bulky. This bony entrance forms a canal of about two lines; after which the dura mater is divided into two laminæ; one ſufficiently thin, *b* E, which lines the orbit, the other thicker, as D D, which continues to ſerve as a ſheath to the nerve. From the angle *b*, formed by the diviſion of theſe two laminæ, ariſe the muſcles of the eye.

The coat of the dura mater D D, that accompanies the optic nerve, and concurs to its formation, is continued in the center of the orbit amidſt the muſcles, about the ſpace of fifteen lines, after which it expands and dilates itſelf into a globe, much in the ſame manner as glaſs is blown in a bottle.

At the root of this expanſion, between the nerve and globe, the dura mater forms a circular band, by means of which it ſtrongly compreſſes the extremity of the nerve, and makes a ſort of valve, which ſeems to ſeparate the globe from the nerve, pretty much reſembling the paper ring applied to teleſcopes. It is formed like the valves of the inteſtines by a running fold of this coat: and it is evident that this fold was inevitable at the angle which the dura mater muſt make for the above-mentioned expanſion.

The dura mater D D (plate LXIV. *fig.* 7.), on thus expanding itſelf, forms the firſt, or exterior membrane, D *bc* of the globe of the eye, called the cornea. The anterior portion *bcb* of this cornea is tranſparent, and correſponds with the pupil; all the reſt is opaque.

Though the tranſparent cornea be a continuation of the ſclerotis, or opaque cornea D D D, it conſtitutes a part of the ſmaller ſphere, which ſeems added there in the manner chryſtals are to watches. By this means it projects a little beyond the common ſphere of the eye, which circumſtance renders it very well adapted to collect a greater quantity of rays and images, in regard of objects that preſent themſelves ſidewiſe to the eye.

The pia mater E, which is ſituated under the dura mater D, expands itſelf in a globe like the dura mater, in order to form the internal membranes, or to double the cornea. It alſo forms before its expanſion, a valve or circular band, which ſtrongly compreſſes the extremity of the nerve; but it is divided into two laminæ, one genuine and ſolid, that is applied exactly to the inner ſurface of the cornea D, where it is actually complicated and united to the other. M. le Cat firſt diſcovered this membrane, and demonſtrated its continuation with the pia mater, and its diſtinct extenſion, even almoſt to the tranſparent cornea.

The ſecond lamina of the pia mater, marked by long points in the figure, conſtitutes the choroides or uvea; but this lamina, properly ſpeaking, is only a texture of nerves and blood-veſſels that go out from the inner ſurface of the true lamina. Theſe veſſels convey a liquid that communicates a black or brown colour to this ſecond lamina. Part of theſe veſſels and nerves open on the internal ſurface of this lamina, and there form by that means a downy or mammillary texture loaded with the black liquor theſe veſſels are charged with. Ruyſch has made a particular coat of the choroides. This, according to us, would be the third coat diſtributed by the pia mater to the eye; namely, one truly membranous, united to the ſclerotis, one vaſcular, called the choroides, and one horny, ſtiled tunica Ruyſchii. Towards the fore part of the eye the choroides is doubled; and this exterior complication forms what is called the iris H H, in the middle of which is the perforation of the pupil. This iris is furniſhed with muſcular fibres in the form of rays and circles, by means of which the pupil dilates and contracts itſelf. It dilates itſelf in the ſhade, and in a paralytic ſtate of the optic nerves, by the repoſe or ſinking of its fibres, and is contracted when affected by light, particularly a ſtrong one, through the ſwelling of its fibres, into which this ſtrong light determines the ſpirits.

The inner complication of the choroides forms on the hinder part the corona ciliaris H H, in the center of which is encloſed the lens of the eye, called the chryſtalline humour. The corona ciliaris or ciliary proceſſes, on a cloſe examination, are the laſt nervous and vaſcular tufts or fringes, which expand themſelves on the inner ſurface of the choroides, where they form the ſecond coat and the corpus mammillare, which is the principal organ of ſenſation. They are plaited at this end like the wriſtband of the ſhirt; inaſmuch as from a large circumference, to which they were extended before, they are reduced to a very ſmall circle, that ſurrounds the chryſtalline humour. Theſe fringes, as they are floating, ſurpaſs a little the bounds of the exterior lamina of which the iris is a continuation.

The external lamina is complicated under the ciliary fibres, where it grows thickiſh and white. In this termination it ſeems to affect approaching to an ungulous nature, as much as can be expected from its delicacy; which indeed is the caſe of almoſt all textures formed by the parallel, cloſe, and compact, beds of nervous fringes.

The whole ſpace of the eye that is before the corona ciliaris I, I, and the chryſtalline humour K, is filled with a limpid water called the aqueous humour, in the center of which ſwims the iris or pupil H H. So that the iris divides this ſpace into two ſmall chambers; one before that is terminated by the tranſparent cornea, or exterior glaſs of the eye *bcb*; and the other on the back part a very ſmall one bounded by the corona ciliaris I, I, the chryſtalline humour K, or the lens of the eye, and the iris H H.

Next to theſe two chambers, behind the corona ciliaris and the cryſtalline humour, the globe of the eye forms a ſpace a great deal larger, K L, than the preceding ones. This ſpace is all occupied by a ſort of tranſparent jelly, called the vitreous humour. The cryſtalline humour K is lodged in the anterior ſurface of this jelly, like a diamond ſet in a ring.

The medullary and interior ſubſtance A of the optic

nerve is expanded as well as the preceding coats, and forms a fleſhy texture, marked by ſmall points in the plate.

This texture conſtitutes the inmoſt membrane of the globe of the eye, called the retina, and terminates at the corona ciliaris. This ſoft ſubſtance of the nerve, at the beginning of its expanſion, forms the ſmall medullary button B.

The extremely fine textures that divide the cavity of the eye, and form cells for the humours it is filled with, are the ſame which, in the cavity of the nerve, divide and ſupport the medullary ſubſtance therein exiſting.

Such is the ſtructure of the eye diſcovered by anatomy. But the lights derived from reaſon and analogous aſſiſtances, let us a great way farther into the nature of this wonderful organ. It is evident, that every individual ſenſation is produced by nervous papillæ; and that the fluid which animates theſe papillæ, receives by the glands the preparations and mixtures that fit it for receiving the ſenſation peculiar to each organ. It is well known, that theſe glands and nervous papillæ are often one and the ſame organ, and that they ſometimes even add to the preceding functions the filtration of a ſenſible liquid. The ſtructure is particularly remarkable in the glandulous papillæ of the tongue, that are at once the organs of the ſenſation of taſte, and the receptacles where the ſenſitive fluid receives its character, its mixture, and the reſervoirs of a filtrated liquid neceſſary to this ſenſation. The eye, all wonderful as it is, is nothing elſe but a glandulous papilla, of a larger ſize and expanſion, and hollower than the other glands. It is like them a triple organ of ſenſation, of preparation, of the ſenſitive fluid, and of filtration. The cloſeſt examination poſſible of this nervous papilla does not make it in the leaſt degenerate; on the contrary, it reflects a conſiderable luſtre on the ſtructure and uſe of thoſe papillæ, the univerſal organs of ſenſation. This ſtructure and theſe uſes, that have been hitherto a kind of myſtery, ceaſe almoſt to be ſo in the organ of ſight.

A glandulous papilla is a tuft and end of a nerve, deſtined to the filtration of ſome liquid. The eye is very evidently the extremity of the optic nerve, expanded, and blown, as it were, into a hollow ſphere full of fluids. One may trace the veſſels conveying thoſe fluids which form the expanded coats of the dura and pia mater, where they are interwoven, and open themſelves on the inſide of this organ. The ſize alone of theſe veſſels viſibly demonſtrates the filtration made there of the contained liquid, and the coats and cavity of this organ are nothing elſe than the prop and reſervoir of it.

The inſide of the glands is the concourſe of arterial and nervous extremities, in which concourſe the animal fluid is united to a volatile part of the arterial blood, to enable it to diſcharge its functions. This union is made by means of the nervous and vaſculating tufts: theſe tufts in the eye produce the down of the choroides. It is therefore highly probable, that the black liquid with which this down is imbued, is nothing elſe than the ſulphureous particles of the blood diffuſed in this texture by the tufts of the arteries, and loaded with the volatile portion that is mixed with the animal fluid, conveyed by the nervous tufts. Or, if you pleaſe, this black liquid is the dregs, as it were, of the fluid that reſults from the mixture of the ſpirits with the volatile part of the blood. The animal fluid partakes in ſome degree of the nature of mercury. Now mercury, intimately united with ſulphur, forms a black ſubſtance, an æthiops, as is well known. In like manner, there is the greateſt reaſon to imagine, that the eye preſents to us ſenſible traces of this ſo uſeful mixture; which we eſtabliſh on no other baſis than that of the neceſſity there ſeems to be for it, in regard of almoſt all the functions, and principally of muſcular motion.

However, this black liquid obſervable in the choroides is not peculiar to the eye; we meet with it on the inſide of almoſt all the glands: it is viſible in the glands of the kidnies; for which reaſon they are called capſulæ atrabiliariæ. It is likewiſe viſible in the pulmonary or bronchial glands. In ſhort, the colour of negroes has no other origin than this fable liquor, with which theſe cutaneous nervous tufts, being very porous, imbue the cuticle that inveſts them.

The down of the choroides, impregnated with the liquid we have been ſpeaking of, forms the inner membrane of the choroides. The exterior lamina this is ſuſtained by, is, in the organ of ſight, what the corpus reticulare is in the organ of the touch, and in that of the taſte. In all theſe organs, the veſſels and nerves, before their expanſion into tufts, are ſtripped of their thick coat; and it is of theſe ſpoils the texture is formed, which in the eye conſtitutes the exterior tunic of the choroides. The nervous papillæ being ſtripped in like manner become more delicate, and endued with a greater ſenſibility; and the texture made of their ſpoils ſerves to ſuſtain the nervous tufts and orifices of the veſſels that convey the neceſſary liquids, as well to the papillæ themſelves, as to the tranſparent humours contained in the globe.

As for the choroides, the veſſels are large enough to admit the ſulphureous particles of the blood to paſs along with the ſpirituous lymph; but beyond this membrane, the minuteneſs of the veſſels ſuffers only an extremely ſubtile lymph to flow, which forms and ſupplies the humours of the eye.

Of theſe the vitreous humour is the moſt conſiderable; it fills about three fourths of the globe of the eye towards the bottom of that organ, and is condenſed into a jelly; becauſe being embraced by all the coats of the optic nerve, and immediately by the medullary part of it, the retina, it is impregnated with a large quantity of this enlivening fluid, the property of which is to give a firmneſs and conſiſtence to the ſolids and fluids, where it is found in abundance.

The cryſtalline humour, for the ſame reaſon, ought to have this conſiſtence in a ſtill greater degree. For, beſides the preceding advantages which it has in common with the vitreous humour, its very ſmall circumference receives likewiſe by means of the corona ciliaris the concourſe of all the nervous extremities of the choroides. It muſt therefore be impregnated with a greater quantity of this fluid, and conſequently acquire a larger proportion of conſiſtence.

For the contrary reaſon, the liquid ſituated under the tranſparent cornea, and remote from this great influx of the conſervatory fluid, muſt fall ſhort in point of conſiſtence, and form a fluid of an aqueous nature.

What is very ſurpriſing, is the diſpoſal of theſe cauſes to produce effects ſo ſingularly peculiar to the organ they compoſe. A glandulous papilla of the tongue is only the extremity of a nervous fibre. This fibre could only form a nervous button full of a limpid liquid, which indeed was all that was neceſſary for it to do. But this would not have been ſufficient for the organs of ſight; more materials were requiſite: beſides, it is not here a nervous fibre, but an entire and very conſiderable nerve, which expands itſelf at once into a ſingle papilla, and by its thick coats forms a perfect and entire globe, which one would almoſt imagine to be impenetrable even to light itſelf; but this, however, is not true; for the exterior coat, which is the only one thick and ſubſtantial enough to complete the circumference of this globe, is naturally diſpoſed to terminate in a tranſparent lamina; and this lamina occurs preciſely at the entrance of the rays; for it can only occur at the extremity of this nervous body, as the nails can be formed only at the ends of the fingers.

The cornea therefore does not at all contradict its origin, but follows the common law of the nerves. The farther they recede from their origin, the harder and more compact they grow. The nails are formed by the extremities of the nerves of the legs and arms; theſe nails are hard and tranſparent, and would have an equal tranſparence with the cornea, if, like that, they were inceſſantly moiſtened with fluids. The cornea has no more tranſparence than the nails, when it is once abridged of its uſual ſupply of moiſture. Theſe parts therefore have the ſame nature, and the ſame origin.

The rays of light tranſmitted to the eye, ſtand in need of being there refracted, and collected in a particular manner; and an uniform fluid, like what is contained in all the glandulous papillæ, would not have effected

that buſineſs agreeable to this organ. But the inner ſubſtance of the larger nerve has provided for this contingency. It is the ſtream of a fluid that gives conſiſtence and ſolidity to all our parts; and its diſtribution is ſuch, that it imparts this conſiſtence preciſely in that order which the perfection of the organ demands. What a ſimplicity of mechaniſm is here to produce ſuch a prodigy of execution! A nerve expanded into a globe; its coats diſtinctly ſpread over one another; fluids collected under theſe coats by a very ordinary filtration; forms the whole apparatus.

EYE, in architecture, is applied to any round window made in a pediment, an Attic, the reins of a vault, or the like.

EYE *of a Block*, in naval affairs, that part of the rope-ſtrop which is faſtened to ſome neceſſary place in the ſhip: the ſtrop is a ſort of wreath, or rope, formed into a ring, and fixed round the block for the double convenience of ſtrengthening the block, and faſtening it in any place where it is wanted.

EYE *of a Dome* is an aperture at the top of the dome, as that of the Pantheon at Rome, or of St. Paul's at London; it is commonly covered with a lantern.

EYE *of the Volute*, in architecture, is the center of the volute, or that point in which the helix or ſpiral of which it is formed commences: or it is the little circle in the middle of the volute, in which are found the thirteen centers for deſcribing the ſeveral circumvolutions.

EYE, in agriculture and gardening, ſignifies a little bud, or ſhoot, inſerted into a tree by way of graft.

EYE *of a Tree*, a ſmall pointed knot to which the leaves ſtick, and from which the ſhoots or ſprigs proceed.

EYE-BROW, in anatomy. See SUPERCILIUM.

EYE-BROW, in architecture, is uſed in the ſame ſenſe as liſt or fillet. See FILLET.

Bull's EYE, in aſtronomy, a ſtar of the firſt magnitude in the conſtellation Taurus. See the article ALDEBARAN.

EYRE, in law, implies the itinerant courts of juſtice.

The word is formed from the old French, *erre*, *iter*, way, path, or track.

EZEKIEL, the name of a canonical book of the Old Teſtament, referring chiefly to the degenerate manners and corruptions of the Jews of thoſe times.

It abounds with elegant ſentences, and fine compariſons, and abundantly ſhews that the writer was no ſtranger to profane learning.

Ezekiel was carried captive to Babylon with Jechoniah, and began his prophecy in the fifth year of the captivity. He was cotemporary with Jeremiah, who propheſied at the ſame time in Judea. Ezekiel foretold many events, particularly the deſtruction of the temple, the fatal cataſtrophe of thoſe who revolted from Babylon to Egypt, and the happy return of the Jews to their own land.

EZEKIEL's *Reed*, or *Rod*, a meaſure of length mentioned by that prophet, and ſuppoſed to be nearly equal to two Engliſh feet.

EZRA, a canonical book of the Old Teſtament, comprehending the hiſtory of the Jews from the time of Cyrus's edict for their return, to the twentieth year of Artaxerxes Longimanus. The author of this book was alſo the publiſher of the canon of the Old Teſtament.

F.

F, The fourth conſonant, and ſixth letter of the alphabet. The letter F is borrowed from the digamma or double gamma of the Ælians, as is evident from the inſcription on the pedeſtal of the coloſſus at Delos; and was undoubtedly formed from the old Hebrew Vau: and though this letter is not found in the modern Greek alphabet, yet it was in the ancient one, from whence the Latins received it, and tranſmitted it to us.

It is formed by a ſtrong expreſſion of the breath, and joining at the ſame time the upper-teeth and under-lip. It has but one ſort of ſound, which has a great affinity with *v* and *φ*, the latter being written for it by us in all Greek words, as *philoſophy*, &c. though the Italians write it *filoſofia*.

The Romans for ſome time uſed an inverted F, Ⅎ, inſtead of V conſonant, which had no peculiar figure in their alphabet. Thus, in inſcriptions we meet with TERMINAⅎIT, DIⅎI, &c. Lipſius and others ſay, that it was the emperor Claudius who introduced the uſe of the inverted digamma, or Ⅎ; but it did not long ſubſiſt after his death; for Quintilian obſerves, that it was not uſed in his time.

F or FA, in muſic, is the fourth note in riſing in this order of the gamut, *ut*, *re*, *mi*, *fa*. It likewiſe denotes one of the Greek keys in muſic, deſtined for the baſs.

F, in phyſical preſcriptions, ſtands for *fiat*, or let it be done. Thus F. S. A. ſignifies *fiat ſecundum artem*.

F was alſo a numeral letter, ſignifying 10, according to the verſe,

Sexta quaterdenos gerit quæ diſtat ab alpha.

And when a daſh was added at top, thus $\overline{F}$, it ſignified forty thouſand.

FABA, the bean, in botany, is comprehended by Linnæus among the viciæ. See the articles VICIA and BEAN.

FABER, in ichthyology, a fiſh of the zeus kind, called in Engliſh doree, or john dory. See the article ZEUS.

FABIANS, FABII, in antiquity, were prieſts of Pan, who were divided into two bodies, under the names of Quintilians and Fabians, to perpetuate the memory of Quintilius and Fabius, the former of which was head of Romulus's party, and the latter of Remus's.

FABLE, a tale, or feigned narration, deſigned either to inſtruct or divert, diſguiſed under the allegory of an action, &c. Jotham's beautiful fable of the trees is the oldeſt that is extant. Nathan's fable of the poor man and his lamb is the next in antiquity, and had ſo good an effect as to convey inſtructions to the ear of a king. We find Æſop in the moſt diſtant ages of Greece; and, in the early days of the Roman commonwealth, we find a mutiny appeaſed by a fable of the belly and the members. As fables had their riſe in the very infancy of learning, they never flouriſhed more than when learning was at its greateſt height: witneſs Horace, Boileau, and Fontaine.

Fable is the fineſt way of giving counſel, and moſt univerſally pleaſing, becauſe leaſt ſhocking; for in the reading of a fable, a man thinks he is directing himſelf, whilſt he is following the dictates of another, and conſequently is not ſenſible of that which is the moſt unpleaſing circumſtance in advice. Beſides, the mind is never ſo much pleaſed as when ſhe exerts herſelf in any action that gives her an idea of her own abilities; this natural pride of the ſoul is very much gratified in the reading of fable.

Poets have intermixed the fable with truth, to adorn their narration. Polybius, Strabo, and many other hiſtorians affirm, that the fable of the Iliad and Odyſſey of Homer is founded on truth, as appears from the ancient hiſtorians. The moſt remarkable writers who have handled moral fables, and introduced beaſts and trees ſpeaking, which ſort of fables is, ſtrictly ſpeaking, diſtinguiſhed by the name of apologue, was Æſop among the Greeks; not that he was the inventor, but becauſe he excelled therein, and Phædrus among the Latins. Some of the ancient critics after Aphthonius and Theon, reckon three kinds of fables; rational, called alſo parables; moral, called apologues; and mixed, compoſed of both ſorts. Beſides this kind there is another in which the actors are paſſions, virtues, vices, and ſuch like imaginary perſons, which in ſtrictneſs may be called allegory. Some of the ancient critics will have it that the Iliad and Odyſſey are fables of this nature. Spencer's Fairy Queen is one continued ſeries of them; and if we look into Cicero, Plato, Xenophon, and many others, we ſhall find that this was their favourite kind of fable; the greateſt Italian wits have alſo applied themſelves to this ſpecies of writing. The firſt fable of this ſort of any note, was that of Hercules meeting with Pleaſure and Virtue; invented by Prodicus, who lived before Socrates. He uſed to travel through Greece by virtue of this fable, telling it as ſoon as he had gathered an audience.

M. de la Motte calls the fable a little epic poem, differing only from it in the extent, and being leſs confined as to the choice of perſons; for it may comprehend all ſorts at pleaſure.

FABLE is alſo uſed for the plot of an epic or dramatic poem; and according to Ariſtotle, it is the principal part and ſoul as it were of a poem. In this ſenſe the fable is defined a diſcourſe invented with art to form the manners by inſtruction, diſguiſed under the allegory of an action. Ariſtotle divides the fable into ſimple and compound; the ſimple having no change of fortune; the compound, which hath a turn from bad fortune to good, and from good to bad. The contrivance of each fable muſt have two parts; namely, the intrigue and the diſcovery. Every fable muſt have theſe two parts to be the ſubject of a juſt poem. The compound fable pleaſes moſt, in Ariſtotle's opinion, as having variety: beſides, the fable muſt, to be perfect, be admirable and probable; the admirable is that part of it which is contrary to the ordinary courſe of nature; the probable is whatever ſuits with the common opinion. But the moſt part of thoſe that compoſe poems, by too great a paſſion to create admiration, take not ſufficient care to temper it with probability. Almoſt all the ancient poets, however

judicious

judicious in other reſpects, have been guilty of this fault; not to ſpeak of the moderns. Probability gives credit to whatever is moſt fabulous in poetry; it ſerves alſo to give a greater luſtre and air of perfection than even truth itſelf; for truth repreſents things only as they are, but probability renders them as they ought to be.

Dr. Trapp obſerves, though fable, action, and deſign, are often uſed indiſcriminately, they have each diſtinct ideas; defining fable, a compoſition of epiſodes and other things which are ſubſervient to the carrying on the action and bringing it to a concluſion.

FABRIC, the ſtructure or conſtruction of any thing, particularly a houſe, hall, church, &c.

The word is Latin, *fabrica*, and derived from *faber*, a workman. See the article BUILDING.

FABULOUS, ſomething conſiſting of, or connected with, a fable. See FABLE.

FABULOUS *Age*, among ancient hiſtorians. See the article AGE.

FACADE, n architecture. See FACE.

FACE, in anatomy. See the article HEAD.

FACE, in architecture, the front of a building, or the ſide which contains the chief entrance. It is alſo ſometimes uſed for the ſide which it preſents to the ſtreet, garden, court, &c. and ſometimes for any ſide oppoſite to the eye.

FACE *of a Stone*, in maſonry, that ſuperficies of it which lies in the front of the work. The workmen generally chuſe to make one of thoſe ſides the face, which, when in the quarry, lay perpendicularly to the horizon, and conſequently the breaking, not the cleaving way of the ſtone.

FACE, in fortification, an appellation given to ſeveral parts of a fortreſs, as the face of a baſtion, &c. See BASTION.

The face of a place is the front comprehended between the flanked angles of two neighbouring baſtions, being compoſed of a curtain, two flanks, and two faces; and is likewiſe called the tenaille of a place. In a ſiege, the attacks are carried on againſt both baſtions, when the whole tenaille is attacked.

Prolonged FACE, that part of the line of defence-razant, which is between the angle of the ſhoulder and the curtain, or the line of defence-razant, diminiſhed by the length of the face.

FACE *of a Gun*, the ſuperficies of the metal at the extremities of the muzzle of the piece.

FACE, in the military art, a word of command, intimating to turn about: thus, *face to the right*, is to turn upon the left heel a quarter-round to the right; and, *face to the left*, is to turn upon the right heel a quarter-round to the left.

FACE *of Plants*, among botaniſts, ſignifies their general appearance, which, being nearly the ſame in plants of the ſame genus, ſerves to diſtinguiſh them at firſt ſight.

FACET, or FACETTE, among jewellers, the name of the little faces or planes to be found in brilliant and roſe diamonds. See the article DIAMOND.

FACTION, a cabal or party formed in a ſtate, city, or company.

FACTION, in antiquity, a name given to the different companies of combatants in the circus.

FACTITIOUS is any thing made by art, and is uſually taken in oppoſition to natural. Thus ſope is a factitious body or concrete, but fuller's earth is a natural one.

The word is Latin, *factitius*, and derived from *facio*, to do, or perform.

FACTOR, in commerce, is an agent or correſpondent reſiding beyond the ſeas, or in ſome remote part, commiſſioned by merchants to buy or ſell goods on their account, or aſſiſt them in carrying on their trade.

FACTOR, in multiplication, a name given to the multiplier and multiplicand, becauſe they conſtitute the product. See the article MULTIPLICATION.

FACTORAGE, called alſo commiſſion, is the allowance given to factors by the merchant who employs them.

FACTORY is a place where a conſiderable number of factors reſide to negotiate for their maſters or employers.

FACTUM, in arithmetic, the product of two quantities multiplied by each other.

FACULÆ, in aſtronomy, are ſhining parts which the moderns have ſometimes obſerved upon the ſun's diſk; but they are very ſeldom ſeen.

The word is Latin, from the plural of *facula*, a little torch.

Kircher and Scheiner conceive them to be a ſort of volcanos in the body of the ſun. But Huygens and others attribute the cauſe of theſe phœnomena to the tremulous agitation of the vapours near our earth; the ſame as ſometimes ſhew a little unevenneſs in the circumference of the ſun's diſk, when viewed through a teleſcope.

FACULTY, in law, a privilege granted to a perſon, by favour and indulgence, of doing what, by law, he ought not to do.

For granting theſe privileges, there is a court under the archbiſhop of Canterbury, called the court of the faculties, the chief officer of which is ſtiled maſter of the faculties; who has a power of granting diſpenſations in divers caſes, as to marry without the banns being firſt publiſhed; to ordain a deacon under age; for a ſon to ſucceed his father in his benefice; a clerk to hold two or more livings, &c.

FACULTY, in the ſchools, a term applied to the different members of an univerſity, divided according to the arts and ſciences taught there.

FACULTY *of Advocates*, a term applied to the college or ſociety of advocates in Scotland, who plead in all actions before the court of ſeſſion.

FACULTY is alſo uſed to denote the powers of the human mind, viz. underſtanding, will, memory, and imagination. See the article UNDERSTANDING, &c.

FÆCES, properly the lees or grounds of any fermented liquor; but generally, in medicine, it is underſtood of wine; though the ſediment of any liquid is called fæx or fæces: by this is alſo underſtood the excrements of the belly.

FÆCES, in chemiſtry, whatever remains in the veſſel after diſtillation, &c.

FÆCULA, in pharmacy, a medicine which conſiſts of the fæces of vegetable juices, chiefly thoſe of roots.

The word is Latin, being a diminutive of *fæx*, ſediment, or lees.

FÆCULENT, in general, is applied to things abounding with fæces, or dregs: thus the blood and other humours of the human body, are ſaid to be fæculent, when without that purity which is neceſſary to health.

FAG-END, in the ſea-language, the end of any rope which is untwiſted and looſened by frequent uſe: to prevent this, the ends of ropes are generally well faſtened by binding a piece of ſmall cord or packthread around them, which is called whipping them.

FAGONA, in anatomy, a conglomerate gland, the ſame with thymus. See THYMUS.

FAGONIA, the cretic trefoil, in botany, a genus of plants, the corolla of which conſiſts of five cordated patent petals, with long ſlender ungues inſerted in the cup; the fruit is a roundiſh acuminated capſule, compoſed of ten valves, which form five lobes, and as many compreſſed cells; the ſeed is ſingle, and of a roundiſh figure.

FAGOPYRUM, buck-wheat, in botany. See BUCK-WHEAT.

FAGOTTINO, in muſic, is a ſingle curtail, a muſical inſtrument ſomething like the baſſoon. See BASSOON.

FAGOTTO, in muſic, the double curtail, or in reality a double baſſoon, as big again as the former.

FAGUS, the beech, in botany. See BEECH TREE.

FAILURE, a ſpecies of bankruptcy, commonly called breaking, or ſtopping payment. See BANKRUPTCY.

FAINT-ACTION, in law, a feigned action, or ſuch as, although the words of the writ are true, yet, for certain cauſes, the plaintiff has no title to recovery thereby.

FAINT PLEADER, in law, a covinous, falſe, or colluſory manner of pleading, to the deceit of a third perſon.

FAINTING. See LIPOTHYMIA.

FAIR, a greater kind of market, granted to a town, by privilege, for the more ſpeedy and commodious providing

viding of ſuch things as the place ſtands in need of. See the article MARKET.

FAIRY, or FARY, in ancient traditions and romances, denotes a kind of imaginary genii, converſant on earth, and diſtinguiſhed by abundance of fantaſtical actions and offices, good or evil. Fairies are of Oriental extraction, and ſeem to have been invented by the Perſians and Arabs, whoſe hiſtory and religion abound with tales of the fairies and dragons. The Perſians call them Peri, the Arabs Ginn, having a peculiar country which they ſuppoſe them to inhabit, called Ginniſtan, by us Fairy-land.

Spenſer's Fairy Queen is an epic poem, under the perſons and characters of the fairies. In this kind of writing, the poet loſes ſight of nature, and entertains his readers with characters of fairies, witches, magicians, demons, and departed ſpirits. It requires an odd turn of thought, and an imagination naturally fruitful and ſuperſtitious. The poet ought likewiſe to be well verſed in legends, fables, antiquated romances, and the tradition of our nurſes, in order to fall in with thoſe natural prejudices and notions which we have imbibed in our infancy.

The whole ſubſtance of this poetry owes its original to the darkneſs and ſuperſtition of later ages, when pious frauds were made uſe of to amuſe or frighten mankind into a ſenſe of their duty. Among the Engliſh poets Shakeſpeare has incomparably excelled all others, particularly in his Macbeth, his Midſummer Night's Dream, &c.

This ſort of poetry raiſes a pleaſing kind of horror in the mind, and amuſes the imagination with the ſtrangeneſs and novelty of the perſons repreſented therein. They bring up into our memory the ſtories we have heard in our childhood, and favour thoſe ſecret terrors and apprehenſions, to which we are naturally ſubject. Men of cool tempers object to this kind of poetry, that it has not probability enough to affect the imagination.

FAIRY-CIRCLE, or RING, is a phœnomenon pretty frequent in the fields, &c. being a kind of circle, which the vulgar ſuppoſe to be traced by the fairies in their dances.

There are two kinds of it; one of about three yards in diameter, containing a bare path about a foot broad, with graſs growing in the middle. Meſſ^rs. Jeſſop and Walker, in the Phil. Tranſ. aſcribe them to lightning, which is confirmed by their being moſt frequently after ſtorms of that kind, as well as by the colour and brittleneſs of the graſs's roots, when firſt obſerved. Lightning, like all other fires, moves round and burns more in the extremity than the middle; the ſecond circle ariſes from the firſt, the graſs burnt up growing more plentifully afterwards. Others maintain that theſe circles are made by ants, which are frequently found in great numbers therein.

FAITH, *Fides*, in antiquity, was deified by the Romans, and had a temple in the Capitol.

Public faith is repreſented on medals ſometimes with a baſket of fruit in one hand, and ſome ears of corn in the other; and ſometimes holding a turtle-dove. But the moſt uſual ſymbol is with her two hands joined together.

FAITH, in divinity and philoſophy, the firm belief of certain truths upon the teſtimony of the perſon who reveals them.

The grounds of a rational faith are, 1. That the things revealed be not contrary to, though they may be above natural reaſon. 2. That the revealer be well acquainted with the things he reveals. 3. That he be above all ſuſpicion of deceiving us.

Where theſe criterions are found, no reaſonable perſon will deny his aſſent: thus, we may as well doubt of our exiſtence, as of the truth of a revelation coming from God, who can neither be deceived himſelf, nor deceive others by propoſing things to be believed, that are contradictory to the faculties he has given us. Whatever propoſitions, therefore, are beyond reaſon, but not contrary to it, are, when revealed, the proper matter of faith.

Confeſſion of FAITH. See CONFESSION.

FAITHFUL, an appellation aſſumed by the Mahometans. See MUSSULMEN.

FAKE, among ſailors, when a cable or other rope is laid in a proper diſpoſition for ſtowage aboard ſhip, it is winded round and round in a ſerpentine revolution; this winding is called coiling, and each of the turns thereof is called a fake; ſix or eight fakes compoſe what is called a tier; and the whole cable conſiſts of a greater or leſs number of theſe tiers, which lie all above one another in the manner deſcribed, according to the room or extent of ſpace in which it is coiled.

FAKIR, in pagan theology, a kind of Indian monks, who even outdo the mortifications and ſeverities of the ancient Chriſtian anchorets.

Some of them mangle their bodies with ſcourges and knives; others never lie down; and others remain all their lives in one poſture.

There are alſo another kind of fakirs, who do not practiſe ſuch ſeverities; theſe flock together in companies, and go from village to village, propheſying and telling fortunes. It is ſaid that even perſons of fortune, in India, become fakirs, and that there are more than two millions of them.

FALCATED, ſomething in the form of a ſickle: thus, the moon is ſaid to be falcated when ſhe appears horned. See the articles MOON and PHASIS.

FALCO, in ornithology, a genus of birds, of the order of the accipitres, with three toes always before, and only one behind.

This genus comprehends the falcon kind, properly ſo called, the hawk, gyrfalcon, eagle, buzzard, pygargus, lannar, kite, keſtril, &c.

FALCON, or FAUCON, in gunnery, a piece of cannon. See the article CANNON.

FALCONET, or FAUCONET. See the article CANNON.

FALCONRY, the art of taming, managing, and tutoring hawks and falcons to catch their prey.

The word is French, *fauconerie*, which ſignifies the ſame.

The terms of falconry, and what we know of the art itſelf, we borrow from the French. The grand ſeignior uſually keeps ſix thouſand falconers in his ſervice; and the French king has a grand falconer. Hiſtorians take notice of this poſt as early as 1250. Falconry, as now practiſed, was unknown to the Greeks and Romans.

FALDAGE, an ancient privilege reſerved to lords, of ſetting up folds for ſheep in any fields within their manors, for the better manuring of the ſame; and this, in former times, was uſually done as well with their tenants ſheep, as with their own.

FALDFEY, or FALDFEE, a rent or fee paid by ſome cuſtomary tenants, for liberty to fold their ſheep on their own lands.

FALL, the deſcent of a heavy body towards the center of the earth. See the articles DESCENT, GRAVITY, ACCELERATION, &c.

FALL is alſo the name of a meaſure of length uſed in Scotland, and containing ſix ells of that country. See MEASURE and ELL.

FALLACY, a deception, fraud, or falſe appearance.

FALLACY, or *Syllogiſtical* FALLACY, in logic, a captious argument, which, on account of its apparent goodneſs and defect, is made uſe of to deceive a reſpondent not well verſed in the art of ſophiſtry. See the article SOPHISM.

FALLING-SICKNESS, the ſame with epilepſy. See EPILEPSY.

FALLOPIAN TUBES, in anatomy, are appendages of the uterus. See the article GENERATION.

FALLOW, a pale red colour, like that of brick half burnt: ſuch is that of a fallow deer. See the article DEER.

FALLOW-FIELD, or FALLOW-GROUND, land laid up, or that has lain untilled for a conſiderable time.

FALLOWING *of Land*, a particular method of improving land.

The great benefit of fallowing appears by the common practice of landlords, who every where take care to oblige their tenants to a ſtrict obſervance of it once in three years; few lands being able to bear two crops without it.

It appears that none will find a year's fallowing a loſs to them, let their land be what it will; but, more particularly,

cularly, the advantage of fallowing conſiſts in, firſt, its laying the land in ridges, and its expoſing it to the froſt, wind, ſun, and dews, all which ſweeten and mellow the land very much; the often ſtirring of it, and breaking the clots, diſpoſe it for the bearing of good crops. Secondly, it kills the weeds, by turning up the roots to the ſun and air; and kills not only the weeds that grew with the laſt corn, but wild oats, darnel, and other weeds that ſow themſelves, and that as ſoon as they begin to peep out of the ground; ſo that they have no time to ſuck out any of the heart of the land.

The way of ordering fallow-lands is, after the crop is off, to let the land lie all winter, and what graſs and weeds grow on it, to eat off with ſheep in April, or beginning of May. As ſoon as they have done ſowing of corn, they begin to plow up their fallows. This firſt fallowing in many places, ought to be very ſhallow, well turned, and clapped cloſe together, becauſe the thinner the turf is, the eaſier will it dry through, and kill the weeds, eſpecially if the weather be dry: but, in ſome places, where there is a very cold clay, that will not bear corn well without being expoſed to the heat of the ſun to warm it, they plow their firſt plowing the depth they deſign to go. About June is the time of the ſecond plowing, which they call twy-fallowing; at which plowing, you muſt go your full depth. About the latter end of July, or the beginning of Auguſt, is the time of try-fallowing, or laſt plowing, before they ſow their rye or wheat: but ſome plow up their land oftener.

If the land riſe full of clots, and if it is a binding land, you muſt make it fine by harrowing of it, when rain comes; but then you muſt not let it lie long before you ſtrike, ſiſe, or plow it up into ſmall ridges, eſpecially if it is wet land; and as near as you can, leave no weeds, turfs, or graſs unkilled, or unbroke with your harrows. But if your land will diſſolve well with the froſt, it is beſt to let it lie a little rougher, eſpecially if you deſign to ſow it with barley; for the rougher it lies for a winter-fallowing, the better. If the winter does not diſſolve the clots, which it will not do in binding lands, you muſt wait rain for the fallowing of it. Where the land is but indifferent, and the manure is not to be got, fallowing every other year is found a great improvement. In ſome places they take a crop of wheat, and a crop of peaſe, and ſo fallow their land again.

FALSE, in general, ſomething contrary to truth, or not what it ought to be: thus we ſay, a falſe witneſs, falſe action, falſe weights, falſe claim, &c. See the articles WITNESS, ACTION, &c.

FALSE *Impriſonment*. See IMPRISONMENT.

FALSE *Judgment*. See JUDGMENT.

FALSHOOD, in philoſophy, an act of the underſtanding repreſenting a thing otherwiſe than it is as to its accidents.

FALX, in anatomy, is a duplicature of the dura mater; ſo called from its curvature. See BRAIN.

The word is Latin, and literally ſignifies a ſickle.

FAMILIARS *of the Inquiſition*, are people that aſſiſt in the apprehending of ſuch perſons as are accuſed, and to carry them to priſon; upon which occaſion, the unhappy perſon is ſurrounded by ſuch a number of theſe officious gentlemen, that there is no poſſibility of eſcaping out of their hands. As a reward of this baſe employ, the familiars are allowed to commit the moſt enormous actions, to debauch, aſſaſſinate, and kill, with impunity. See the article INQUISITION.

FAMILY, *Familia*, denotes the perſons that live together in one houſe, under the direction of one head or chief manager. It alſo ſignifies the kindred or lineage of a perſon, and is uſed by old writers for a hide or portion of land ſufficient to maintain one family. See the article HIDE.

FAMILY, in natural hiſtory, a term uſed by authors to expreſs any order of animals, or other natural productions of the ſame claſs. See CLASS and ORDER.

FAMILY *of Curves*. See CURVE.

FAN, a machine uſed to raiſe wind and cool the air by agitating it.

FAN is alſo uſed as an inſtrument for winnowing corn.

FANATICS, wild, enthuſiaſtic, viſionary perſons, who pretend to revelation and inſpiration.

FANCY, or IMAGINATION. See IMAGINATION.

FANIONS, in the military art, ſmall flags carried along with the baggage.

FANUM, TEMPLE. See TEMPLE.

FAPESMO, a form of ſyllogiſm, wherein the major or firſt propoſition is an univerſal affirmative, the minor an univerſal negative, and the concluſion a particular negative.

FARCE originally implied thoſe little pieces of drollery exhibited by mountebanks and their buffoons, in the open ſtreets, to gather the people together.

The word is French, and ſignifies forced meat or ſtuffing.

Farce is at preſent of more dignity: it is removed from the ſtreet to the theatre, and inſtead of being performed by merry-andrews to amuſe the rabble, is acted by comedians, and become the entertainment of a polite audience. Poets have reformed the wildneſs of the primitive farces, and brought them to the taſte and manner of comedy. The difference of the two upon the Engliſh ſtage is, that comedy keeps to nature and probability, and therefore is confined to certain laws preſcribed by ancient critics; whereas farce diſallows of all laws, or rather ſets them aſide on occaſion. Its end is purely to make merry, and it ſticks at nothing which may contribute thereto, however wild and extravagant. Hence the dialogue is uſually low, the perſons of inferior rank, the fable or action trivial or ridiculous, and nature and truth every where exaggerated to afford the more palpable ridicule. The ancient farces ſeem to have been a true imitation of the antique mimes. Our modern farces are now denominated entertainments.

FARCIMINALIS TUNICA, in anatomy, the ſame with the allantois. See ALLANTOIS.

FARCIN, or FARCY, in farriery, a diſtemper of the blood-veſſels, which generally follows the courſe of the veins, and when inveterate thickens their coats and integuments.

At firſt one or more ſmall ſwellings, or round buds like grapes or berries, ſpring out over the veins, and are often exquiſitely painful to the touch; in the beginning they are hard, but ſoon turn into ſoft bliſters, which, when broke, diſcharge an oily or bloody ichor, and turn into very foul and ill diſpoſed ulcers. In ſome horſes it appears on the head only; in ſome on the external jugular; in others on the plate vein, and runs downwards on the inſide of the fore-arm towards the knee, and very often upwards towards the briſket; in ſome the farcy ſhews itſelf on the hind parts, about the paſterns, and along the large veins on the inſide of the thigh, riſing upwards into the groin, and towards the ſheath; and ſometimes the farcy makes its appearance on the flanks, and ſpreads by degrees towards the lower belly, where it often becomes very troubleſome.

When the farcy appears on the head only, it is eaſily cured; eſpecially when it is ſeated in the cheeks and forehead, the blood veſſels being here ſmall; but it is more difficult when it affects the lips, the noſtrils, the eyes, and kernels under the jaws, and other ſoft and looſe parts, eſpecially if the neck vein becomes chorded. When it begins on the outſide of the ſhoulder or hips, the cure is ſeldom difficult; but when the farcy ariſes on the plate vein, and that vein ſwells much, and turns chorded, and the glands or kernels under the arm-pit are affected, it is hard to cure; but more ſo when the crural veins within ſide of the thigh are chorded, and beſet with buds, which affect the kernels of the groin, and the cavernous body of the yard. When the farcy begins on the paſterns or lower limbs, it often becomes very uncertain, unleſs a timely ſtop is put to it; for the ſwelling in thoſe dependant parts grows ſo exceſſively large in ſome conſtitutions, and the limbs ſo much diſfigured thereby with foul ſores and callous ulcerations, that ſuch a horſe is ſeldom fit for any thing afterwards, but the meaneſt drudgery: but it is always a promiſing ſign, wherever the farcy happens to be ſituated, if it ſpreads no farther. It is uſual to affect only one ſide at a time, but when it paſſes over to the other, it ſhews great malignancy; when it ariſes on the ſpines, it is then for the moſt part dangerous, and is always more ſo to horſes that are fat and full of blood, than to thoſe that are in more moderate caſe. When the farcy

is epidemical, as ſometimes happens, it riſes on ſeveral parts of the body at once, forms naſty foul ulcers, and makes a profuſe running of greeniſh bloody matter from both noſtrils; and ſoon ends in a miſerable rot.

From this deſcription of the farcy, it will appear how greatly thoſe may be diſappointed, who depend on ſome ſingle ſpecific drink or ball for a certain cure; for the ſymptoms are ſometimes ſo favourable, that it is eaſily conquered by a very ſimple management; and when it ariſes ſuperficially upon the ſmaller veſſels, it will often go off, with moderate labour, without any other means than bleeding. Such inſtances as theſe may eaſily give a reputation to things of no great efficacy, and bring them into eſteem: but whoever has acquired any true notion of the farcy, will know that this diſtemper is not to be conquered but by ſuch things as are fitly adapted to the various ſymptoms that occur in the different ſtages of it. To avoid therefore the perplexity that ariſes from the various complications ſo uſual in the farcy, we ſhall conſider it in its different ſtates, or degrees, viz. when it ſeizes only the ſmaller veſſels; when the larger veins are chorded, and the feet, paſterns, and flanks affected: and laſtly, when the farcy beginning on one ſide only, breaks out on the other alſo, and affects the whole body.

When the farcy makes its firſt appearance on the head, it riſes on the cheeks and temples, and looks like a network, or ſmall creeping twigs full of berries. Sometimes it inflames the eye, and ſometimes little bliſters or buds run along the ſide of the noſe. It ariſes often on the outſide of the ſhoulder, running along the ſmall veins with heat and inflammation; and ſometimes a few ſmall buds appear near the withers, and on the outſide of the hip. In all theſe appearances, the diſeaſe being ſuperficial, and affecting only the ſmaller veſſels, is eaſily conquered by the following method, when taken in time; for the ſimpleſt farcy, if neglected, may degenerate into the worſt ſort.

This diſtemper then being of an inflammatory nature, and in a particular manner affecting the blood veſſels, muſt neceſſarily require large bleeding, particularly where the horſe happens to be fat and full of blood. This always checks the beginning of a farcy, but is of ſmall ſervice afterwards; and if a horſe is low in fleſh, the loſs of too much blood ſometimes proves injurious. After bleeding, let the horſe have four ounces of cream of tartar and lenitive electuary; which may be given every other day for a week, to cool the blood, and open the body; and then give nitre three ounces a day, for three weeks or a month; and anoint the buds and ſwellings with the following ointment twice a day.

"Take ointment of elder four ounces, oil of turpentine two ounces, ſugar of lead half an ounce, white vitriol powdered two drams; mix together in a gally-pot."

The buds ſometimes by this method are diſperſed, leaving only little bald ſpots, which the hair ſoon covers again. When they break and run, if the matter be thick and well digeſted, they will ſoon be well: but in order to confirm the cure, and to diſperſe ſome little lumps, which often remain for ſome time on the ſkin without hair, give the liver of antimony for a month; two ounces a day for a fortnight, and then one a day for the other fortnight; by following this method, a farcy which affects only the ſmall veſſels, may be ſtopped in a week or ten days, and ſoon after totally eradicated.

When the farcin affects the larger blood veſſels, the cure is more difficult; but let it always be attempted early: therefore, on the plate, thigh, or neck veins appearing chorded, bleed immediately on the oppoſite ſide, and apply the following to the chorded vein.

"Take oil of turpentine in a pint bottle ſix ounces, oil of vitriol three ounces; drop the oil of vitriol into the oil of turpentine by little at a time, otherwiſe the bottle will burſt; when it has done ſmoaking, drop in more oil of vitriol, and ſo on till all is mixed."

This mixture is one of the beſt univerſals in a beginning farcy; but where it is ſeated in looſe fleſhy parts, as flanks or belly, equal parts of the oil of vitriol and turpentine are neceſſary.

Rub the parts firſt with a woollen cloth; and then apply ſome of the mixture over the buds, and wherever there is any ſwelling, twice a day. Give the cooling phyſick every other day, and then three ounces of nitre every day for ſome time. This method muſt be continued till the buds digeſt, and the chord diſſolves; and when the ſores run plentifully, the matter digeſts well, and the lips and edges are no ways thick or callous, you may expect a ſpeedy recovery; yet to confirm the cure, and prevent a relapſe, give the liver of antimony or crude antimony, as before directed; and to heal the ſores and ſmooth the ſkin, dreſs with bees-wax and oil. *Bartlet's Farriery.*

FARDING-DEAL, the fourth part of an acre of land. See the article ACRE.

FARE moſt commonly ſignifies the money paid for a voyage, or paſſage, by water; but, in London, it is what perſons pay for being conveyed from one part of the town to another in a coach or chair.

FARINA, a Latin term ſignifying meal, or the flour of corn.

FARINA FOECUNDANS, among botaniſts, the impregnating meal or duſt on the apices or antheræ of flowers; which being received into the piſtil, uterus, or ſeed veſſel of plants, fecundates the rudiments of the ſeeds in the ovary, which otherwiſe would decay and come to nothing. See the article GENERATION *of Plants.*

FARLEY, or FARLIEU, money paid by tenants in the weſt of England, in lieu of a heriot. See the article HERIOT.

FARM, or FERM, ſignifies the chief meſſuage in a village, or any large meſſuage whereto belongs land, meadow, paſture, wood, common, &c. and which has been uſed to let for term of life or years, under a certain yearly rent payable by the tenant for the ſame.

FARMER, the perſon who occupies or is leſſee of a farm, whether for life or years.

FARMER, among miners, ſignifies the lord of the field, or the perſon who farms the lot and cope of the king.

FARRIER, one whoſe employment is to ſhoe horſes, and cure them when diſeaſed or lame.

FARRIERY, the art of trimming the feet, and curing diſeaſed horſes. See HORSE.

FARTHING, the leaſt copper coin uſed in Britain; being half of the half-penny. See the article EXCHANGE.

FASCES, in Roman antiquity, axes bound up together with rods or ſtaves, and carried before the Roman magiſtrates as a badge of their authority and office.

FASCETS, in the art of making glaſs, are the irons thruſt into the mouths of bottles, in order to convey them into the annealing tower.

FASCIA, in architecture, ſignifies any flat member having a conſiderable breadth and but a ſmall projecture, as the band of an architrave, larmier, &c.

Faſcias, in brick buildings, are certain juttings out of the bricks over the windows of each ſtory, except the upper one. Theſe are ſometimes plain, like thoſe of columns; but ſometimes they are moulded, and the moulding is uſually a ſcima reverſa at the bottom, above which are two plain courſes of bricks, then an aſtragal, and laſtly, a boultin. See the articles ASTRAGAL and BOULTIN.

FASCIA LATA, in anatomy, the name of a muſcle, or muſcular ligament.

It is very conſiderable for its extent and ſtrength, being compoſed principally of two planes of fibres, of which the external are more or leſs longitudinal; the internal more or leſs tranſverſe. It is further ſtrengthened in ſome places by a great number of other fibres, which augment its thickneſs, and form particular expanſions. The tranſverſe fibres are much ſtronger than the longitudinal.

It is fixed above to the criſta of the os ilium, from the large tuberoſity, to the anterior ſuperior ſpine, to the ligamentum Fallopii, and to the aponeuroſis of the obliquus externus of the abdomen, on which it runs up by a thin lamina. It is likewiſe fixed in the lateral inferior part of the os ſacrum, and to the neighbouring parts of the ligaments, by which that bone is connected to the ilium and iſchium.

From thence it advances over the glutæi and thigh, between the membrana adipoſa and muſcles, down to the anterior and outer parts of the knee. It is very thin on the

the patella: it is alſo continued over the external anterior part of the tibia covering the muſcles thereof, and is ſtrongly inſerted in the head and criſta of that bone, and in the upper part of the fibula.

It ſends off elongations, which, like ſcepta, run in between the muſcles, and ſometimes meet ſo as to form vaginæ. It is ſtrongeſt on the anterior and outer parts of the thigh, growing gradually thinner on the inner and back parts.

It is ſtrongly inſerted in the linea femoris aſpera, between the vaſtus externus and biceps, forming a ſeptum between theſe. It furniſhes particular vaginæ to the muſcles, on the inſide of the thigh, which vaginæ, though thin, are pretty ſtrong, principally conſiſting of tranſverſe fibres.

The muſculus FASCIÆ *Latæ* is a ſmall and pretty long muſcle, ſituated ſomewhat obliquely upward and downward, on the fore-part of the hip. It is fixed above to the outſide of the anterior ſuperior ſpine of the ilium, between the inſertions of the glutæus medius and ſartorius. Thence its fleſhy fibres run down a little obliquely backward, forming a very flat body, four fingers breadth in length, and two in breadth.

This body lies between two laminæ of the faſcia, and is inſerted therein by ſhort tendinous fibres, which diſappear, at that place where the faſcia adheres to the great trochanter and tendon of the glutæus maximus. *Winſlow's Anat.*

FASCIÆ, in aſtronomy, ſeveral rows of bright ſpots on Jupiter's body, reſembling belts or ſwaths.

Theſe faſciæ or belts are more lucid than the reſt of the planet's diſk, and are terminated by parallel lines. Some have imagined that they are long canals of ſome fluid matter, or water; and, becauſe they have diſcovered ſeveral dark ſpots on his diſk, they conclude that the planet's ſurface is divided into land and water, like that of our globe.

FASCIALIS, in anatomy, is the ſame with faſcia lata. See FASCIA LATA.

FASCICULUS, in medicine, denotes a handful; or, according to others, as much as can be taken up between two fingers and the thumb.

The word is Latin, being a diminutive of *faſcis*, a bundle.

FASCINATION, a kind of witchcraft or enchantment, ſuppoſed to operate by the influence either of the eye or tongue.

FASCINES, or FAGGOTS, in fortification, are ſmall branches of trees or bavens bound up in bundles, which are uſed in an army, in order to cover themſelves, and burn the enemies lodgments; and which, when mixed with earth, ſerve to fill up ditches, mend roads, &c.

FASHION, a term uſed among artificers in gold and ſilver, for the trouble, time, and labour employed in a piece of work. It is by the faſhion that workmens wages are regulated.

FASHION-PIECES, in ſhip-building, the aftmoſt or hindmoſt of the timbers of a ſhip, which limit the breadth and form the ſhape of the ſtern. See the article SHIP-BUILDING.

FAST, or FASTING, in general, denotes the abſtinence from food; but is more particularly uſed for ſuch abſtinence on a religious account.

FAST-DAYS, thoſe appointed, by public authority, to be obſerved in faſting and humiliation.

FAST-GROUND, or FAST-COUNTRY, among miners, denotes the ſame with ſhelf. See the article SHELF.

FASTERMANS, among our Saxon anceſtors, were pledges or bondſmen, who were anſwerable for each other's good behaviour.

FASTI, in Roman antiquity, the calendar wherein were expreſſed the ſeveral days of the year, with their feaſts, games, and other ceremonies.

FASTI CONSULARES, a tablet or chronicle, wherein the ſeveral years were denoted by the reſpective conſuls, with the principal events that happened during their conſulſhip. And hence, the term faſti is ſtill applied to the archives and public regiſters of a nation.

FASTIGIUM, in architecture, the ſame with pediment. See PEDIMENT.

FAT, in anatomy, an oily, ſulphureous part of the blood, depoſited in the cells of the membrana adipoſa, from the innumerable little veſſels which are ſpread amongſt them.

This fat is to be found immediately under the ſkin, in all the parts of the body, except the forehead, eye-lids, lips, upper-part of the ear, penis, and ſcrotum. In ſome bodies the veſicles of the membrana adipoſa are ſo full, that the fat is an inch or more thick; and in others they are almoſt flat, containing little or no fat. There are two ſorts of fat, one white, or rather yellow, ſoft and lax, which is eaſily melted, and is called pinguedo; another white, firm, brittle, and which is not ſo eaſily melted, called ſebum, ſuet or tallow. Some reckon the marrow of the bones for a third ſort of fat.

Dr. Grew takes the fat of animals to be a curdling or coagulating of the oily parts of the blood, either by ſome of its own ſaline parts, or by the nitrous particles of the air mingled therewith: whence it is that ſome animals, as rabbits and field hares, grow fat in froſty weather: and for the ſame reaſon it is, that the fat of animals is hard; whereas that of fiſhes is ſoft, and runs all to oil, becauſe the water in which they live, hath but few nitrous particles in it, in compariſon of air.

FAT, or VAT, is alſo uſed for ſeveral utenſils, as, 1. A large wooden veſſel, uſed for the meaſuring of malt, and containing a quarter, or eight buſhels. 2. A large brewing veſſel, uſed by brewers to run their wort in. 3. A leaden pan or veſſel for the making of ſalt at Droitwich.

FAT likewiſe denotes an uncertain meaſure of capacity. Thus a fat of iſinglaſs contains from three hundred and a quarter to four hundred weight; a fat of unbound books, half a maund or four bales; of wine, from twenty to twenty-five hundred weight; and of yarn, from two hundred and twenty, to two hundred and twenty-one bundles.

FATE, or DESTINY, is ſomething that is ſuppoſed to infer the neceſſity of any event, the cauſe of which we are but very little acquainted with, and which ariſes from a power ſuperior to any that is ſubject to man.

The Stoics who admitted a providence, did, however, ſubject it to fate; and yet they did not make it more inflexible than the predeſtination of the Calviniſts.

FATHER, a term of relation denoting a perſon who hath begot a child.

FATHER, in theology, is uſed in ſpeaking of the firſt perſon of the Trinity. See the article TRINITY.

FATHER is alſo uſed in ſpeaking of ſpiritual and moral things. Thus Abraham is called the father of the faithful.

FATHER, in church hiſtory, is applied to ancient authors who have preſerved in their writings the tradition of the church.

FATHER is alſo a title of honour given to prelates and dignitaries of the church, to the ſuperiors of convents, to congregations of eccleſiaſtics, and to perſons venerable for their age and quality.

FATHER-LASHER, a name given by the inhabitants of Cornwall to a fiſh of the cottus kind, with the upper-jaw longeſt, and a prickly head.

FATNESS. See the article CORPULENCY.

FATTENNING of oxen, horſes, ſwine, poultry, &c. See the articles OX, HORSE, &c.

FAVIFORM, in general, ſomething reſembling a honey-comb. Surgeons give this appellation to certain ulcers, which emit a ſanies through little holes, eſpecially in the head. See HONEY-COMB.

FAUNALIA, in Roman antiquity, three annual feſtivals in honour of the god Faunus, the firſt of which was obſerved on the ides of February; the ſecond on the ſixteenth of the calends of March; and the third on the nones of December.

FAUNS, FAUNI, or SATYRS, were a kind of rural deities, or rather demi-gods, among the Romans, and inhabited the woods; wherefore they were called ſylvani; they were companions of Pan or Faunus. They were not known among the Greeks. The Latins repreſented them half man and half goat, with the horns, ears, feet, and tail of a goat, a flat noſe, and with hair on their bodies. The wild pine and olive were conſecrated to the Fauns. We find ſome authors ſo ridiculous as ſeriouſly to examine,

whether there were ſuch animals whoſe bodies were part man and part beaſt!

FAUSSE-BRAYE, in fortification, is a mount or rampart, of four fathoms width, on the outſide of the firſt rampart, that goes quite round the place, in order to defend the foſſe; and is covered with a parapet. It is made uſe of to fire upon the enemy, when advanced ſo far as not to be driven off the parapet from the body of the place; and it alſo ſerves to receive the ruins which the cannon make in the body of the place.

FAWN, among ſportſmen, a buck, or doe, of the firſt year; or the young one of the buck's breed in its firſt year.

FEALTY, in law, an oath taken on the admittance of any tenant, to be true to the lord of whom he holds his land: by this oath the tenant holds in the freeſt manner, on account that all who have fee, hold *per fidem et fiduciam*, that is, by fealty at the leaſt.

FEAST, or FESTIVAL, is applied now to any ſolemnity or feſtivity; but, in the church, it ſignifies thoſe days which are obſerved in honour of God, or of ſome ſaint.

According to Athenæus, feaſts were occaſioned by devotion to the gods; for though on feſtival days people reſted from their labour, and lived more plentifully than at other times, yet believing the gods were preſent at their tables, they behaved with ſobriety; neither did they drink to exceſs, but, after a moderate refreſhment, offered libations and ſo departed home. The Hebrews were very magnificent and expenſive in their feaſts, which they had frequently; where all was gaiety and mirth, and every thing that could delight the ſenſes was introduced. Sitting was their original poſture at meals, which they afterwards changed to lying on beds. The Greeks and Romans had a ſympoſiarch, or governor of the feaſt, whoſe office Plutarch deſcribes.

At Athens no perſon was allowed to entertain above thirty at once. Men and women were never feaſted together, as Cicero inform us, Orat. 3. in Verrem, wherein the Greeks differed from the Romans, amongſt whom women were allowed more freedom. Before people went to an entertainment, they anointed themſelves. They who came off a journey were waſhed and clothed in the houſe of the entertainment, before they were admitted to the feaſts. They were uſually clad in white, or ſome ſuch chearful colour; they waſhed their hands before they ſat down, and between every courſe, and after ſupper.

FEATHER, *Pluma*, the part which covers birds, and enables them to fly. See BIRD.

FEATHER, in horſemanſhip, a ſort of natural frizzling of the hair, which in ſome parts riſes above the reſt, reſembling the tip of an ear of corn. This happens moſt frequently between the eyes; and if lower, it is a ſign of a weak ſight.

A feather upon a horſe's neck, is called a Roman feather; being a row of hair turned back, and forming a mark like a ſword-blade near the mane.

Mid-FEATHER, in the ſalt-works, the partition in the middle of the furnace, which it divides into two chambers.

FEATHER-EDGED, among carpenters, an appellation given to planks or boards, which have one ſide thicker than the other.

Prince's FEATHER, a plant otherwiſe called amaranth. See the article AMARANTH.

FEBRIFUGES, in medicine, are ſuch things as mitigate or remove a fever; they are otherwiſe called antifebrilia.

The word is Latin, *febrifuga*, and derived from *febris*, a fever, and *fugo*, to remove, or drive away.

FEBRIS, FEVER, in medicine. See FEVER.

FEBRUARY, the ſecond month in the year, reckoning from January. It was added to Romulus's calendar by Numa Pompilius.

The word is Latin, *Februarius*, and derived from *februa*, which was a certain kind of ceremony performed in that month, in which wax candles and flambeaux were lighted at the graves of the dead, and oblations made to their manes.

FECIALES, or FOECIALES, a college of prieſts inſtituted at Rome by Numa, conſiſting of twenty perſons, ſelected out of the beſt families. Their buſineſs was to be arbitrators of all matters relating to war and peace, and to be the guardians of the public faith.

FECULA, or FÆCULA, in pharmacy. See the article FÆCULA.

FECULENT, or FÆCULENT. See the article FÆCULENT.

FECUNDITY, or FOECUNDITY, the ſame with fertility. See the article FERTILITY.

FEE, in law, ſignifies a certain allowance to phyſicians, barriſters, attornies, and other officers, as a reward for their pains and labour.

FEE alſo denotes a ſettled perquiſite of public officers, payable by thoſe who employ them.

FEE-ESTATE, that held by the benefit of another, and for which ſome ſervice, rent, or acknowledgment is paid to the chief lord, or ſuperior, in whom the mere propriety of the ſoil always continues.

Fee is generally divided into abſolute and conſtitutional. Abſolute, otherwiſe termed fee-ſimple, is where a perſon is ſeized of lands or tenements, to him and his heirs for ever; whereas, fee-tail, or conditional fee, is where a perſon is ſeized of lands, with a limitation to him and the heirs of his body. A fee-ſimple is the largeſt eſtate a perſon can have, and can be conveyed by no other expreſſion, but heirs for ever; yet, in a will, which is more favoured than a grant, the intention of the teſtator is more conſidered than the literal meaning of the words.

FEE-FARM, a kind of tenure without homage, fealty, or other ſervice, except that mentioned in the feoffment; which is uſually the full rent, or at leaſt a fourth part of it.

The nature of this tenure is, that if the rent be behind, and unpaid for two years, then the feoffer and his heirs may have an action for the recovery of the lands.

FEELERS, in natural hiſtory, a name uſed by ſome for the horns of inſects. See the article HORN.

FEELING, TOUCHING, one of the external ſenſes, by which we attain the ideas of ſolid, hard, ſoft, rough, hot, cold, wet, dry, and other tangible qualities.

The feeling participates of leſs delicacy than the other ſenſes, but at the ſame time ſurpaſſes them in point of certainty. It abſolutely cuts off all incredulity; beſides which good property, it enjoys that of being the moſt general ſenſation. Seeing and hearing reſult from the organization of a very minute portion of our ſtructure; but it is requiſite that every part of the animal œconomy ſhould be endued with the faculty of feeling, to diſtinguiſh us from mere machines, that may be taken to pieces at pleaſure, without the conſciouſneſs of any violence offered to their mechaniſm. This is what nature has furniſhed; and wherever we find nerves and life, there alſo ſubſiſts this ſort of ſenſation; which does not ſeem to ſtand in need of any particular organization, or to depend on the ſtructure of the nervous papillæ, the ſimple ſolid texture of the nerve being alone ſufficient to produce it. The lips of a green wound, the perioſteum, or a tendon, laid bare, have a very quick ſenſation, though deſtitute of the nervous papillæ obſervable on the ſkin. Nature, whom one would conclude neceſſarily obliged to be at a great expence in producing this ſenſe of feeling, has, nevertheleſs, eſtabliſhed it at a ſmall one; ſo that the nervous papillæ are not abſolutely neceſſary to feeling, but to the perfection of it, and the variety of the reſpective ſenſations. The ſenſe of feeling, therefore, is the baſis of all other ſenſations: it is the genus of which they are the moſt perfect ſpecies. All the nervous ſolids, animated by a fluid, are endued with this general ſenſation. But the papillæ of the ſkin, thoſe of the fingers, for example, enjoy it to a degree of perfection, which adds to the firſt ſenſation a ſort of diſcernment of the figure of the body touched. The papillæ of the tongue ſurpaſs thoſe of the ſkin; and, in ſhort, thoſe of the noſe, the papillæ of the tongue: and ſo of the reſt, in proportion to the delicacy of the ſenſation. What we are advancing, in regard to the papillæ, does not at all exclude the reſt of the nervous texture from the ſhare it has in cauſing ſenſation. The papillæ are more concerned than this texture, in particular organs, as on the ſkin and the tongue. In others they have a leſs portion aſſigned them; namely, in reſpect of the

the noſe, or the pituitary membrane, which conſtitutes the organ of ſmelling. In ſhort, in other places, the papillæ ſeem to have ſtill a leſs ſhare; and the ſolid nervous texture almoſt ſingly compoſes the organ, as in the ſight. Theſe differences proceed from each organ's being proportioned to the object whoſe impreſſion it receives. It would be very conducive to the perfection of feeling, were the nerves to form ſmall ſenſible eminences; becauſe theſe ſort of ſharp-pointed ſubſtances are more eaſily irritated by the ſurface of bodies, than any uniform texture could poſſible be. The taſte would require nervous papillæ, that ſhould be of a ſpongy nature, and at the ſame time ſufficiently impregnated with moiſture, to dilute and diſſolve the principles of taſte, and to admit them eaſily into their texture, in order to their making a more lively impreſſion. The pituitary membrane that lines the organ of ſmelling, is furniſhed with ſoft, downy windings, and little cells, to confine the odoriferous vapours; but its object being ſubtile, it would have no occaſion either for papillæ or ſenſible points. The choroides, the immediate organ of ſight, has likewiſe its ſoft black down, to abſorb the images that make its object: but the bottom of theſe velvet ſubſtances, formed to receive the images, ought to be a nervous membrane very ſmooth and ſenſible.

All matter, of ſufficient conſiſtence or ſolidity to affect the ſurface of our ſkin, becomes the object of feeling. This ſenſe aſcertains the bulk and figure of bodies, their diſtance, inaction, motion, ſolidity, ſoftneſs, fluidity, heat, coldneſs, dryneſs, moiſture, &c. theſe are its proper objects.

The ſenſation of warmth or heat is a ſort of light emotion, or irritation of our nervous parts, and an expanſion of our ſolids and fluids, produced by the ſlight action of a moderate quantity of the ſubtile matter that compoſes fire, or the origin of heat, whether natural or artificial.

When this matter either exceeds in quantity, or is more than ordinarily agitated, then, inſtead of irritating or expanding our ſolids and fluids, it tears and diſſolves them; and this violence of action cauſes an inflammation.

The ſenſation of cold, on the contrary, is a ſort of obſtruction in the nervous papillæ, and generally in all the ſolids, and a condenſation or defect of motion in our fluids, ariſing either from the contact of ſome cold ſubſtance; that is to ſay, of a ſubſtance that is not to any degree impregnated with ſubtile agitated matter, like the air or water; or by any other accidental cauſe, whereby the motion of our fluids, and natural elemental heat, is ſuppreſſed, like the periodical convulſion of the ſolids that produces the ſhivering in an ague. It is probable that our fluids being either totally condenſed, or impeded in their motion, by one or other of theſe cauſes, the nervous papillæ, and the ſolids in general, which are ſolely expanded by the impulſe of theſe fluids, are immediately blocked up; and it is this conſtipation that is the ſource of all the effects of cold in the human body.

The ſkin, the organ of feeling, is a compoſition of fibres, nerves, and veſſels, which are interwoven one with the other in ſuch an extraordinary manner, that the texture, in ſome meaſure, reſembles net-work. See CUTIS.

This fibrous texture is viſible in thick ſhammy, and in the ſoles of ſhoes made of a thick and ſoft leather, where, indeed, the fibres appear very diſtinctly.

The ſkin adheres to all the parts it incloſes, by means of blood-veſſels, lymphatics, nerves, and ſometimes fleſhy fibres, as in the face; but commonly by ſeveral very thin complicated foliages, which form themſelves into little cells, where the extremities of the arteries ſecrete an oil, termed fat. The anatomiſts call theſe ſtrata of foliages the cellular membrane, or membrana adipoſa.

The ſkin is formed of all the parts themſelves that faſten it to the body which it infolds. Theſe foliages, veſſels, and capillary nerves are determined one over the other by the compreſſion of the waters that ſurround the fœtus in the womb, and after its birth by the preſſure of the atmoſphere. Theſe fibres, being thus interwoven and preſſed together, form the ſubſtance we have been deſcribing. Several of theſe veſſels, originally hollow, acquire, in a ſhort ſpace, a firm ſolidity, and become, as it were, tendinous; and are, with the nerves, the principal ſubſtance of this thick texture.

The nervous capillaries, after having concurred, by thin twining and running acroſs one another, to the formation of the ſkin, terminate in its external ſurface, where they ſhed their firſt coat, to wit, that ſupplied by the dura mater. This firſt coat, commonly ſtiled the ſheath of the nerve, is divided into ſeveral ſhreds, that ſtick entangled together on the ſurface of the ſkin, and by that means conſtitute a ſort of net-work, called the reticulary body.

The mechaniſm of this nervous net-work is very well accommodated for receiving the impreſſion of objects; but the extremity of the nerve, ſtripped of this firſt coat, expands and raiſes itſelf between the interſtices of this net-work, and forms the nervous papillæ. Theſe are elevated above the net-work, are far more ſuſceptible of irritation, and conſequently entirely formed for the production of the moſt perfect ſenſation. A ſpirituous lymph moiſtens theſe papillæ, renders them ſuple and elaſtic, and of courſe furniſhes an organ, in all reſpects complete and accompliſhed.

Theſe papillæ are ranged in lines, and in a certain order: and it is this order that produces the little ridges obſervable on the cuticle or ſcarf-ſkin, and ſo viſible at the ends of our fingers, where they are ſpiral.

The nervous papillæ are perpendicular to the ſurface of the body. At the ends of the fingers they are lengthened in proportion to the extent of that part, and are ſo cloſely connected together, as to form thoſe ſolid bodies, the nails.

Their very ſtraight union is the reaſon why there is no paſſage for the animal fluid through this compoſition, whence the nail becomes inſenſible. But to make amends, at the root of the nail, where the nervous papillæ are very ſolid, very elaſtic, and remain open to the flux of ſpirits, the ſenſation is extreme. The ſanguinary, lymphatic, and oily capillaries, that penetrate the texture of the ſkin, are diſtributed almoſt like the nerves: being interwoven one with another in the ſkin, they form the vaſculary net-work. Their expanſion on the ſurface of the ſkin conſtitutes the excretory veſſels, and the cuticle that inveſts the papillæ, and is very neceſſary to them, by ſoftening the impreſſion of objects, and rendering by that means the perception more diſtinct. In ſhort, to this ſtructure, ſo adapted to forming the organ of feeling, we muſt add the glands ſituated under the ſkin; which ſerve to ſupply, at the end of the lymphatics, the ſpirits neceſſary for the lymph that moiſtens the nervous papillæ, and to beſtow on the animal fluid a preparation requiſite to the perfection of this ſenſation.

FEINT, in muſic, the ſame with dieſis. See the article DIESIS.

FEINT, in fencing, a ſhew of making a thruſt at one part, in order to deceive the enemy, that you may really ſtrike him in another.

A ſimple feint is a mere motion of the wriſt, without ſtirring the foot.

FELAPTON, in logic, one of the ſix moods of the third figure of ſyllogiſms, wherein the firſt propoſition is an univerſal negative, the ſecond an univerſal affirmative, and the third a particular negative.

FELIS, in zoology, is uſed by Linnæus as the name of a large genus of quadrupeds, of the order of the feræ; the characters of which are theſe: the fore-teeth are ſmall, obtuſe, and equal; the tongue is furniſhed with prickles, all pointing backwards; and the feet are formed for climbing, with claws which may be drawn in or extended at the creature's pleaſure.

To this genus belong the lion, tiger, leopard, cat, cat of the mountain, lynx, and ounce.

FELLING *of Timber*.—Many circumſtances are well known and conſtantly obſerved in the felling of timber for building, which, though to a haſty obſerver they might appear trifling, yet prove, on experience, to be of the utmoſt conſequence. One thing obſerved by Mr. De Buffon, which very greatly increaſes the ſolidity and ſtrength of timber, is, that the trees intended to be felled for ſervice ſhould firſt be ſtripped round of their bark, and ſuffered to ſtand and die upon the ſpot before the cutting. The ſappy part, or blea of the oak, becomes

by

by this means as hard and firm as the heart, and the real ſtrength and denſity of the wood has been proved, by many experiments, to be greatly increaſed by it; nor is this a practice of any detriment to the proprietor, ſince the remaining ſtumps of theſe trees ſend up their young ſhoots as vigorouſly as if they had been cut down in their natural condition.

When any tree is to be cut down for timber, the firſt thing to be taken care of is a ſkilful diſbranching ſuch limbs as may endanger in its fall: many trees are utterly ſpoiled for want of a previous care of this kind. In arms of timber that are very great, it is always neceſſary to chop or ſink in them cloſe to the bole, and then, meeting it with down-right ſtrokes, it will be ſevered from the tree without ſplitting. In felling the tree, take care always to cut it as cloſe to the ground as poſſible, unleſs it is intended to be grubbed up; and the doing this is of advantage both to the timber, and to the wood; for timber is never ſo much valued, if it be known to grow out of old ſtocks.

FELLOWSHIP, COMPANY, or PARTNERSHIP, in arithmetic, is a rule of great uſe in balancing the accounts of ſeveral partners trading in a company, ſo that every partner may have his juſt part of the gain, or ſuſtain his juſt part of the loſs, according to his proportion or ſhare of money he hath in the joint ſtock: this falls under two conſiderations, called the *Single* and *Double Rule of* FELLOWSHIP.

Single FELLOWSHIP, or FELLOWSHIP *without Time*.—By this rule are adjuſted the accounts of thoſe partners that put all their ſeveral, and perhaps different, ſums of money into a common ſtock at one and the ſame time; and therefore it is uſually called the Rule of Fellowſhip without Time: queſtions of this nature are anſwered by ſo many ſeveral operations in the Rule of Three direct, as there are partners in the ſtock.

Example 1. Suppoſe three partners, A, B, and C, make a joint ſtock of 192 *l.* in this manner: A puts in 48 *l.* B puts in 64 *l.* and C puts in 80 *l.* with this 192 *l.* they trade and gain 24 *l.* it is required to find each man's true part of that gain?

Here it will be as the ſum of the ſtocks 192 *l.* is to the total gain 24 *l.* ſo is each man's particular ſtock to his reſpective ſhare of the total gain: wherefore in this caſe A's ſhare of the gain will be 6 *l.* B's 8 *l.* and C's 10 *l.*

Proof. 6 *l.* + 8 *l.* + 10 *l.* = 24 *l.* the whole gain.

That is, if the ſum of each man's particular gain amount to the whole gain, the work is true; if not, ſome error is committed which muſt be found out.

Examp. 2. Three merchants A, B, and C, freight a ſhip with 248 tuns of wine; A loaded 98 tuns; B 86 tuns; and C 64 tuns. By extremity of weather the ſeamen were forced to caſt or throw 93 tuns of it overboard, How much of this loſs muſt each merchant ſuſtain?

	98	36,75	for A's loſs.
As 248 is to 93 ſo is	86	to 32,25	for B's loſs.
	64	24,00	for C's loſs.
Proof — — — —		93,00	= to the whole loſs.

Now, if the queſtion were, to find how much of the remaining wine that was ſaved belongs to A, to B, and to C?

Then 98 − 36,75 = 61,25 belongs to A.
And 86 − 32,25 = 53,75 belongs to B.
And 64 − 24, = 40 belongs to C.

That is, A ought to have 61 tuns and 63 gallons; B ought to have 53 tuns and 189 gallons; and C ought to have 40 tuns of what was left.

Double FELLOWSHIP, or FELLOWSHIP *with Time*.—This is uſually called the Double Rule of Fellowſhip, becauſe any particular man's money is to be conſidered, with relation to the time of its continuance in the joint ſtock.

Example 1. A and B join in partnerſhip upon theſe terms, viz. A agrees to lay down 100 *l.* and to employ it in trade three months; then B is to laydown his 100 *l.* and with the whole ſtock of 200 *l.* they are to trade three months more. Now, at the end of this time, they find their whole gain to be 21 *l.* it is required to know what each man's part of the gain ought to be, according to his ſtock, and the time of employing it?

Here it is but reaſonable to conclude that, as the ſum laid down by each perſon is the ſame, their reſpective gains ſhould be in the proportion of the times thoſe equal ſums were employed; conſequently as 9, the ſum of the times, is 3 B's time, ſo is the whole gain 21 *l.* to 7 *l.* B's ſhare of the gain, which taken from 21 *l.* leaves 14 *l.* for the ſhare of A.

If in the above example the times had been equal, but the ſums laid down unequal, it is evident the whole gain in that caſe muſt have been divided between the partners in the ratio of the ſums adventured; whence it follows, that when the ſtocks and times of continuance are reſpectively unequal, the total gain muſt be divided in the ratio compounded of each man's money and time reſpectively. Therefore, in order to reſolve all queſtions of this nature, be the partners never ſo many, obſerve this rule.

Multiply every particular man's ſtock, with the time it is employed; then it will be as the ſum of all theſe products is to the whole gain or loſs; ſo is every one of theſe products to its proportional part of that whole gain or loſs.

Examp. 2. Three merchants, A, B, and C, enter into partnerſhip, thus; A puts into the ſtock 65 *l.* for eight months, B puts in 78 *l.* for twelve months, and C puts in 84 *l.* for ſix months; with theſe they traffic and gain 166 *l.* 12 *s.* it is required to find each man's ſhare of the gain proportionable to his ſtock and time of employing it?

1. A's ſtock 65 *l.* × 8 mon. the time it was employed = 520
2. B's ſtock 78 *l.* × 12 mon. the time it was employed = 936
3. C's ſtock 84 *l.* × 6 mon. the time it was employed = 504

The ſum of theſe products — — — — 1960

Then, according to the rule, the ſeveral proportions will ſtand thus:

1960 : 166,6 :: 520 : 44,2 =	44 *l.*	4 *s.*	0 *d.*	for A.
1960 : 166,6 :: 936 : 79,56 =	79	11	2 ½	for B.
1960 : 166,6 :: 504 : 42,84 =	42	16	9 ½	for C.
The whole gain — —	166	12	0	

Or you may work by firſt finding the proportional part of the gain due to one pound, which will ſerve for a common multiplier.

Thus 1960 : 166,6 :: 1 : 0,085, the ſaid common multiplier.

Then 520 × 0,085 = 44,2 for A.
And 936 × 0,085 = 79,56 for B. } as before.
Alſo 504 × 0,085 = 42,84 for C.

FELO DE SE, in law, a perſon that deliberately lays violent hands on himſelf, and is the occaſion of his untimely death, whether by hanging, drowning, ſtabbing, ſhooting, or any other way.

FELON, in law, a perſon guilty of felony.

FELON-WORT, in botany, the ſame with the ſolanum, or deadly night-ſhade.

FELONY, in law, a capital crime, next in degree to petit treaſon, and committed with an evil intention; as murder, theft, ſodomy, rape, ſetting fire to houſes wilfully, &c.

FELT, in commerce, a kind of ſtuff, compoſed either of wool alone, or of a mixture of wool and hair; but neither ſpun nor wove, deriving all its conſiſtence from being fulled, or wrought, with lees and ſize.

FEMALE, a term peculiar to animals, and ſignifies that ſex which conceives and generates its young within itſelf.

The word is alſo applied, in a figurative ſenſe, to inanimate objects, from the reſemblance they bear to the female of animals: thus we ſay, a female ſcrew, a female flower, &c. See FLOWER, SCREW, &c.

FEMME COVERT, in law, a married woman. See COVERTURE.

FEMME SOLE, an unmarried woman, whoſe debts, contracted before marriage, become thoſe of her huſband after that ceremony has been performed.

FEMININE, in grammar, is that gender which denotes a female.

FEMUS, the thigh, in anatomy, is that part of the body intercepted between the buttocks and the knee. See the article THIGH.

FEN,

FEN, a general name for boggy or marſhy land, commonly overflowed with water.

In draining theſe ſort of lands, which is the only method of making them uſeful, trenches and drains for carrying off the water muſt be formed, in order to render the ſurface dry, and of a proper conſiſtence for producing vegetables.

This may be attempted by various methods; but whatever mode of proceeding be adapted, the loweſt part of the ground is to be found out firſt, and the overflowing from great rains, and from land floods, muſt be provided for, in the carrying off that way; for, ſhould this be neglected, all the labour and coſt employed on the other principle would be thrown away. If it is found that this can be done, there muſt be afterwards cut a large drain through the middle of the land, and ſeveral ſmaller drains communicating with this.

The great drain muſt be dug deep enough to drain the whole level; and this, and all the others, muſt be made the narroweſt at the head, and wider all the way to the mouth, where it muſt be wideſt of all.

Theſe drains muſt be all well cleanſed from mud and weeds every ſpring and autumn, and the water from land-floods muſt be kept from coming in upon theſe lands, as much as poſſible, that there may be the leſs to be drained off; the lower edges of the ſen-land muſt be for this purpoſe guarded with banks to turn the water into other channels. In Eſſex, they have many lands that lie below the high-water mark, and are above the low-water mark, and have land-floods or fleets running through them, which make a ſort of ſmall creek. Theſe lands they have a very eaſy way of draining, though they are naturally very moiſt, when they firſt incloſe them from the ſea; they do it with a bank, which they extend from one ſide of the land they deſign to take in, to the other, excepting a ſpace that they leave, where the creek or land-floods run into the ſea. They then prepare a wooden frame, well planked, and of a conſiderable thickneſs, fitted to the head of the creek, and capable of ſhutting it wholly up; in this frame they make ſeveral holes, in which are placed wooden troughs, made each of four boards, and ſuited in ſize and number to the quantity of water that is to be diſcharged through them from the land-floods. Each of theſe trunks is open towards the creek, but on the ſea-ſide it has a door or flap, which opens when the land-flood preſſes againſt it, and gives it free paſſage out; but, when the ſea-water is riſen to the height of it and preſſes it, it is ſhut by the force, and no ſea water is let in. When this head is prepared, they let it in, and, ſtopping up the whole creek, they continue the banks on each ſide till they meet it: thus all the land-floods are let out at low water, and not a drop of ſea water can be admitted, ſo that the lands are kept dry and uſeful, which were before rendered uſeleſs, by being drowned with ſalt water at every high-water mark. The freſh water of the creek is thus kept unmixed with the ſea water, and therefore affords good drink for the cattle, which is commonly very difficult to be had in this ſort of lands, the tides ſpoiling what freſh waters there are, every time they come up.

The wet grounds, called fens, in Lincolnſhire and elſewhere in England, bring many advantages to the inhabitants of thoſe countries. Fowl and fiſh are very plentiful in them. The pike and eels are large, and eaſily caught, but they are uſually coarſe. The duck, mallard, and teal are in ſuch plenty, as is ſcarce to be conceived; they are taken in decoys, by prodigious flocks at a time. They ſend theſe fowl to London from Lincolnſhire, twice a week on horſe-back, from Michaelmas to Lady-day, and one decoy will furniſh twenty dozen, or more, twice a week, for the whole ſeaſon, in this manner. The decoy-men contract with the people who bring them to London at a certain rate, and they are obliged to take the whole number that is catched off their hands. Two teal are uſually reckoned equal to one duck, and ſix ducks and twelve teal are accounted a dozen of wild-fowl; and the uſual market price is about nine ſhillings for ſuch a dozen. About Midſummer, when the moulting ſeaſon is, a great number are deſtroyed alſo by the people of the neighbourhoods. The poor birds at this time are neither able to ſwim nor to fly well; and the people going in with boats among the reeds, where they lie, beat them down with long poles.

A little before Michaelmas, vaſt flights of theſe birds arrive at the decoys from other places; they ſoon grow fat in them, and continue there a prey to the maſters or owners, as long as the decoys are unfrozen; but, when they are iced over, they fly away again, and go to the neighbouring ſeas for food. *Philoſ. Tranſ.* N°. 223.

FENCE, in gardening and huſbandry, a hedge, wall, ditch, bank, or other incloſure, made round gardens, fields, woods, &c.

In hotter climates than England, where they have not occaſion for walls to ripen their fruit, their gardens lie open, where they can have a water fence, and proſpects; or elſe they bound their gardens with groves, in which are fountains, walks, &c. which are much more pleaſing to the ſight than a dead wall: but in colder countries, and in England, we are obliged to have walls to ſhelter and ripen our fruit, although they take away much from the pleaſant proſpect of the garden.

Since therefore we are under a neceſſity to have walls to ſecure our gardens from the injury of winds, as well as for the convenience of partitions or incloſures, and alſo to ripen our fruit, brick walls are accounted the beſt and warmeſt for fruit: and theſe walls, being built panel-wiſe, with pillars at equal diſtances, will ſave a great deal of charge, in that the walls may be built thinner than if they were built plain without theſe panels; for then it would be neceſſary to build them thicker every-where; and, beſides, theſe panels make the walls look the handſomer.

Stone walls are to be preferred to thoſe of brick, eſpecially thoſe of ſquare hewn ſtones. Thoſe that are made of rough ſtones, though they are very dry and warm, yet, by reaſon of their unevenneſs, are inconvenient to nail up trees to, except pieces of timber be laid in them here and there for that purpoſe.

But in large gardens it is better to have the proſpect open to the pleaſure garden; which ſhould be ſurrounded with a foſſe, that from the garden the adjacent country may be viewed; but this muſt depend on the ſituation of the place: for, if the proſpect from the garden is not good, it had better be ſhut out from the ſight by a wall, or any other fence, than to be open. As alſo, when a garden lies near a populous town, and the adjoining grounds are open to the inhabitants; if the garden is open, there will be no walking there in good weather, without being expoſed to the views of all paſſengers, which is very diſagreeable.

Where the foſſes are made round a garden which is ſituated in a park, they are extremely proper; becauſe hereby the proſpect of the park will be obtained in the garden, which renders thoſe gardens much more agreeable than thoſe which are confined.

In the making theſe foſſes there have been many inventions; but, upon the whole, I have not ſeen any which are in all reſpects preferable to thoſe which have an upright wall next the garden, which (where the ſoil will admit of a deep trench) ſhould be five or ſix feet high; and, from the foot of this wall, the ground on the outſide ſhould riſe with a gradual eaſy ſlope, to the diſtance of eighteen or twenty feet; and where it can be allowed, if it ſlopes much farther, it will be eaſier, and leſs perceptible as a ditch to the eye, when viewed at a diſtance: but, if the ground is naturally wet, ſo as not to admit a deep foſſe, then, in order to make a fence againſt cattle, if the wall be four feet high, and ſlight poſts of three feet high are placed juſt behind the wall, with a ſmall chain carried on from poſt to poſt, no cattle or deer will ever attempt to jump againſt it: therefore it will be a ſecure fence againſt them; and, if theſe are painted green, they will not be diſcerned at a diſtance, and at the ſame time the chain will ſecure perſons walking in the garden from tumbling over.

In ſuch places where there are no good proſpects to be obtained from a garden, it is common to make the incloſure of park-paleing; which, if well performed, will laſt many years, and has a much better appearance than a wall: and this pale may be hid from the ſight within, by plantations of ſhrubs and ever-greens; or there may be a

quick hedge planted within the pale, which may be trained up, ſo as to be an excellent fence by the time the pales begin to decay.

There are ſome perſons who make ſtuckade fences round their gardens to keep out cattle, &c. which, when well made, will anſwer the purpoſe of fences; but this being very expenſive in the making, and not of very long duration, has occaſioned their not being more commonly in uſe.

As to fences round parks, they are generally of paling; which, if well made of winter-fallen oak, will laſt many years; but a principal thing to be obſerved, in making theſe pales, is not to make them too heavy; for, when they are ſo, their own weight will cauſe them to decay; therefore the pales ſhould be cleft thin, and the rails ſhould be cut triangular, to prevent the wet lodging upon them; and the poſts ſhould be good, and not placed too far aſunder. If theſe things are obſerved, one of theſe pales will laſt, with a little care, upwards of forty years very well. The common way of making theſe fences is, to have every other pale nine or ten inches above the intermediate ones; ſo that the fence may be ſix feet and a half high, which is enough for fallow deer; but, where there are red deer, the fence ſhould be one foot higher, otherwiſe they will leap over.

Some incloſe their parks with brick walls; and in countries, where ſtone is cheap, the walls are built with this material; ſome with, and others without mortar.

A kitchen garden, if rightly contrived, will contain walling enough to afford a ſupply of ſuch fruits as require the aſſiſtance of walls for any family; and this garden, being ſituated on one ſide, and quite out of ſight of the houſe, may be ſurrounded with walls, which will ſcreen the kitchen garden from the ſight of perſons in the pleaſure garden; and, being locked up, the fruit will be much better preſerved than it can be in the public garden: and the having too great a quantity of walling is often the occaſion that ſo many ſcandalous trees are frequently to be ſeen in large gardens, where there is not due care obſerved in their management.

The height of garden walls ſhould be twelve feet, which is a moderate proportion; and, if the ſoil be good, it may in time be well furniſhed with bearing wood in every part, eſpecially that part planted with pears, notwithſtanding the branches being trained horizontally from the bottom of the walls.

I would recommend the white thorn, the holly, the black thorn, and crab, for outward fences to a good ground: but I do not approve of the intermixing them.

The white thorn is the beſt quick to plant; becauſe it is the moſt common, and may be clipped ſo as to render it the cloſeſt and the hardieſt fence of any other tree; and, being very durable, is preferred to all others for outward fences; or for the diviſion of fields, where they are expoſed to cattle, &c.

The black thorn, and crabs, make very good fences, and are to be raiſed as the white thorn; but, if the kernels of apples or crabs be ſown, it is beſt to ſow the pommace with them, and they will come up the ſooner, i. e. the firſt year.

If crab ſtocks be planted, while young, in the ſame manner as quick, they make excellent hedges; and ſo will ſome ſorts of plumbs.

The holly will make an excellent fence, and is preferable to all the reſt; but it is difficult to be made to grow at firſt, and is a ſlow grower; but when once it does grow, it makes amends by its height, ſtrength, and thickneſs. *Miller's Gard. Dict.*

FENCE-MONTH, the month wherein deer begin to fawn, during which it is unlawful to hunt in the foreſt.

It commences fifteen days before Midſummer, and ends fifteen days after it. This month, by ancient foreſters, is called defence-month. There are alſo certain fence-months, or ſeaſons, for fiſh as well as wild beaſts, as appears by Stat. Weſt. 13 Geo. II.

FENCING, the art of making a proper uſe of the ſword, as well for attacking an enemy, as for defending one's ſelf.

Fencing is a genteel exerciſe, of which no gentleman ought to be ignorant. It is learned by practiſing with foils, called in Latins, *rudes*. See FOIL.

According to Pyraid, fencing is in ſo high repute in the Eaſt-Indies, that the greateſt noblemen, and even princes, teach it.

Fencing is either ſimple or compound. Simple is that performed nimbly and off hand, on the ſame line. In this the principal intention, in reſpect to the offenſive part, ſhould be to attack the enemy in the moſt unguarded part; and in the defenſive, to parry or ward off the enemy's thruſts and blows. See the articles GUARD, THRUST, PARRYING, &c.

FENDERS, among ſailors, certain pieces of rope, wood, faggots, or other material, hung over the ſide of a ſhip or boat to prevent them from ſtriking or rubbing againſt each other, when they lie cloſe together; alſo to prevent ſhips, boats, and other veſſels from beating againſt a wharf or key.

FENDUE *en Pal*, in heraldry, a croſs clove down in pale, that is, from top to bottom, and the two parts ſet at ſome diſtance from each other.

FENESTRA, in anatomy, a term applied to two openings or foramina within the ear, diſtinguiſhed by the names of the oval and the round feneſtra.

FENNEL, *ſæniculum*, in botany. See FOENICULUM.

FENUGREEK, or FOENUGREEK. See FOENUGREEK.

FEOFFMENT, in law, is a gift or grant of any manors, meſſuages, lands, or tenements, to another in fee, that is, to him and his heirs for ever, by delivery of ſeiſin, and poſſeſſion of the eſtate granted.

FERALIA, in antiquity, a feſtival obſerved amongſt the Romans, on the twenty-firſt of February; or, according to Ovid, on the ſeventeenth of that month, in honour of the manes of their deceaſed friends and relations.

FER DE FOURCHETTE, in heraldry, a croſs having at each end a forked iron, like that formerly uſed by ſoldiers to reſt their muſkets on. It differs from the croſs fourché, the ends of which turn forked, whereas this has that ſort of fork fixed upon the ſquare end.

FER DE MOULIN, *Milrinde*, *Inke de Moulin*, in heraldry, is a bearing ſuppoſed to repreſent the iron-ink or ink of a mill, which ſuſtains the moving mill-ſtone.

FERIÆ, in Roman antiquity, holidays, or days upon which they abſtained from work.

FERIAL DAYS, according to the Statute 27 Henry VI. cap. v. are taken for all days of the week except Sunday.

FERMENT, any body which, being applied to another, produces fermentation.

Ferments are either matters already in the act of fermentation, or that ſoon run into this act. Of the firſt kind are the flowers of wine, yeaſt, fermenting beer, or fermenting wine, &c. and of the ſecond are the new expreſſed vegetable juices of ſummer fruits.

Among diſtillers, ferments are all thoſe bodies which, when added to the liquor, only correct ſome fault therein, and by removing ſome obſtacle to fermentation, forward it by ſecondary means; as alſo ſuch as being added in time of fermentation, make the liquor yield a larger proportion of ſpirit, and give it a finer flavour. See the article ADDITION.

FERMENTATION, the inteſtine motion excited in vegetables, by which they are changed in ſuch a manner, that the firſt thing that riſes from them in diſtillation is acrid, mixible with water, of a warm aromatic taſte, inflammable like oil, thin and volatile; or elſe acid, that will extinguiſh fire and flame, and is leſs thin and volatile.

The word is Latin, *fermentatio*, and derived from *fermentum*, leaven.

A certain degree of warmth ſeems requiſite, in the northern climates, to all artificial liquors intended for immediate fermentation, eſpecially in the winter: but the natural juices of vegetables that have never been inſpiſſated, as that of grapes, and other fruits, when fully ripened, will uſually ferment as ſoon as they are expreſſed, without any external aſſiſtance. But as a certain degree of inſpiſſation

ſpiſſation prevents all tendency to fermentation in vegetable juices, otherwiſe ſtrongly diſpoſed to ferment; ſo a long continuance or increaſe of the inſpiſſating heat, eſpecially if it acts immediately, through a metalline or ſolid body, upon the juice, will deſtroy its fermenting property; and this the more effectually, as the heat employed approaches to that of ſcorching, or the degree capable of giving an empyreuma. After the ſame manner, ſeveral experiments make it appear, that there is a certain degree of heat, the continuance, or leaſt increaſe whereof, proves detrimental, or deſtructive to fermentation, as there is another that wonderfully encourages and promotes it. Theſe two degrees of heat ought to be carefully noted and ſettled by the thermometer, or other more certain method, for philoſophical and chemical uſes; but for common or œconomical occaſions, they may be limited to what we uſually underſtand by a tepid and a fervid heat: a fervid heat is the bane of all vinous fermentation; as a tepid one, or rather an imperceptible warmth, is the great promoter thereof. In this neutral ſtate therefore, with proper contrivances to preſerve and continue it, the liquor is to be put into a ſuitable veſſel for fermentation; at which time, if it work not of itſelf, it muſt be quickened by additions; and, in general, by ſuch things as are properly called ferments. See FERMENT.

When thus the proper quantity of a good-conditioned and ſuitable ferment is got ready, it muſt be put to the fermentable liquor in the bare tepid, or ſcarce luke-warm ſtate above-mentioned. The beſt manner of bringing them together, for raiſing the fermentation quick and ſtrong, ſeems to be this: when the ferment is ſolid, it ſhould be broke into ſmall pieces, and gently thinned, with the hand, or otherwiſe, in a little of the luke-warm liquor: but a complete uniform ſolution ſhould not be here endeavoured, becauſe this would in ſome meaſure weaken the power of the ferment, or deſtroy its future efficacy. The whole intended quantity therefore, being thus looſely mixed with a moderate quantity of the liquor, ſhould be kept in a tepid ſtate, free from the action of the external air; and at proper intervals more of the warm liquor ſhould be added, till the whole quantity is well ſet to work together: and thus, by dividing the buſineſs into parts, it may be much more ſpeedily and effectually performed.

FERMENTED, in general, ſomething that has undergone a fermentation. See the preceding article.

FERN, *Filix*, in botany. There are great varieties of this plant, in different parts of the world; but we ſhall only mention two ſpecies, the male and the female.

The leaf of the male fern is compoſed of other leaves, which adhere to a rib in ſuch a manner, as to have lobes on both ſides, cut into the depth of the main fibre: the fruit reſembles that of polypody.

The common female fern, or brakes, has many large leaves divided into ſeveral branches, beſet with long, narrow, ſtiff pinnulæ, which are moſtly ſmooth about the edges, though ſometimes they are a little indented: the back of theſe, about Midſummer, will be covered round the margins with a great number of duſky brown particles, which are the ſeed.

The ſeeds of the ſeveral ſpecies of fern were wholly unknown to the ancients. Swammerdam, in his Biblia Naturæ, claims to himſelf the honour of having firſt diſcovered them; but it appears from Hook's works, that Dr. William Cole ſent an account of the ſeeds of ſeveral of the plants of this kind to that author, in 1669; whereas Swammerdam declares his diſcovery of them to have been in 1673; ſo that it is plain that Dr. Cole's was prior to his by ſome years. Swammerdam is an author of that ſtrict probity, that there is no room to doubt but that he ſpoke what he thought to be true; and it is even poſſible that he might have diſcovered them ſooner than the time he mentions; but, however that be, it appears from the later obſervations of the ingenious Dr. Miles, that his accounts are extremely accurate and juſt. The ſeed-veſſels of the common fern, the Engliſh and foreign maiden-hairs, the wall-rue, hart's-tongue, and the like plants, are all alike in their general form, their only differences being in the ſize, and their arrangement on the plants. The number or quantity of the ſeeds is very different in different plants; but Dr. Miles obſerves, that, the fewer ſeeds there are in any ſpecies, there is always the more in quantity of a ſort of ſpongy or fungous matter, which forms a kind of tubercle, not unaptly reſembling what is called Jew's-ears, which ſeems a ſubſtance intended for the ſheltering the ſeeds.

Theſe ſeed-veſſels conſiſt of a ſtalk, by which they are inſerted into the leaf; this repreſents an elaſtic cord, and is ſurrounded by a great number of annular ribs, reſembling the cartilages of the aſpera arteria; and indeed nothing in nature ſo exactly reſembles this cord or ſtalk, as the wind-pipe of a ſmall bird. This cord incircles the globular membranous pod, wherein the ſeeds lie, adhering to it, and dividing it into two hemiſpheres.

The pod is compoſed of a fine whitiſh membrane, ſomewhat like that which lines the inſide of a pea-ſhell; the ſeeds are irregular in ſhape, and of a reticulated ſurface. The moſt advantageous way of viewing this is to uſe the common microſcope for opake objects, puttling on a ſmall magnifier, and laying the ſeeds with their capſules, &c. as taken from the back of the plant, on a piece of poliſhed ivory. The proper time of the year is in the beginning of September; and then, if the plant be newly gathered, the ſeed-veſſels often burſt, while they are under inſpection, and ſhew a very elegant appearance. The manner of this burſting of the pod, which is the method nature has taken for the ſcattering and diſperſing of the ſeed, is this: the cord becomes extended in ſome one part, and ſoon after breaks aſunder; this by expanding burſts the pod into two parts, and, continuing to expand itſelf, as it departs from a curve, and approaches to a right line, it rends itſelf away from the globular pod, till it be at length wholly diſengaged from it; and then, as there can be no farther reſiſtance given to its expanding, it ſuddenly flies off, with a ſort of jerk, and becomes quite ſtraight at once. By this laſt action the capſules are ſhook, and the ſeeds are diſcharged out of them on the plate of ivory, in the ſame manner as the grains of wheat or barley would be thrown out of a bowl placed on a table by the ſhaking of the bowl.

FERN *Oil*, in pottery, a name given, by the Engliſh merchants who have been in China, to a ſort of varniſh, which the Chineſe uſe in their porcelain manufactories. See CHINA.

FERRET, *Viverra*, in zoology, a quadruped of the muſtela kind.

The head is ſmall and depreſſed; the ſnout ſharp; the eyes look very fierce and red; the ears are ſhort, patulous, and erect, they are conſiderably wide, eſpecially towards the baſe; the mouth is large, and the teeth are very ſharp; the neck is ſhort; the body is long and thin; the legs are ſhort, and each divided at the foot into five toes, and there armed with ſharp claws. This animal is very common in England, but is a native of America.

FERRETS, in glaſs-making, the iron with which the workman tries the melted metal to ſee if it be fit to work.

It is alſo uſed for thoſe irons which make the ring at the neck of bottles. *Neri's Art of Glaſs.*

FERRETTO, in the glaſs trade, a ſubſtance which ſerves to colour glaſs. This is made by a ſimple calcination of copper, but it ſerves for ſeveral colours. There are two ways of making this; the firſt is this: take thin plates of copper, and lay them on a layer of powdered brimſtone, in the bottom of a crucible; over theſe lay more brimſtone, and over that another layer of the plates, and ſo on alternately, till the pot is full. Cover the pot, lute it well, place it in a wind furnace, and make a ſtrong fire about it for two hours. When it is taken out and cooled, the copper will be found ſo calcined, that it may be crumbled to pieces between the fingers, like a friable earth; it will be of a reddiſh, and in ſome parts a blackiſh colour. This muſt be powdered and ſifted fine for uſe.

The other way is leſs eaſy, but it makes a more valuable ferretto. It is this: make a number of ſtratifications of plates of copper and powdered vitriol alternately in a crucible, which place in the floor of the glaſs furnace, near the eye, and let it ſtand there three days; then take it out, and make a new ſtratification with more freſh vitriol,

triol, and calcine it again as before; repeat this operation ſix times, and a moſt valuable ferretto is produced. *Neri's Art of Glaſs.*

FERRUGINOUS, any thing partaking of iron, or that contains particles of that metal. It is particularly applied to certain mineral ſprings, whoſe waters are impregnated with particles of iron, generally called chalybeates.

The word is Latin, *ferrugineus*, and derived from *ferrum*, iron.

FERRUGO, Rust. See the article Rust.

FERRUM, Iron. See Iron.

FERTILITY, that quality which denotes a thing fruitful or prolific.

FERULÆ, in ſurgery, ſplinters or chips of different matter, as of wood, bark, leather, paper, &c. applied to bones that have been disjointed, when they are ſet again.

FESSE, in heraldry, one of the nine honourable ordinaries, conſiſting of a line drawn directly acroſs the ſhield, from ſide to ſide, and containing the third part of it, between the honour-point and the nombril.

It repreſents a broad girdle or belt of honour, which knights at arms were anciently girded with.

Fesse Point is the exact center of the eſcutcheon. See the article Point.

Fesse Ways, or *In* Fesse, denotes any thing borne after the manner of a feſſe; that is, in a rank acroſs the middle of the ſhield.

Party per Fesse implies a parting acroſs the middle of the ſhield, from ſide to ſide, through the feſſe-point.

FESTI Dies, in Roman antiquity, certain days in the year devoted to the honour of the gods.

FESTINO, in logic, the third mood of the ſecond figure of ſyllogiſm, the firſt propoſition of which is an univerſal negative, the ſecond a particular affirmative, and the third a particular negative, as in the following example:

Fes No bad man can be happy,
ti Some rich men are bad men:
no *Ergo*, Some rich men are not happy.

FESTIVAL, the ſame with feaſt. See the article Feast.

FESTOON, in architecture and ſculpture, &c. an ornament in form of a garland of flowers, fruits, and leaves, intermixed or twiſted together.

It is in the form of a ſtring or collar, ſomewhat biggeſt in the middle, where it falls down in an arch; being extended by the two ends, the extremities of which hang down perpendicularly.

Feſtoons are now chiefly uſed in friezes, and other vacant places, which want to be filled up and adorned; being done in imitation of the long cluſters of flowers, which the ancients placed on the doors of their temples and houſes on feſtival occaſions.

FETLOCK, in the menage, a tuft of hair growing behind the paſtern-joint of many horſes; for thoſe of a low ſize have ſcarce any ſuch tuft.

FEUD, *Feodum*, the ſame with fee. See the article Fee-Estate.

FEUDAL, or Feodal, denotes any thing belonging to a fee. See the article Fee.

FEUDATARY, or Feodatary, a tenant who formerly held his eſtate by feodal ſervice. See the article Vassal.

FEVER, Febris, in medicine, a diſeaſe, or rather claſs of diſeaſes, whoſe characteriſtic is a preternatural heat felt through the whole body, or at leaſt the principal parts of it.

All fevers, of what kind ſoever, are attended with a preternatural heat of the blood and humours, which impairs the bodily ſtrength and its vital functions: wherefore nature raiſes all her forces, and engages the diſeaſe as a mortal enemy; and, if ſhe gets the better, drives out the cauſe of the diſorder by ſuch outlets as ſhe is able. This action is by phyſicians called the criſis of the diſeaſe.

As there is no fever cured without ſome conſiderable evacuation, raiſed either by nature or by art, the phyſician ought carefully to obſerve which way nature ſeems to intend the expulſion of the morbid matter, and to aſſiſt her by all poſſible means. Now this expulſion is very frequently made through ſeveral outlets of the body at a time; and an evacuation by one outlet, more or leſs, checks that by another; thus a looſeneſs checks a ſweat, and *vice verſa*: wherefore it is the phyſicians buſineſs to diſcern what evacuation is moſt likely to be of ſervice, and ſo to promote this, as to give the leaſt interruption poſſible to any other; for any one evacuation is not equally ſuitable to all perſons, both on account of the difference of conſtitution and of diſeaſes; although evacuations through every emunctory are ſometimes neceſſary, as we find by experience in malignant fevers.

But of all ſolutions of the diſeaſe the moſt deſirable is by ſweat; next to that by ſtool and urine; the worſt is by a hæmorrhage, whether it proceeds from the noſe, or from any other part, becauſe it indicates, that the blood is ſo far vitiated, that no proper ſeparation of the humour can be made.

Laſtly, ſome fevers terminate in abſceſſes formed in the glands, which, if they happen in the decline of the diſeaſe, and ſuppurate kindly, are ſalutary: wherefore the ſuppuration is to be forwarded by cataplaſms or plaſters, and ſometimes by cupping on the tumour; and then, if the abſceſs does not break ſpontaneouſly, it ought to be opened with the knife or a cauſtic.

At this time this rule of practice is generally right, not to exhauſt the patient's ſtrength by evacuations of any kind: and yet in ſome caſes there is a neceſſity for drawing a little blood; as when the humours are in great commotion, and the heat exceſſive; for this remedy, prudently adminiſtered, makes the tumour ripen kindly, becauſe nature has always a great abhorrence of a turbulent ſtate.

Continual Fevers.—There is no diſeaſe to which the uſeful precept, *principiis obſta*, is more applicable than to fevers; becauſe in the beginning it is generally eaſy to do good; but when the diſtemper has gained ground, the cure is often attended with difficulty: for a medicine, which early adminiſtered might have prevented the impending danger, frequently fails when the bodily ſtrength is exhauſted by the violence of the diſeaſe. However, a patient who applies late for aſſiſtance, is not to be abandoned to his fate; ſince it is certain, that thoſe diſeaſes, which in old times were aſcribed to the divine wrath, are frequently cured by natural means, even when they appear moſt deſperate: wherefore the phyſician ought to lay it down as an abſolute rule, never to be wanting in his duty.

And firſt, as blood-letting is a moſt excellent remedy in the beginning of all fevers; if it has happened to be neglected for ſome days, let us conſider whether it is ſtill proper to be ordered.

In caſe of intolerable pain in any part of the body, of difficulty of breathing, or a delirium, blood is to be taken away, according to the patient's ſtrength; with the lancet, if he be able to bear it; if too weak, by cupping; but if exceſſively ſo, by leeches: and if this may be done when the diſeaſe has got to the height, it ought for ſtronger reaſons to take place in the beginning: and let me obſerve by the way, that leeches are often of vaſt ſervice in a delirium. I have alſo ſometimes found, by experience, that pieces of lamb's lungs, applied warm to the head, have carried off the phrenzy, by the exudation of the noxious or ſuperfluous humour.

Fevers *attended with Eruptions*, the chief of which, after the ſmall-pox, meaſles, and plague, is the miliary fever, than which no fever puts on more various appearances. Puſtules, rough to the touch, break out ſooner or later all over the body; ſometimes red, ſometimes whitiſh, and again both ſorts intermixed; at one time ſmaller, at another larger and more elevated, and of a bad ſmell. Sobbing and anxiety about the heart are very frequent ſymptoms, which are often followed by a delirium and convulſions. The diſeaſe runs into a conſiderable length; and if it happen to end too ſoon, without a ſufficiently perfect criſis, it often brings on a bad habit of body. The red pimples are not ſo dangerous as the whitiſh; and the more lively their colour, the ſafer they are. Hence it appears, that this fever is more owing to a defect in the humours, and the animal ſpirits in particular,

cular, than to any bad quality of the air; and that it requires different methods of cure, according to its different circumſtances.

But of what kind ſoever the puſtules are, blood is to be drawn in the beginning, if the patient hath ſtrength to bear it; unleſs he be actually in a ſweat, in which caſe blood-letting is either to be omitted, or at leaſt to be put off for a day or two, or to ſome other convenient time.

Now red puſtules bear bleeding much better than the whitiſh: and though in both ſorts bliſters are ſerviceable, yet they are more neceſſary in the latter; and they are to be applied to the neck, head, and all the limbs, at proper diſtances of time. After all, I would adviſe the phyſician always to bear in mind, that the more ſparingly blood has been drawn, the more happily the diſeaſe generally terminates: for when the ſtrength has been exhauſted by evacuations towards the latter end, the eruption ſinks in, and the patient dies.

Nature's endeavours to expel the morbific matter through the ſkin, are to be aſſiſted by moderately cordial medicines. Of this tribe the moſt proper are the bezoardic powder, the compound powder of contrayerva, and the cordial confection; adding nitre in caſe of an inflammation: and this ſalt may be very advantageouſly joined to cordial medicines in almoſt all malignant fevers, at leaſt in the beginning. Toward the decline, warm bathing is ſometimes ſerviceable, in order to bring forth the remains of the puſtules.

But if, either at the height, or on the decline of the fever, the only appearance of an eruption is a vaſt number of pellucid veſicles, ſo ſmall as hardly to be ſeen: it is not ſafe to perſiſt too long in the uſe of internal medicines of this tribe, unleſs the length of the diſtemper has ſo far weakened the patient, as to render even more powerful cordials neceſſary: for ſuch little roughneſſes of the ſkin are not able to bring on a good criſis, but on the contrary, generally denote a difficult and tedious illneſs; wherefore, without diſcontinuing the bliſters, the cauſe of the diſeaſe is to be carried off by other ways, eſpecially through the inteſtinal canal by gentle purges of rhubarb, or manna and Glauber's ſalts.

It is to be obſerved, that this diſeaſe is not always terminated by any one ſort of criſis. It has ſometimes one ſort, ſometimes another; and, in ſome caſes, ſeveral ſorts together, as frequently happens in other malignant fevers. Thus, at the ſame time that there are other diſcharges of the morbific matter, a thruſh ſometimes breaks out, and ſpreads all over the mouth and throat. This commonly begins with a hiccup: and if it be whitiſh and very moiſt, and occaſion a plentiful ſpitting, it is ſo far from portending any great danger, that it is a ſign of the diſtemper's ending happily; but if it be of the black kind and dry, and the ſpittle rough and little in quantity, it is a fatal omen, as it indicates the mouth and throat choaked up with ſlimy phlegm. In theſe caſes it is proper to uſe gargles made of barley-water and ſyrup of mulberries, or ſome ſuch other ſyrup, or the pectoral decoction: for repellents of all kinds are to be carefully avoided.

It may poſſibly ſeem ſtrange to ſome, that Sydenham preſcribed the bark in this fever, and the aphthæ attending it, who ſays, he always found it to anſwer his expectations. But this was not a raſh practice in that ſagacious phyſician; for this fever often intermits when the aphthæ do not appear; but it more frequently ends upon their going off. In both caſes this excellent antidote is of very great ſervice. Sydenham was the firſt, among us, who deſcribed this fever, which, he ſays, took its riſe here in the month of February 1684, after the long ſevere froſt of the preceding winter. Hence it is probable, that it aroſe from the acrimony of the humours, induced by the conſtruction of the fibres of the ſkin from cold, and the conſequent diminution of perſpiration.

The Petechial Fever.—The petechiæ, from which this fever has its name, are broad red ſpots, like the bites of fleas, not riſing above the ſurface of the ſkin. When they are livid or black, they are of very dangerous prognoſtic; becauſe they are really ſo many little gangrenes; and therefore, the more numerous they are, the more their conſequence is to be dreaded.

The common practice of giving hot medicines in the beginning of this diſtemper, in order to raiſe ſweats, is quite wrong. It is much the ſafer way to check the gangrenous diſpoſitions of the humours by the bezoardic powder, or rather the compound powder of contrayerva, with nitre, as is before-mentioned; or to aſſiſt nature with the cordial confection diſſolved in ſimple, alexeterial water; and alſo to acidulate the patient's drink with dulcified ſpirit of nitre; to repair his ſtrength with Rheniſh wine; and, in fine, a very proper drink will be barley-water with juice of lemons: and all theſe liquors are to be drank plentifully. It will likewiſe be of uſe ſometimes to adminiſter ſome doſes of the calx of antimony and bezoardic powder mixed, in order to provoke ſweat; but the calx ſhould not be too much waſhed: yet it is neceſſary to admoniſh, that it is not an uncommon caſe, eſpecially towards the latter end of the diſeaſe, that the patient's weak low ſtate requires warmer cordials; ſuch as Virginia ſnake-root, contrayerva-root, the root of wild valerian, ſaffron, and the like: and infuſions of theſe in water will be far more convenient than any other powders, eſpecially if they be mixed with a ſmall quantity of diſtilled vinegar.

Intermitting Fever.—That this is not carried off by the Peruvian bark with a proper degree of certainty, without premiſing a vomit or a purge, or both, is not unknown to phyſicians; but to join ſome mild cathartic to this remedy will perhaps appear new in practice: for it is commonly thought among us, that this medicine has little or no effect, unleſs the patient be coſtive while he takes it: but long experience has taught me, that it is quite neceſſary to add a ſmall quantity of rhubarb to this febrifuge, ſo as to procure two ſtools at leaſt every day: nor have I ever obſerved that this procedure has leſſened its virtue, but rather rendered it more efficacious; for altho' ſtrong irritating cathartics raiſe ſuch diſturbances in the blood and humours, as make the proper medicines ineffectual; yet moderate purging is attended with this good effect, that the ſtomach better digeſts whatever is taken in, whether medicines or food; whereby their fineſt and moſt wholeſome parts paſs into the maſs of blood.

The occaſion of my contriving this method of giving the bark was this: about five and thirty years ago intermittent fevers, of a worſe ſort than ordinary, were very rife, and frequently terminated in a bad habit of body, and even in a dropſy; which conſequences, when I had maturely conſidered, I thought that this method might probably guard againſt them; nor was I deceived in my opinion: and the ſucceſs, with which it was attended, encouraged me to purſue it, whenever this diſeaſe attacked bodies loaded with groſs humours: but I was well aware of the danger of purging too much; for after having given a drachm or two of rhubarb in this manner, it was my uſual cuſtom to omit the purgative, and continue the uſe of the febrifuge alone: and beſides the advantages already recited, I made this obſervation, that when the diſeaſe is carried off by this method, there is always leſs danger of a relapſe.

Now, with regard to this noble medicine, I have this one admonition to give, that it is not proper in any other fevers but thoſe of the intermittent kind: for in continuals it is ſo far from being of ſervice, that it does much miſchief; and it is alſo pernicious in thoſe hectics which are accompanied with ulcers of any kind of the internal parts; though they often have periodical returns, and much reſemble quotidian or tertian intermittents: whence it may not perhaps appear an improbable conjecture, that this medicine operates on the bile alone; for that the bile has a conſiderable ſhare in cauſing intermitting fevers, I have not the leaſt doubt.

However, it ſometimes happens that this febrifuge fails in true intermittents; which failure is generally owing to a bad habit of body: wherefore the phyſician ſhould uſe his beſt endeavours to diſcover in what part the fault lies; and it will be commonly found to be in the viſcera and glands of the abdomen: upon this account it will be neceſſary to preſcribe ſome purges, and ſometimes vomits; and in the intermediate days deobſtruents and ſtomachics, the beſt of which are aromatic bitters and preparations of ſteel: and for the ſame reaſon it is, that quartans are of more difficult cure than any other intermittents; for in

theſe the blood and humours are inert and exceſſively viſcid; ſo that there are two diſeaſes to be conquered together, the bad habit of body and the fever; which is generally done effectually, by joining Virginia ſnake-root and ſteel with the bark: however, it may not be improper to take notice, that in ſome caſes where the bark did not anſwer, I have taken off intermitting fevers with a powder compoſed of chamomile flowers, myrrh, ſalt of wormwood, and a little alum.

But there is more danger attending that ſort of intermitting fevers, by the Greeks named ἡμιτριταῖος, that is, ſemitertian. This fever returns every third day; and of forty-eight hours the fit commonly takes up about thirty-ſix, more or leſs; nor does the fever go off entirely, but only remits between the paroxyſms. Hence Galen was right in ſaying, that it was compounded of a continual, quotidian, and an intermitting tertian.

Thus a particular regard is due to this diſeaſe, which ſeems to be cauſed by an inflammation of ſome internal parts, accompanied with obſtructions from bilious humours and too viſcid lymph: wherefore blood is to be drawn once or oftener, according to the patient's ſtrength; and gentle purgatives, ſuch as the diuretic ſalt, manna with Glauber's ſalt, and the like, are to be ordered and repeated at proper diſtances of time; nor ought we to be haſty in giving the bark, for fear it ſhould increaſe the inflammation by adding to the obſtruction of the viſcera, and bring on a hectic. It will be much ſafer, firſt, to order the ſaline draughts, with juice of lemons, ſalt of wormwood, and ſimple cinnamon water, to be taken frequently.

Epidemic FEVERS.—Theſe are cauſed by ſome fault in our ambient air; and that is chiefly owing to the exceſs of heat, cold, drought, or moiſture, or to the unſeaſonable viciſſitudes of theſe qualities.

In Greece and Aſia, where the ſeaſons are generally uniform, and the winds pretty regular from certain but different quarters in the different months of the year, it was eaſy for men of ſagacity to obſerve the changes of the weather, with their good and bad effects: and on a long uſe of this method of obſervation was built the art of prognoſtic in diſeaſes, wherein Hippocrates, the father of phyſic, firſt excelled.

But in our climates, ſuch is the inconſtancy of the weather, and ſo many are the cauſes that raiſe different and even contrary winds on a ſudden, that it ſeems impoſſible to erect any ſolid ſuperſtructure on that foundation: and accordingly Sydenham, who, in imitation of Hippocrates, attempted to deſcribe the fevers of each reſpective year, and to account for their differences from the differences of the weather and ſeaſons, found at length "That he had made no progreſs in diſcovering the cauſes of epidemical diſeaſes by obſerving the manifeſt qualities of the air; as having remarked that in different years, which agreed perfectly well in the viſible temperature of the air, the reigning diſeaſes were very different, and ſo on the contrary; and likewiſe, that there are various conſtitutions of years, which depend not on heat, cold, drought, or moiſture, but on ſome occult and inexplicable alteration in the very bowels of the earth."

Now this matter, in my opinion at leaſt, ſtands thus: that the manifeſt qualities of the air have a conſiderable ſhare in producing epidemic diſeaſes, is a point that admits of no doubt; but there are other conjunct cauſes which alter the force of thoſe qualities, either by increaſing or diminiſhing them. Theſe chiefly ſpring from the earth, as Lucretius wiſely ſaid:

——*ubi puterem humida noctu eſt,*
Intempeſtivis pluviiſque et ſolibus icta.

When ſhe's grown putrid by the rains, and ſweats
Such noxious vapours, preſſed by ſcorching heats.

Now as this terreſtrial putridity is chiefly occaſioned by rotted vegetables, and ſometimes alſo by the dead bodies of animals, and by minerals; ſo the waters, eſpecially of lakes and moraſſes, which have their plants and animals, in the ſame manner frequently exhale peſtilential vapours, which infect the circumambient air. In this claſs may be ranged, though rarely happening in our climates, inundations, earthquakes, eruptions from mountains, and all other remarkable and uncommon phenomena of nature, which are capable of filling the air we breathe, with particles offenſive to animal life: for theſe affect our bodies, and prepare them for the eaſy reception of diſeaſes.

Slow or hectic FEVERS.—Theſe are owing to ſo many different cauſes, that they may well ſeem not to be the ſame, but different diſeaſes. Of all this tribe the moſt pernicious are thoſe which ariſe from an ulcer in any principal part of the body, the lungs eſpecially, by the purulent matter mixing with the blood, and diſturbing its natural motion.

Now it is to be obſerved, that the perſons moſt liable to theſe exulcerations of the lungs, are ſuch as have been afflicted with ſcrophulous diſorders in their infancy or youth. To which purpoſe the experienced Dr. Radcliffe was wont to ſay, that pulmonary conſumptions in this and the colder countries are generally ſcrophulous: and, indeed, in the diſſection of bodies dead of conſumptions, we very often find the lungs beſet with tubercles or indurated glands, which had ſuppurated and thrown off purulent matter.

Medical writers have accurately deſcribed the various ſtages of this diſeaſe, as they ſucceed each other; but they have not taken ſufficient notice, that ſome of its firſt cauſes have their periods or returns: and yet it is of great conſequence to obſerve and prevent theſe periodical returns, as much as poſſible. Thus we ſee ſeveral perſons at certain or ſtated times ſeized with a ſpitting of blood, or a defluxion of thin ſeroſities on the lungs, and ſometimes with bilious vomitings. In all theſe caſes the bark is of ſervice, if joined with pectorals, and given before the expected return of the diſorder; which rule holds equally good in other hæmorrhages: but when the lungs are actually ulcerated, this ſame medicine is very prejudicial.

In ulcers of the lungs phyſicians particularly recommend a milk courſe, as having the double advantage of being food and phyſic: but this practice is liable to ſome caution, becauſe ſome people have a natural averſion to milk. Moreover, in head-achs, acute fevers, and exceſſive thirſt occaſioned by them, and likewiſe in flatulencies, in bilious looſeneſſes, and very bloody ſtools, milk ought always to be deemed a poiſon. Now we generally give the preference to aſſes milk, though leſs nutritive; becauſe it is more cooling and detergent: but when it cannot be conveniently had, whey made of cows milk, or even of goats milk, may be ſubſtituted in its room, eſpecially if the goats have been fed on fragrant herbs: but cows milk itſelf, although diluted as uſual with barley-water, is very frequently inconvenient: and the whey may be rendered more ſuitable to the diſeaſe by infuſing ſtomachic and carminative herbs in it: but it happens unluckily ſometimes, that when milk is extremely neceſſary for the body, ſuch is the laxity of the inteſtines that they cannot bear it. In this caſe the milk may be medicated in this manner: take of red roſes dried, of balauſtines, pomegranate rind and cinnamon, each one drachm; boil them in a pint of cow's milk; when the decoction begins to boil, pour a little cold water in it, to make it ſubſide; repeat this proceſs ſeveral times, till you have uſed a pint of water, and till the milk and water together are reduced to a pint: then ſtrain off the liquor, ſweeten it with ſugar, and divide it into convenient draughts, ſo that the patient may take the whole quantity every day. This diet will anſwer the double intention of affording nouriſhment and reſtraining the looſeneſs, without putting the leaſt obſtacle to the uſe of their food or medicines.

Now it is of the utmoſt conſequence to attempt the cure of this dreadful diſeaſe early; and as it ariſes from inflammation, it requires not only one, but ſeveral bleedings. If the blood be thick and black, or fizy, it is called bad blood, and is thought to indicate farther bleeding; but if it be red and florid, it is eſteemed good, and the lancet is no more uſed: but this notion is apt to lead into miſtakes; for it is not uncommon to ſee blood drawn, when in the higheſt effervescence, extremely florid, and at the ſame time thick and ſtiff: in which caſe bleeding ought to be repeated till its redneſs and fizineſs are diminiſhed; which may be done without danger. It will poſſibly be thought a raſh practice to draw blood, even when the patient is much waſted in his fleſh and very weak:

weak: but it is better to try a doubtful remedy than none; and a temporary leſſening of the ſtrength is of ſervice, when attended with a removal of part of the cauſe, which would weaken the body more and more every day: wherefore, if the lungs be ulcerated, and the fever run high, it will be proper to take away as much blood as the patient can bear, at proper intervals, ſo as to allow the body time to recruit. I have ſeen caſes judged almoſt deſperate, when this method of practice ſucceeded well; but if it happen otherwiſe, the phyſician is not to be branded with the death of the patient, whoſe viſcera were ſo corrupted that it was impoſſible to ſave him.

Fumigations with balſamics, ſuch as frankincenſe, ſtorax, amber, or benzoin, in order to correct and ſweeten the acrid and ſalt humours, are of vaſt ſervice in ſome caſes; which is to be done by throwing the ingredients on red-hot coals, and receiving the fumes through a proper tube directly into the wind-pipe and lungs. This method of adminiſtering balſamics is almoſt entirely neglected, as uſeleſs: but whoſoever conſiders the length of the way, which they muſt make by the blood veſſels, before they reach the lungs; and what a ſmall part of them comes to the place of their deſtination, will eaſily ſee, that this is the beſt way of communicating their virtue, if they have any.

For the ſame reaſon I have known the ſmoke of the balſam of Tolu, ſucked into the lungs through a proper tube, as we ſmoke tobacco, to be of ſignal benefit, eſpecially in ſpitting of blood.

To theſe little ſuppurations it may not be improper to ſubjoin a larger abſceſs, which is ſometimes formed in the ſame part, and is named vomica. — This diſeaſe, tho' bad in itſelf, and though it often terminates in a conſumption, yet it is not attended with ſo much danger as thoſe leſſer exulcerations: for I have ſeen caſes, wherein the patients in a fit of coughing threw up a pint or two of purulent matter, mixed with blood, of ſuch an exceſſive ſtench, that people could not bear the room; and yet they were perfectly cured by a milk diet and balſamics, with anodynes at proper intervals.

There are two other ſpecies of conſumption, which waſte a perſon different ways. In one the body is not nouriſhed; and as ſome particles are always naturally flying off, and nothing coming to ſupply their place, an exceſſive waſting of fleſh enſues, which is called an atrophy. This is very frequently owing to a defect in the nervous fluid; and is either accompanied with a cachexy, which is the other ſpecies, or gradually brings it on. In both ſpecies the food is corrupted by reaſon of the bad habit of body, and the parts are not recruited; and therefore a well regulated courſe of living, and ſteel medicines ſtrengthen the ſtomach, with laxatives at proper intervals, are particularly indicated.

Laſtly, in all decays, exerciſe and frictions according to the patient's ſtrength, ought to be conſtantly uſed: change of air is generally of ſervice, and ſometimes a long ſea-voyage. Patients labouring under diſorders of the lungs, in this country, are very juſtly ſent to Liſbon or Naples: but riding on horſeback, if practicable, if not, in a coach, or a litter at leaſt, or ſome other way of moving the body, is always proper. *Mead's Monita et Præcepta.*

Bilious or Choleric FEVER, a ſpecies of acute fever, owing its origin to diſtemperatures of the bile.

The general ſigns of the bilious or choleric fever, are a remarkable anxiety, and frequent complaints about the breaſt, as of a ſtraitneſs and painful heat. A violent heat in the inſide of the mouth, and inſatiable and intolerable thirſt, trembling and convulſive motions of the joints, and violent deliriums. Dryneſs of the mouth and tongue are often ſo terrible in this diſeaſe, that the ſkin cracks with it; and often the whites of the eyes, ſometimes the whole body, becomes yellowiſh. The peculiar and appropriated ſymptoms of a cholerica febris, ſtrictly ſo called, are an univerſal langour and debility of the limbs.

A ſevere ſhivering firſt ſeizes the patient, and is ſoon ſucceeded by a very violent heat, and raging pain in the head; and, after the two firſt days, there uſually are very terrible ſtrainings and reachings to vomit. The matter brought up at theſe times is cauſtic, acrid, and bilious, and inflames and even ulcerates the fauces; and, if voided upon a ſtone floor, effervesces violently. If this vomiting abates, there immediately comes on a diarrhœa attended with a teneſmus, occaſioned by the irritation of this ſharp matter in the rectum. Faintings alſo are very frequent in this diſeaſe, eſpecially where the vomitings do not bring up a ſufficient quantity of the offending matter. The peculiar and appropriated ſigns of the cauſus, ſtrictly ſo called, are theſe: a violent and inſatiable thirſt, greater than that in any other fever. The bowels are always bound, and it is but very ſeldom that there is any tendency to vomit. The urine is reddiſh and turbid, and, after ſtanding ſome time, depoſits a red ſediment. Often there is a ſenſible pain and ſoreneſs in the præcordia, ſo that the patient cannot bear the leaſt touch upon the breaſt; and uſually, in the courſe of the diſeaſe, there are faintings and violent convulſions.

Perſons moſt ſubject to this diſeaſe are ſuch as eat largely, and drink heavy and imperfectly fermented liquors after it. The cholerica febris, properly ſo called, is moſt frequent with thoſe of a cholerico-ſanguineous habit, and ſuch as feed on high-ſeaſoned meats, and drink abundance of wine or other ſtrong liquors; and is often brought on ſuch perſons by their falling into violent paſſions after a full meal. The cauſus peculiarly attacks the people of melancholic habits, who are much inclined to paſſion, but ſuppreſs it, and who are naturally coſtive.

Method of cure. — The cure of theſe diſeaſes conſiſts in the mitigating the violent ſharpneſs of the humour, and promoting its evacuation; and, finally, in abating the burning heat brought on by it. The utmoſt endeavours are firſt to be made to correct and alter the morbific matter. To this purpoſe the ſeveral preparations of nitre, with the teſtaceous powders and mucilaginous ptiſans, with ſmall mixtures of lemon-juice, and frequent draughts of cooling and diluting liquors, are to be given moderately warm. If the coſtiveneſs be too violent, clyſters of broth muſt be injected, with the addition of a little oil and ſalt; and, if neceſſary, ſmall doſes of rhubarb. To quell the febrile heat and emotion of the blood, the miſtura ſimplex may be given with great ſucceſs; and there is often a ſenſible good effect from the application of rags, wetted in camphorated ſpirit of wine, to the pit of the ſtomach. After the morbific matter is evacuated, the reachings to vomit may be allayed by gentle opiates. All hot medicines change the bilious fevers into inflammatory ones, and the common ſudorifics drive the morbific matter into the blood, and uſually bring on almoſt immediate diſcolourings of the ſkin, like thoſe of the jaundice. Bleeding, though performed ever ſo early in the diſeaſe, ſeldom does any good, except only in remarkable plethoric habits. *Junker's Conſp. Med.*

Colliquative FEVER is that in which the body is much emaciated and conſumed in a ſhort ſpace of time: the ſolid parts, and the fat itſelf waſte, ſometimes by a diarrhœa, ſometimes by ſweat, by urine, or by feveriſh heats alone, without any ſenſible diſcharge. A colliquative fever is obſerved to accompany a cancer of the breaſt, with a diarrhœa. See the articles DIARRHOEA, DIABETES, CANCER, &c.

For this diſeaſe, emulſions of almonds, and of the four cold ſeeds, as alſo aſſes, goats, or woman's milk are proper; or cow's milk with the juice of water-creſſes; chicken broth, broth made of river crabs, or wood ſnails bruiſed.

Diary FEVER, the ſame with ephemera. See EPHEMERA.

Gaol or *Camp* FEVER. See GAOL.

Hoſpital FEVER. See HOSPITAL.

Yellow FEVER. See the article *Bilious* FEVER.

FEVERFEW, in botany, a plant with firm branched ſtalks, and rough leaves, each of which is compoſed of two or three pairs of indented oval ſegments, ſet on a middle rib, with an odd one at the end, cut into three lobes: the flowers ſtand on the tops in the form of an umbel, conſiſting each of a number of ſhort white petals, ſet round a yellow diſk, which is followed by ſmall ſtriated

ſeeds. It is biennial, or of longer duration; grows wild in hedges and uncultivated places, and flowers in June.

The leaves and flowers of feverfew have a ſtrong, not agreeable ſmell, and a moderately bitter taſte; both which they communicate, by warm infuſion, to water and to rectified ſpirit.

This herb is recommended as a warm, aperient, carminative bitter; ſuppoſed to be particularly ſerviceable in female diſorders, and to be a medicine of no inconſiderable virtue, in ſome degree ſimilar to chamomile.

FEUILLANS, an order of barefooted monks, who obſerve the ſame rules with the bernardines. See BERNARDINES.

FIAT, in law, a ſhort order or warrant ſigned by a judge, for making out and allowing certain proceſſes.

FIAT JUSTITIA, is where the king, on a petition to him for his warrant to bring a writ of error in parliament, writes on the top of it *fiat juſtitia*, "let juſtice be done;" upon which the writ of error is made out.

FIBER, the beaver, in zoology, is made, by Linnæus, a ſpecies of caſtor. See the article BEAVER.

FIBRE, in anatomy, a perfectly ſimple body, or at leaſt as ſimple as any thing in the human ſtructure; being fine and ſlender like a thread, and ſerving to form other parts: hence ſome fibres are hard, as the bony ones; and others ſoft, as thoſe deſtined for the formation of all the other parts.

The fibres are divided alſo, according to their ſituation, into ſuch as are ſtraight, oblique, tranſverſe, annular, and ſpiral; being found arranged in all theſe directions, in different parts of the body; for an account of which ſee BONE, MUSCLE, NERVE, ARTERY, VEIN, &c.

FIBRE is alſo uſed to denote the ſlender filaments which compoſe other bodies, whether animal, vegetable, or mineral; but more eſpecially the capillary roots of plants. See PLANT, WOOD, &c.

FIBRILLA, a term ſometimes uſed for a very minute or ſlender fibre.

FIBROSE, ſomething conſiſting of fibres, as the roots of plants. See ROOT.

FIBULA, in anatomy, the outer and ſmaller bone of the leg, called alſo perone. It is nearly of a triangular figure, and ſtands parallel to, but diſtant from, the tibia, or inner bone of the leg. Its upper extremity does not reach to the os femoris, but is only joined to the external ſide of the tibia; and its lower extremity, called malleolus externus, concurs in the articulation of the tarſus, which its eminence ſerves to ſtrengthen, by rendering a luxation leſs eaſy. It has no particular motion of its own, but wholly follows that of the tibia.

FIBULÆUS, a muſcle of the leg, more uſually called peronæus. See PERONÆUS.

FICUS, in botany. See FIG.

FIDD, among ſailors, a piece of wood or iron thruſt through a hole in the foot of the top-maſt, after it is drawn up to its utmoſt height. See MAST and TRUSSEL TREES.

In the article CAP we obſerved, that it was uſed to keep ſteady the top maſt above the frame of the top, as it is kept ſteady below by the truſſel-trees: the fidd reſts upon the truſſel-trees, and with it of courſe the whole weight of the top-maſt: the fidd-hole is therefore juſt above them when the top-maſts are erect.

FIDE JUSSOR, among civilians, the ſame with a ſurety. See SURETY.

FIELD, *Campus*, in agriculture, a piece of ground incloſed, whether for tillage or paſture. See TILLAGE and PASTURE.

FIELD, in heraldry, is the whole ſurface of the ſhield, or the continent, ſo called becauſe it containeth thoſe atchievements anciently acquired in the field of battle. It is the ground on which the colours, bearings, metals, furs, charges, &c. are repreſented. Among the modern heralds, field is leſs frequently uſed in blazoning than ſhield or eſcutcheon. See SHIELD, &c.

FIELD BOOK, in ſurveying, that wherein the angles, ſtations, diſtances, &c. are ſet down. See SURVEYING.

FIELD-COLOURS, in war, are ſmall flags of about a foot and a half ſquare, which are carried along with the quarter-maſter general, for marking out the ground for the ſquadrons and battalions.

FIELD-FARE, in ornithology, the Engliſh name of the variegated turdus, with a hoary-head. See the article TURDUS.

It is larger than the common black-bird, and with us is a bird of paſſage, coming over in great numbers in winter.

FIELD-FORT, in fortification. See FORT.

FIELD-OFFICERS, in the art of war. See the article OFFICER.

FIELD-PIECES, ſmall cannons, from three to twelve pounders, carried along with an army in the field. See CANNON.

FIELD-STAFF, a weapon carried by the gunners, about the length of a halbert, with a ſpear at the end; having on each ſide, ears ſcrewed on, like the cock of a match-lock, where the gunners ſcrew in lighted matches, when they are upon command; and then the field-ſtaffs are ſaid to be armed.

FIELD-WORKS, in fortification, are thoſe thrown up by an army in beſieging a fortreſs, or by the beſieged to defend the place. Such are the fortifications of camps, highways, &c.

Elyſian FIELDS. See ELYSIAN.

FIERI FACIAS, in law, a writ that lies where a perſon has recovered judgment for debt or damages in the king's courts againſt one, by which the ſheriff is commanded to levy the debt and damages on the defendant's goods and chattels.

FIFE, in muſic, is a ſort of wind-inſtrument, being a ſmall pipe. See PIPE.

FIFTH, in muſic, the ſame with diapente. See the article DIAPENTE.

FIG-TREE, *Ficus*, in botany, a genus of plants producing male and female flowers ſeparate, neither of which have any flower leaves: the ſtamina are three ſetaceous filaments of the length of the cup; and the fruit is large, fleſhy, and of a terbinated figure; being properly nothing more than the common calyx, or cup, of the fructification.

Method of cultivating FIG-TREES.—Theſe trees are always planted as ſtandards, in all warm countries; but in England they are generally planted againſt walls, there being but few ſtandard fig-trees, at preſent, in the Engliſh gardens: however, ſince the fruit is found to ripen well upon the ſtandards, and the crop of figs is often greater upon them, than upon thoſe trees againſt walls, it may in time become the general practice to plant them either in ſtandards or eſpaliers: the latter, I think, will ſucceed beſt in England, if they were managed as in Germany; where they untie the fig-trees from the eſpalier, and lay them down, covering them from the froſt with ſtraw or litter, which prevents their ſhoots being injured by the froſt; and this covering is taken away gradually in the ſpring, and not wholly removed until all the danger of froſt is over; by which management they generally have a very great crop of figs; whereas, in England, where the trees grow againſt warm walls, if the ſpring proves warm, the young figs are puſhed out early; and the cold, which frequently returns in April and May, cauſes the greateſt part of the fruit to drop off, ſo that our crop of figs is generally more uncertain than moſt other ſort of fruit; and it frequently happens, that trees which are planted againſt north and eaſt aſpected walls, produce a greater quantity of fruit in England, than thoſe which are planted againſt ſouth and ſouth-eaſt aſpects, which muſt happen from the latter putting out their fruit ſo much earlier in the ſpring than the former: and, if there happen cold froſty nights, after the figs are come out, which is frequently the caſe in this country, the forwardeſt of the figs are generally ſo injured as to drop off from the tree ſoon after. In Italy, and the other warm countries, this firſt crop of figs is little regarded, being few in number; for it is the ſecond crop of figs which are produced from the ſhoots of the ſame year, which is their principal crop; but theſe rarely ripen in England; nor are there above three or four ſorts which ever ripen their ſecond crop, le

the ſummer prove ever ſo good; therefore it is the firſt crop which we muſt attend to in England: ſo that when theſe trees are growing againſt the beſt aſpected walls, it will be a good method to looſen them from the wall in the autumn; and, after having diveſted the branches of all the latter fruit, to lay the branches down from the wall, faſtening them together in ſmall bundles, ſo that they may be tied to ſtakes, to keep them from lying upon the ground; the damp whereof, when covered in froſty weather, might cauſe them to grow mouldy; and hereby they will be ſecured from being broken by the wind. When they are thus managed in the autumn, if the winter ſhould prove very ſevere, the branches may be eaſily covered with peas-haulm, ſtraw, or any other light covering, which will guard the tender fruit-bearing branches from the injury of froſt: and when the weather is mild the covering muſt be removed, otherwiſe the figs will come out too early; for the intention of this management is to keep them as backward as poſſible: then in the ſpring, when the figs are beginning to puſh out, the trees may be faſtened up to the wall again. By this management I have ſeen very good crops of figs produced in two or three places.

I have alſo ſeen great crops of figs in ſome particular gardens, after very ſharp winters, when they have, in general, failed in other places, by covering up the trees with reeds made into panels, and fixed up againſt the walls.

In the pruning of fig-trees, the branches muſt never be ſhortened; becauſe the fruit are all produced at the upper part of the ſhoots; ſo, if theſe are cut off, there can be no fruit expected; beſides, the branches are very apt to die after the knife; ſo that, when the branches are too cloſe together, the beſt way is to cut off all the naked branches quite to the bottom, leaving thoſe which are beſt furniſhed with lateral branches at a proper diſtance from each other, which ſhould not be nearer than a foot; and, when they are well furniſhed with lateral branches, if they are laid four or five inches farther aſunder, it will be better.

The beſt ſeaſon for pruning of fig-trees is in autumn, becauſe, at that time, the branches are not ſo full of ſap; ſo they will not bleed ſo much as when they are pruned in the ſpring; and, at this ſeaſon, the branches ſhould be diveſted of all the autumnal figs; and the ſooner this is done, when the leaves begin to fall off, the better will the young ſhoots reſiſt the cold of the winter. There are ſome ſeaſons ſo cold and moiſt that the young ſhoots of the fig-trees will not harden, but are ſoft and full of juice: when this happens, there is little hope of a crop of figs the ſucceeding year; for the firſt froſt in the autumn will kill the upper part of theſe ſhoots, for a conſiderable length downwards: whenever this happens, it is the beſt way to cut off all the decayed part of the ſhoots, which will prevent the infection from deſtroying all the lower part of the branches; and by this method I have ſeen a moderate crop of figs put out from the lower part of the ſhoots, where, if the ſhoots had not been injured, there would have been no fruit produced; becauſe it is chiefly from the four or five uppermoſt joints of the ſhoots that the fruit comes out: and it is for this reaſon, that as many of the ſhort lateral branches ſhould be preſerved as poſſible, thoſe being the moſt productive of fruit; for, where the long ſtraight ſhoots are faſtened up, there will be no fruit, but at their extremities; ſo that all the lower part of the trees will be naked, if there be not a particular regard had to ſupply young ſhoots in every part of the trees. *Miller; Gard. Dict.*

Figs, both freſh and dry, are very wholeſome food; they are nutritive and emollient; they are alſo good in diſorders of the breaſt and lungs; but a too free uſe of them has ſometimes brought on obſtructions of the viſcera, a common complaint in the Levant. They are frequently made ingredients in our pectoral decoctions, and by ſome are greatly recommended againſt nephritic complaints. They are much uſed externally by way of cataplaſm, either roaſted or boiled in milk, for the ripening of tumors, and for eaſing the pain of the piles.

Fig, in farriery, a ſort of wart on the ſruſh, and ſometimes all over the body of a horſe. The figs that appear on the ſruſh or ſole make an evacuation of malignant ſtinking humours, that are very hard to cure.

FIGHT. See Battle.

FIGURAL, Figurate, or Figurative, a term applied to whatever is expreſſed by obſcure reſemblances. The word is chiefly applied to the types and myſteries of the Moſaic law; as alſo to any expreſſion which is not taken in its primary and literal ſenſe.

Figural, or Figurative Numbers, are ſuch as do or may repreſent ſome geometrical figure in relation to which they are always conſidered, as triangular numbers, pentagonal numbers, pyramidal numbers, &c.

FIGURATIVE, among grammarians, is the ſame with what is otherwiſe called characteriſtic. See Characteristic.

Figurative Counterpoint, in muſic, is that wherein there is a mixture of diſcords along with the concords. See the article Counterpoint.

Figurative Descant, in muſic. See the article Descant.

FIGURE, in philoſophy, the ſurface or terminating extremities of any body.

Figures, in arithmetic, are certain characters whereby we denote any number, which may be expreſſed by any combination of the nine digits; as 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0.

Figure, in aſtrology, is applied to the deſcription, ſtate, and diſpoſition of the heavens at a certain hour, where the places of the planets and ſtars are marked in a figure of twelve triangles called houſes, with regard to the horoſcope to be drawn from it. They likewiſe call it horoſcope and celeſtial themis.

Figure, in conic ſections, according to Apollonius, is the rectangle of the latus rectum and tranſverſum in the hyperbola and ellipſis. De la Hire calls the rectangle of any diameter and its proper parameter, in the hyperbola and ellipſis, the figure of that diameter.

Figure, in dancing, denotes the ſeveral ſteps which the dancer makes in order and cadence, conſidered as they mark certain figures on the floor.

Figure, in fortification, the plan of any fortified place, or the interior polygon; of this there are two ſorts, regular and irregular; a regular figure is that where the ſides and angles are equal; an irregular is the contrary.

Figure, in geometry, the ſuperficies included between one or more lines, of which there are three ſorts, as rectilineal, curvilineal, and mixed figures: rectilineal have their extremities all right-lines, as triangles, quadrilaterals, &c. Curvilineal are ſuch as have their extremities crooked, as circles, ellipſes, &c. Mixed, are partly right-lines and partly crooked, as a ſemicircle, ſegment of a circle, &c.

FILAMENT, a ſmall fine fibre or thread, which compoſes the texture of the fleſh, nerves, ſkin, &c. of an animal: and it is likewiſe applied to the component parts of vegetables; as alſo to the fibres belonging to their roots. It is alſo uſed to ſignify that viſcid concreted matter, which appears like hairs or threads in urine.

The word is Latin, *filamentum*, which is a diminutive of *filum*, a thread.

Filaments, among botaniſts, is particularly uſed for the ſtamina. See the article Stamina.

FILAZER, or Filacer, an officer of the Common-Pleas, ſo called from his filing thoſe writs whereon he makes out proceſs.

FILBERT, or Filberd, the fruit of the corylus, or hazel. This ſpecies of nuts is more nouriſhing than the common ones; but is hard to digeſt. They are however worthy of being propagated in orchards and gardens; which is done by planting them in February.

FILE, among mechanics, a tool uſed by workmen in metal, &c. in order to ſmooth, poliſh, or cut. It is uſed, in pharmacy, to reduce hard ſubſtances to fine particles, whoſe conſiſtence will not admit of powdering.

File or Label, in heraldry, conſiſts ſometimes of more, and ſometimes of fewer points. According to Guillim, it is borne as a charge in a coat of arms: but it is uſually the difference or mark of diſtinction, which the

elder brother bears in his coat during his father's life-time. Some call the file the upper horizontal line, and the label the point that iſſues from it.

FILE, in the art of war, a row of ſoldiers, ſtanding one behind another, which is the depth of the battalion, or ſquadron. The files of a battalion of foot are generally three deep; as are ſometimes thoſe of a ſquadron of horſe. The files muſt be ſtraight, and parallel one to another.

FILIGRANE, or FILIGREE-WORK, any piece of gold or ſilver-work that is curiouſly done, with grains or drops on the filaments or threads.

FILING, in ſmithery, the operation of faſhioning metalline bodies by means of a file. See FILE.

FILIPENDULA, dropwort, in botany, a genus of plants, whoſe characters are the following.

The root is fibrous and perennial, with glandulous bulbs faſtened to it: the leaves are finely jagged, like thoſe of milleſoil: the calyx is monophyllous, denticulated, and divided into ſix or ſeven ſegments, which are retroflected, or bent backwards: the flowers are hexapetalous or heptapetalous, looſely diſpoſed in panicles on long ſtalks, which are almoſt naked: the ſtamina are numerous, and ſituated on the reflected margin of the calyx: the fruit is generally round, and contains many ſeeds compacted together, each of them furniſhed with its tube.

This plant contains a ſalt, approaching to that of alum; but it is mixed with a great deal of ſulphur. All authors agree that it is very diuretic and aperitive; and is alſo recommended for the epilepſy and dyſentery.

FILIX, in botany, an order of the cryptogamia claſs of plants, comprehending the fern, horſe-tail, adder's tongue, maiden-hair, ſpleenwort, polypody, &c. See the articles FERN, HORSE-TAIL, &c.

FILLER-HORSE, one yoked immediately to a cart. See the article CART.

FILLET, in heraldry, the fourth part of the ordinary called a chief, which is placed in the chief point of the eſcutcheon.

FILLET, in painting, gilding, &c. is a little rule or reglet of leaf-gold drawn over ſome mouldings; or on the edges of frames, &c. eſpecially when painted white, by way of ornament.

FILLET, in anatomy, the nervous ligament under the tongue, which midwives uſually divide with their nail, or a ſixpence, immediately after the child's birth: it is moſt commonly called the frænum.

FILLET, or FILET, in architecture, a little ſquare member, or moulding, uſed in divers places and on divers occaſions; but generally as a crowning over a greater moulding. It is called liſta or liſtella by the Italians; by the French, reglet; and by others band and bandelette.

FILLET, in the menage, the loins of an horſe, which begin at the place where the hinder part of the ſaddle reſts.

FILLING *the Sails*, in the ſea-language, the act of diſpoſing a ſail in ſuch a manner, that the wind preſſing into the cavity or belly of it ſhall force the ſhip forward, or a-head, in contradiſtinction to backing, which forces her a-ſtern; and ſhivering, which makes her remain almoſt in a ſtate of reſt, neither advancing nor retreating. It may appear ſomething remarkable, but is certainly true, that a ſhip may be forced backward or forward, or may remain in her place, with any wind, while her ſtem is all the while directed to one part of the horizon; and theſe different ſtates of motion or reſt may be communicated by backing, filling, or ſhivering the ſails, by drawing the braces on one ſide, and looſening them on the other. See the articles BRACE, BACKING, and SHIVERING.

FILLY, a term among horſe-dealers, to denote the female or mare colt. See the article FOAL.

FILM, in botany, that woody ſkin which ſeparates the ſeeds in the pods of plants.

FILTER, or FILTRE, in chemiſtry, a ſtrainer, commonly made of bibulous or filtring paper, in the form of a funnel, through which any fluid is paſſed, in order to ſeparate the groſs particles from it, and render it limpid. This filtre is put into a funnel, with the ſmall end in the veſſel for the reception of the filtrated liquor, and then the liquor is poured into the paper, not too much at once, for fear of burſting it. A filtre is alſo made of a woollen bag, called Hippocrates's ſleeve, or one of linen, according to the nature of the liquor to be filtred.

FILTRATION, in chemiſtry. See DEPURATION.

FIMBRIÆ, denotes appendages diſpoſed by way of fringe round the border of any thing: ſuch are thoſe about the thicker extremities of the Fallopian tubes. See GENERATION.

FIMBRIATED, in heraldry, an ordinary with a narrow border or hem of another tincture.

This, in Latin, is called *fimbriatus*; that is, edged or fringed.

FIN, *Pinna*, in natural hiſtory, a well known part of fiſhes, conſiſting of a membrane ſupported by rays, or little bony or cartilaginous oſſicles.

FINANCES, in the French polity, ſignify the revenues of the king and ſtate.

FINE, in law, hath divers applications: ſometimes it is uſed for a formal conveyance of lands or tenements, or of any thing inheritable, being *in eſſe tempore finis*, in order to cut off all controverſies. Others define it to be a final agreement between perſons, concerning any lands or rents, &c. of which any ſuit or writ is depending between them in any court.

FINE ſometimes ſignifies a ſum of money paid for entering lands or tenements lett by leaſe; and ſometimes a pecuniary mulct for an offence committed againſt the king and his laws, or againſt the lord of the manor.

FINE *adnullando levato de tenemento quod fuit de antiquo dominico*, is a writ to the juſtices for diſannulling a fine levied of lands holden in ancient demeſne to the prejudice of the lord.

FINE *capiendo pro terris, &c.* a writ lying for one that, upon conviction by a jury, having his lands and goods taken into the king's hands, and his body committed to priſon, obtains favour for a ſum of money, &c. to be remitted his impriſonment, and his lands and goods to be redelivered to him.

FINE *Force*, an abſolute neceſſity that is unavoidable, whereby one is compelled to do any thing.

FINE *levando de tenementis tentis de rege in capite, &c.* a writ directed to the juſtices of the Common-Pleas, to licenſe them to admit of a fine for ſale of lands holden in capite.

FINE *non capiendo pro pulchre placitando*, a writ to inhibit officers of courts to take fines for fair pleading.

FINE *pro rediſſeiſina capienda, &c.* a writ that lies for the releaſe of one laid in priſon for a reſeiſin, upon a reaſonable fine.

FINE *for Alienation*, a reaſonable fine paid the king by his tenants in chief, for licenſe to alienate their lands.

FINERS *of Gold and Silver*, are thoſe who ſeparate theſe metals from coarſer ores. See the article REFINERS.

FINERY, in the iron works, one of the forges at which the iron is hammered and faſhioned into what they call a bloom, or ſquare bar. See the article IRON.

FINE STILLER, in the diſtillery, that branch of the art which is employed on the diſtilling the ſpirit from treacle or other preparations or recrements of ſugar, is called fine-ſtilling, by way of diſtinction from malt-ſtilling; and the perſon who exerciſes this part of the trade is called a fine-ſtiller.

The operation in procuring the ſpirit from ſugar is the ſame with that uſed in making the malt ſpirit; a waſh of the ſaccharine matter being made with water from treacle, &c. and fermented with yeaſt. It is uſual to add, in this caſe, however, a conſiderable quantity of malt, and ſometimes powdered jalap, to the fermenting backs. The malt accelerates the fermentation, and makes the ſpirit come out the cheaper; and jalap prevents any muſty head on the ſurface of the fermenting liquor, ſo as to leave a greater opportunity for the free acceſs of the air, and thus to ſhorten the work, by turning the foamy into a hiſſing fermentation. *Shaw's Lect.*

FINGERS, in anatomy. See HAND.

FINING *of Wines*. See WINE.

FINISHING, in architecture, is frequently uſed for a crowning, acroter, &c. raiſed over a piece of building, to

to terminate, complete, or finiſh it. See the article CROWNING.

FINITE, ſomething bounded or limited, in contradiſtinction to infinite. See the article INFINITE.

FINITOR, in aſtronomy, the ſame with horizon, ſo called becauſe it terminates the ſight or proſpect. See HORIZON.

FINNIKIN, the Engliſh name of a ſpecies of pigeon, remarkable for its wheeling round ſeveral times, whenever it courts the female.

FIRE, a general name, by which men ſeem to underſtand a certain ſenſation or complex notion of light, heat, burning, melting, &c.

The power of fire is ſo great, its effects ſo extenſive, and the manner of its acting ſo wonderful, that ſome of the wiſeſt nations of old reverenced and worſhipped it, as the ſupreme deity. Some of the chemiſts alſo, after they had diſcovered its ſurpriſing operations, ſuſpected it to be an uncreated being: and indeed the moſt famous of them have acknowledged it as the ſource of all their knowledge; and hence have profeſſed themſelves philoſophers by fire, nor thought they could be honoured with a nobler title. Now, amongſt all the wonderful properties of fire, there is none more extraordinary than this, that though it is the principal cauſe of almoſt all the ſenſible effects that continually fall under our obſervation, yet it is itſelf of ſo infinitely a ſubtile nature, that it illudes the moſt ſagacious enquiries, nor ever comes within the cognizance of our ſenſes; and hence others have been led to be of opinion that it ought to be looked upon as ſpirit rather than body. Fire is generally divided into three kinds or ſpecies, viz. celeſtial, ſubterraneous, and culinary.

By celeſtial fire is principally underſtood that of the ſun, without regard to that of the fixed ſtars, though this perhaps may be of the ſame nature.

By ſubterraneous fire we underſtand that which manifeſts itſelf in fiery eruptions of the earth, volcanoes, or burning mountains; or by any other effects it produces in mines, or the more central parts of the earth.

By culinary fire we mean that employed in all chemical operations, and the common occaſions of life.

The ſun's heat appears to be the actuating principle, or general inſtrument of all the operations in the animal, vegetable, atmoſpherical, marine, and mineral kingdoms.

Fire, conſidered in itſelf, ſeems to exiſt, in the greateſt purity and perfection in the celeſtial regions; at leaſt we are inſenſible of any conſiderable ſmoke it yields: for the rays of light come to us from the ſun, unmixed with any of that groſs, feculent, or terreſtrial matter, found in culinary and ſubterranean fires: but, allowing for this difference, the effects of the ſolar fire appear the ſame as thoſe of culinary fire.

If we examine the effects of ſubterraneous fires, we ſhall find them the ſame with thoſe produced by culinary fire. Thus burnt coals, cinders, and melted minerals, are thrown up by Veſuvius and other burning mountains. Warm nephritical exhalations, natural hot ſprings, ſteams, vapours, ſmoke, &c. are found in ſeveral parts of the globe, riſing nearly in the ſame manner as if they were produced by the heat of a furnace. Whence it appears that ſubterraneous fires are of the ſame nature with the culinary.

All the phyſical knowledge we can have of a ſubject, muſt ariſe from attending to its properties and effects: but theſe properties and effects can never be diſcovered without the help of experiments; which in philoſophical enquiries are the only interpreters betwixt the ſenſes and the reaſon: whence all thoſe notions of fire ſhould be rejected as precarious and unſound, that are taken from the direct teſtimony of the ſenſes, or the naked reaſon unaſſiſted by experiments. In this enquiry, therefore, the mind ſhould particularly be kept unpreposſeſſed, and, before it pronounces, wait for full information. As men generally affix to the word fire, a complex idea of burning, light, heat, melting, &c. this idea ſhould be analyſed, in order to ſee what parts are eſſential, and what precarious or arbitrary.

We frequently find the effects of fire produced, where no viſible fire appeared. Thus the fingers are eaſily burnt by an iron heated below the degree of ignition, or ſo as to be no ways viſibly red-hot or fiery: whence it follows, that the eye is no judge of fire.

So likewiſe the touch gives us no poſitive notice of any degree of fire below the natural heat of the body, or any ſo great as to deſtroy the organ.

Again, the effects of fire are often produced without any manifeſt ſigns of burning, melting, &c. as in evaporations, &c. If this method of excluſion and rejection were purſued to its due length, we ſhould, perhaps, find no criterion, infallible mark, or characteriſtic of fire in general, but that of a particular motion ſtruggling among the minute parts of bodies, and tending to throw them off at the ſurface. If this ſhould prove the caſe, then ſuch a motion will be the form and eſſence of fire, and which, being preſent, makes fire alſo preſent; and, when abſent, makes fire alſo abſent: whence to produce, and produce this motion in bodies, will be one and the ſame thing. See ELECTRICITY.

The great and fundamental difference in reſpect to the nature of fire is, whether it be originally ſuch, formed thus by the Creator himſelf at the beginning of things, or whether it be mechanically producible from other bodies, by inducing ſome alterations in the particles thereof. The former opinion is maintained by Homberg, Boerhaave, the younger Lemery, and s'Graveſande; the latter is chiefly ſupported by the Engliſh philoſophers, lord Bacon, Mr. Boyle, and Sir Iſaac Newton.

Bacon, in the treatiſe De Forma Calidi, deduces, from a great number of particulars, that heat in bodies is no other than motion, ſo and ſo circumſtanced; ſo that to produce heat in a body, nothing is required but to excite a certain motion in the parts thereof.

Boyle ſeconds him in an expreſs treatiſe of the mechanical origin of heat and cold, and maintains the ſame doctrine with new obſervations and experiments; as a ſpecimen of which, we ſhall here give the two following:

1. In the production of heat, ſays that able philoſopher, there appears nothing on the part either of the agent or patient, but motion and its natural effects. When a ſmith briſkly hammers a piece of iron, the metal thereby becomes exceedingly hot; yet there is nothing to make it ſo, except the forcible motion of the hammer impreſſing a vehement and variouſly determined agitation on the ſmall parts of the iron, which, being a cold body before, grows, by that ſuper-induced commotion of its ſmall parts, hot: firſt, in a more looſe acceptation of the word, with regard to ſome other bodies, compared with which it was cold before; then ſenſibly hot, becauſe this agitation ſurpaſſes that of the points of our fingers; and in this inſtance oftentimes the hammer and anvil continue cold after the operation; which ſhews that the heat acquired by the iron was not communicated by either of thoſe implements, as heat; but produced in it by a motion, great enough ſtrongly to agitate the parts of ſo ſmall a body as the piece of iron, without being able to have the like effect upon ſo much greater maſſes of metal as the hammer and the anvil: though if the percuſſions were often and briſkly renewed, and the hammer were ſmall, this alſo might be heated: whence it is not neceſſary that a body itſelf be hot to give heat.

2. If a large nail be driven by a hammer into a plank of wood, it will receive ſeveral ſtrokes on its head before it grows hot; but when it is once driven to the head, a few ſtrokes ſuffice to give it a conſiderable heat; for while, at every blow of the hammer, the nail enters further into the wood, the motion produced is chiefly progreſſive, and is of the whole nail tending one way; but when that motion ceaſes, the impulſe given by the ſtroke being unable to drive the nail further on, or break it, muſt be ſpent in making a various, vehement, and inteſtine commotion of the parts among themſelves, wherein the nature of heat conſiſts.

Agreeable to this is the opinion of Sir Iſaac Newton, who conceives that groſs bodies may be converted into light, by the agitation of their particles; and light, again, into groſs bodies, by being fixed therein.

On the other hand, M. Homberg, in his Eſſai du Souffre Principe, holds, that the chemical principle, or element ſulphur, which is ſuppoſed one of the ſimple, primary, pre exiſtent ingredients of all natural bodies, is

is real fire, and conſequently that fire is coeval with bodies.

Dr. s'Graveſande goes on much the ſame principle: fire, according to him, enters the compoſition of all bodies, is contained in all bodies, and may be ſeparated or procured from all bodies, by rubbing them againſt each other; and thus putting their fire in motion: but fire, he adds, is by no means generated by ſuch motion.

Mr. Lemery, the younger, agrees with theſe two authors in aſſerting this abſolute and ingenerable nature of fire: but he extends it farther. Not contented to confine it as an element to bodies, he endeavours to ſhew, that it is equally diffuſed through all ſpace, and that it is preſent in all places; in the void ſpaces between bodies, as well as in the inſenſible interſtices between their parts.

This laſt ſentiment falls in with that of Boerhaave, and the celebrated M. Muſſchenbrock. But notwithſtanding what thoſe able philoſophers have advanced, it is evident that fire, heat, flame, &c. are only the different modifications of the particles of light, and that the particles of light themſelves depend entirely on velocity for their lucific quality; ſince, by many experiments, we know, that the particles of bodies become lucid, or particles of light, by only producing in them a requiſite degree of velocity: thus the particles in a rod of iron, being hammered very nimbly, ſhine and become red hot: thus alſo the violent ſtroke of the flint againſt the ſteel, in ſtriking fire, puts the particles of the ſteel, which it takes off, into ſuch a motion as cauſes them to melt and become ret hot, which makes the ſparks of fire produced by each ſtroke: as, therefore, fire conſiſts in the great velocity of the particles, ſo it may be communicated from one body in which it is, to another in which it is not, after the ſame manner that one body in motion will communicate motion to another that has got none.

Fire differs from heat only in this, that heat is a motion in the particles of a body, with a leſſer degree of velocity; and fire a motion with a greater degree of velocity, viz. ſuch as is ſufficient to make the particles ſhine; though we often call ſuch a ſtate as will burn, fire, tho' it does not actually ſhine; and we ſeldom call thoſe lucid bodies fires, which only ſhine, and do not burn. Theſe are a ſort of phoſphori, which, though they have no heat, yet ſeem to owe their lucidity to the motion of their parts. See the articles HEAT and PHOSPHORUS.

There ſeems to be no other difference between fire and flame, than this; that fire conſiſts in a glowing degree of velocity in the parts of a body, while yet ſubſiſting together in the maſs; but flame is the ſame degree of velocity in the particles diſſipated and flying off in vapour: or, to uſe Sir Iſaac Newton's expreſſion, flame is nothing elſe but a red hot vapour. See the article FLAME.

FIRE, in chemiſtry, the great inſtrument by which moſt of the operations in that art are performed.

The kind, degree, direction, &c. of fire, are things the chemiſt is principally to attend to. There are, in chemiſtry, as many kinds of fire as there are mediums thro' which it may be conveyed, or fuels that afford it. For common uſe, fire is conveyed through aſhes, ſand, water, &c. or directly through the containing veſſel. Hence, fires are denominated of various kinds, as thoſe of ſand, filings of iron, and aſhes, the reverberatory fire, the ignis rotæ, or fire for fuſion, the lamp fire, the balneum mariæ, the vapour bath, and the fire of ſuppreſſion. The chemiſts uſe alſo ſeveral other kinds of heats, which may be claſſed among the fires, ſuch as inſolation, a bath of horſe-dung, a bath of the ſkins of grapes, and the heat of quick-lime.

For the balneum arenoſum, or the fires or baths of ſand, filings of iron, and aſhes, balneum mariæ, balneum vaporis, or vapour-bath, ſee BALNEUM.

The reverberatory fire is made in a furnace covered with a dome, that by this means the heat or flame, which has always a tendency to make its eſcape at the ſuperior parts of the furnace, may be reverberated, or beat back on the veſſel immediately expoſed to it. To expoſe a veſſel to a naked fire, or to diſtil with a naked fire, is when there is no intermediate ſubſtance between the diſtilling veſſel and the fire.

The ignis rotæ, or fire for fuſion, is when a crucible or any other veſſel containing the matter deſtined for fuſion, is ſurrounded with live-coals.

Lamp-fire is when any matter contained in a glaſs-veſſel is rendered hot by the equable heat of a lighted lamp.

Fire of ſuppreſſion is when, in order to diſtil per deſcenſum, the fire is laid above the matter, ſo that the moiſture forced from it, by means of the heat, is precipitated to the bottom of the veſſel; or when the body of the retort, or other veſſel, is covered over with fire.

Inſolation is when any matter deſigned either to be put into fermentation or dried, is expoſed to the heat of the ſun.

The bath of horſe-dung, called alſo the horſe's-belly, is when a veſſel, containing any matter to be either digeſted or diſtilled, is placed in a large heap of horſe-dung.

Bath of the ſkins of grapes, like the bath of horſe's-dung, ſerves for digeſtions or diſtillations; the ſkins are to be collected after the vintage.

The heat of quick-lime moiſtened, may ſerve for ſome diſtillations.

Some differences may be found in the effects produced by theſe different fires, applied in the ſame degree: but they have not, perhaps, been noted as they deſerve. In ſeveral bodies it is evident that dry and moiſt heats have different effects, which we may find remarkably in the common culinary operations of boiling, roaſting, baking, &c. and hence, when the ſame effects are required perfectly ſimilar, the ſame kinds as well as degrees of fire are to be uſed.

The pureſt fire is that of alcohol, or perfectly pure ſpirit of wine; the next in purity is that of diſtilled oils; the next, that of charcoal, or charred turf; and the impureſt, pit coal: but all theſe have nearly the ſame effect, when received through the ſame kind of medium.

Degrees of FIRE. The laſt thing to be conſidered is, how to regulate and aſcertain the degrees of fire in chemical operations, ſo as to produce the effects required in every caſe. The common directions of chemiſts about this matter are full of uncertainty; the firſt, ſecond, third, and fourth degrees of heat, or fire, meaning no preciſe degrees, meaſured by any ſtandard: however, according to Boerhaave, they are as follow.

The firſt degree of fire is that by which nature performs the office of vegetation in plants, and whereby chemiſtry imitates or does the like: this commences from the higheſt degree of cold, which, in Fahrenheit's thermometer, is denoted by one, and ends at eighty degrees; ſince in this whole interval we find certain plants give indications of life and growth. This heat is ſuited to extracting of the native ſpirits of odoriferous vegetables with oils, as that of roſes, jeſſamin, &c. and again, to making the more curious inſolations, &c.

The ſecond degree of fire may be accounted that of the human body, in a healthy ſtate. This degree is always greater than that of the ambient air, and may be ſuppoſed to commence at the 40th degree of the thermometer, and end about the 94th. Within this compaſs animals may live and ſubſiſt, that is, if their juices be of any degree of heat within theſe bounds. This degree is adapted to vinous and acetous fermentation, putrefaction, excluſion of the chick, the finer digeſtions, the making of tinctures and elixirs; and the adepts have uſed it for the firſt digeſtion of their mercury, by carrying the including veſſel conſtantly in their pocket.

The third degree of fire is that which extends from 94 degrees of the thermometer to 212, at which laſt water uſually boils. This degree is required in the diſtillation of ſimple and compound waters, the eſſential oils of vegetables, and will coagulate or conſolidate the ſerum, blood, and other animal juices, and conſequently deſtroy the creatures.

The fourth degree may be taken from 211 to 600 of the thermometer, within which latitude quickſilver or oil of vitriol boils, diſtils, or becomes volatile. This degree is ſuited to the melting of lead, tin, biſmuth, &c. and the ſubliming of ſal armoniac and ſulphur, the calcining of antimony, &c.

The fifth degree is that wherein the other metals melt, and which commences from 600 degrees of the thermometer,

ter, and ends where iron is held in a ſtate of fuſion. In this degree moſt bodies are deſtroyed; but glaſs, gold, ſilver, copper, and iron, remain long unchanged; all other fixed bodies grow red-hot in this degree, and all the unvitrifiable ſtones are calcined.

The ſixth and higheſt degree of fire, hitherto known, is that of the burning lens, or concave, by M. Villette, Tſchirnhauſen, Buffon, and others. The focus of theſe lenſes will even volatilize what is called the metalline or mercurial part of gold, and vitrify the more terreſtrial. See the article BURNING-GLASS.

The fires of ſand, filings of iron, and aſhes, have generally their degrees from the firſt to the third: the reverberatory fire has its degrees from the firſt to the fourth: the ignis rotæ ſerves for calcinations and fuſions; and a veſſel may receive different degrees of heat from a lighted lamp: the balneum mariæ and balneum vaporis have alſo their degrees, as has the fire of ſuppreſſion its degrees: inſolation has its degrees in proportion to the heat of the ſun, to which the ſubſtances are expoſed: the bath of horſe's-dung has its degrees, according to the bulk of the heap, or the place in which it is lodged: the bath of grape-ſkins has alſo its degrees like that of the bath of horſe's-dung: and the heat of quick-lime has alſo its degrees; for according as we deſire it more or leſs ſtrong, we expoſe it to powder longer or ſhorter in the open air; and when we have occaſion for all its heat, we uſe it as quick as we poſſibly can.

FIRE, in medicine. See CAUSTICS.

FIRE, in ſurgery. See CAUTERY.

St. Anthony's FIRE, in medicine. See the article ERYSIPELAS.

Walking FIRE, in meteorology. See WILL-WITH-A-WHISP.

FIRE, in theology. See the articles HELL, CONFLAGRATION, &c.

FIRE, in the art of war, a word of command to the ſoldiers, to diſcharge their muſquets; to the cavalry, to diſcharge their carbines or piſtols; to the grenadiers, to fire their grenadoes; and to the gunners, to fire the guns.

Running FIRE is when a rank of men, drawn up, fire one after another; or, when the lines of an army are drawn out to fire on account of a victory, each ſquadron or battalion takes it from another, from the right of the firſt line to the left, and from the left to the right of the ſecond line.

FIRE-ARMS are all ſorts of arms charged with powder and ball, as cannon, muſquets, carbines, piſtols, blunderbuſſes, &c. See the articles CANNON, GUN, &c.

FIRE-BALL, in the art of war, a compoſition of meal-powder, ſulphur, ſalt-petre, pitch, &c. about the bigneſs of a hand-grenade, coated over with flax, and primed with a ſlow compoſition of a fuſee. This is to be thrown into the enemy's works in the night-time, to diſcover where they are; or to fire houſes, galleries, or blinds of the beſiegers; but they are then armed with ſpikes or hooks of iron, that they may not roll off, but ſtick or hang where they are deſigned to have any effect.

FIRE-LOCK. See GUN, MUSQUET, &c.

FIRE-MASTER, in our train of artillery, an officer who gives the directions and proportions of ingredients for each compoſition required in fire-works, whether for the ſervice of war, or for rejoicings and recreations.

His orders are given to the fire-workers and bombardiers, who muſt execute them.

FIRE-POTS, in the military art, ſmall earthen pots, into which is put a charged grenade, and over that powder enough till the grenade is covered, then the pot is covered with a piece of parchment, and two pieces of match acroſs, lighted: this pot being thrown where it is deſigned, it breaks and fires the powder, and burns all that is near it, and likewiſe fires the powder in the grenade, which ought to have no fuſe, to the end its operations may be the quicker.

FIRE-WORKERS, officers ſubordinate to the fire-maſter.

FIRE-WORKS. See PYROTECHNIA.

FIRE-BARE, in our old cuſtoms, ſignifies a beacon, or tower, by the ſea-ſide, wherein there were kept continual lights.

FIRE-BOTE is fuel or firing for neceſſary uſe, allowed to tenants, out of the lands granted to them.

FIRE-ENGINE. See the article ENGINE.

Wild-FIRE, a kind of artificial or factitious fire, which burns even under water, and that with greater violence than out of it. It is compoſed of ſulphur, naphtha, pitch, gum, and bitumen; and is only extinguiſhable by vinegar mixed with ſand and urine, or by covering it with raw hides. Its motion or tendency is ſaid to be contrary to that of natural fire, and it always follows the direction in which it is thrown, whether it be downwards, ſideways, or otherwiſe.

Several are of opinion that the ancient Greeks and Romans uſed this fire in their engagements at ſea: whether or not that was the caſe, it was applied againſt the Saracens in a ſea-fight, commanded by Conſtantine Pogonates, in the Heleſpont, and with ſuch effect that he burnt the whole fleet therewith, wherein there were thirty thouſand men.

Electrical FIRE. See ELECTRICITY.

FIRING-IRON, in farriery, an inſtrument not unlike the blade of a knife; which being made red-hot, is applied to a horſe's hams, or other places ſtanding in need of it, as in preternatural ſwellings, farcy-knots, &c. in order to diſcuſs them. Sometimes this is done for wrenches of the paſterns.

FIRKIN, an Engliſh meaſure of capacity, for things liquid, being the fourth part of the barrel: it contains eight gallons of ale, ſoap, or herrings; and nine gallons of beer. See MEASURE and BARREL.

FIRLOT, a dry meaſure uſed in Scotland. The oat-firlot contains 21 ¼ pints of that country; the wheat-firlot contains about 2211 cubical inches; and the barley-firlot 31 ſtandard pints. Hence it appears that the Scotch wheat-firlot exceeds the Engliſh buſhel by 33 cubical inches. See the article MEASURE.

FIRMAMENT, in the old aſtronomy, the eighth ſphere or heaven, with regard to thoſe of the ſeven planets which it ſurrounds. Beſides the diurnal motion, according to Ptolemy, given it by the primum mobile, from eaſt to weſt round the poles of the equator, it has an oppoſite motion to this, from weſt to eaſt upon the poles of the ecliptic, called the ſecondary motion: by this the fixed ſtars advance, according to the order of the ſigns, about one degree in 70 or 72 years. More properly the firmament is that ſpace expanded above us in the heavens.

The word is Latin, *firmamentum*, and derived from *firmus*, ſure, or ſtedfaſt.

FIRMAN is a paſſport or permit granted by the Great Mogul to foreign veſſels, to trade within the territories of his juriſdiction.

FIRMNESS, *Firmitas*, denotes the conſiſtence of a body, or that ſtate wherein its ſenſible parts co-here in ſuch a manner, that the motion of one part induces a motion of the reſt.

FIRST-FRUITS, *Primitiæ*, among the Hebrews, were oblations of part of the fruit of the harveſt, offered to God as an acknowledgement of his ſovereign dominion. The firſt of theſe fruits was offered in the name of the whole nation, being either two loaves of bread, or a ſheaf of barley which was threſhed in the court of the temple. Every private perſon was alſo obliged to bring his firſt-fruits to the temple, and thoſe conſiſted of wheat, barley, grapes, figs, apricots, olives, and dates. They were carried in proceſſion by a company of twenty-four perſons, preceded by an ox, appointed for ſacrifice, his horns gilded, and crowned with olives.

FIRST FRUITS, in the church of England, are the profits of every ſpiritual benefice for the firſt year, according to the valuation thereof in the king's books. See the article ANNATES.

FIR-TREE, *Abies*, in botany, a genus of ever-green trees, whoſe leaves are ſingle, and for the moſt part produced on every ſide of the branches; the male flowers or catkins are placed at remote diſtances from the fruit on the ſame tree; the ſeeds are produced in cones, which are ſquamoſe.

The difference between theſe and the pines is, the latter having two or more leaves produced out of the ſheath or cover.

Theſe trees are all raiſed from ſeeds taken out of their polyſpermous cones. The way to get out the ſeeds is, either by expoſing the cones to a gentle fire, or by ſoaking them all night in water, which will cauſe their ſquamoſe cells to open, and readily emit their ſeeds. The former method is the beſt, provided they are not expoſed to too great heat. But this ought not to be done until you are ready to ſow them; which is beſt performed in the beginning of March.

Theſe plants ſhould be all raiſed in a nurſery, where they may be protected from the birds; otherwiſe they will be in danger of being deſtroyed, when they firſt come up: for as they bring up the huſk of the ſeed on the top of the plant, the birds in picking off the huſk will break off the plant, whereby a whole bed may be loſt in a few hours, if they are not carefully guarded from them.

The beſt time of ſowing theſe ſeeds is about the latter end of March, or the beginning of April, on a bed of light earth, covering the ſeeds about half an inch deep with the ſame ſort of earth. In this bed the plants ſhould remain until the following ſpring, when there ſhould be a number of beds prepared in the nurſery to receive theſe ſeedling plants; and the beginning of April they ſhould be tranſplanted into the beds, at the diſtance of ſix inches row from row, and at three inches aſunder in the rows. If the ſeaſon ſhould prove dry, it will be proper to water the plants every week once or twice, according to the warmth of the weather; and the beds ſhould be covered with mats, to ſcreen the plants from the ſun, and drying winds, until they have taken good root; after which time they will require no farther care, but to keep them clear from weeds. In theſe beds the plants may remain two years; at the end of which they ſhould be tranſplanted into an open ſpot of ground; for their roots will in that time meet quite over the beds.

The diſtance which theſe plants ſhould be placed in this nurſery, ſhould be four feet row from row, and two feet aſunder in the rows.

When the plants are planted, if the ſeaſon ſhould prove dry, they ſhould be watered, to ſettle the earth to their roots; and if this is repeated three or four times, if the ſeaſon ſhould continue dry, it will greatly promote their taking new root, and ſecure them from the injuries of the drying winds. In this nurſery the plants may remain two or three years, according to the growth they ſhall have made; and, during this time, the ground between the plants ſhould be conſtantly kept clean from weeds, and dug between the rows every ſpring; in doing of which, care muſt be taken not to cut or injure the roots of the plants: this is all the culture they will require during their continuance in the nurſery: and, when they are tranſplanted into the places where they are to remain, the neceſſary care to be taken is, in taking them up, not to injure or cut off their roots, and let them be as little time out of the ground as poſſible; and, when they are out, to guard their roots from the drying winds. The ſureſt time for removing of theſe trees is about the beginning of April; though they may, and often are removed with ſucceſs at Michaelmas, yet the ſpring is the more ſure ſeaſon, eſpecially in moiſt land.

Moſt of the kinds of firs may be removed at the height of ſix or ſeven feet; but thoſe of two feet high are much better, and will in a few years get the better of thoſe taller trees. *Miller's Gard. Dict.*

FISC, *Fiſcus*, in the civil law, the treaſury of a prince.

FISCAL, in the civil law, ſomething relating to the pecuniary intereſt of the prince or people.

FISH, in natural hiſtory, an animal which lives in the water, that being its natural element.

Willoughby, after Ariſtotle, has accurately diſtinguiſhed fiſhes into *cetaceous*, *cartilaginous*, and *ſpinous*.

The *cetaceous*, called alſo *bellua marinæ*, have lungs, and breathe like quadrupeds; they copulate alſo like them, and conceive and bring forth their young alive, which they afterwards ſuckle with their milk.

The *cartilaginous* ſort are thoſe produced from eggs like large birds; which are alſo excluded the womb like thoſe of birds.

The *ſpinous* kind are alſo oviparous; but their eggs are ſmaller, and they have ſpinæ up and down in their fleſh to ſtrengthen them.

The ſame author is likewiſe of opinion that it would be alſo proper to divide fiſhes into ſuch as breathe with lungs, and ſuch as breathe with gills; and then to ſubdivide thoſe that breathe with gills into viviparous and oviparous.

Naturaliſts remark that the ſtructure of fiſhes, and their confirmation to the element they reſide in, is very wonderful. Their bodies are cloathed and guarded in the beſt manner, with ſcales or ſhells, ſuitable to their reſpective circumſtances, the danger they are expoſed to, and the motion and buſineſs they are to perform. The center of gravity is placed in the propereſt part of the body for ſwimming; and their ſhape the beſt adapted to their making their way through the water, and moſt conformable to the rules of geometry. They have ſeveral parts peculiar to themſelves; as fins to balance and keep them upright, and an air-bladder to enable them to riſe or ſink at pleaſure. They have gills or branchiæ, whereby they reſpire, as animals do by the lungs. The tail is the inſtrument of progreſſive motion, and ſerves to row them forward. Their eyes are peculiarly formed to enable them to correſpond with all the conveniencies and divergencies of rays, which the variations of the watery medium, and refractions thereof, may occaſion; in which reſpect they bear a near reſemblance to birds.

FISH, among ſeamen, a machine for drawing up the flooks of the anchor to the davit. See the article DAVIT.

It is compoſed of four parts, viz. the hook, the pendant, the block, and the tackle.

The pendant is a piece of ſtrong rope paſſing through the block, hung over the end of the davit, which projects out from the forecaſtle to keep the anchor at a diſtance from the ſhip's ſide, that the flooks may not tear it as they are drawn up: at one end of the pendant is faſtened the hook, which is of ſufficient ſtrength and capacity to grapple the flooks under water, and ſuſtain their weight: at the other end of the pendant is fixed the tackle, which is a complication of pullies, to perform this operation.

FISHES *of the Maſt*, certain pieces of wood hollowed on one ſide, and convex on the other, faſtened ſecurely on the maſts of a ſhip to ſtrengthen them, either when it is apprehended there is a neceſſity for this additional ſupport to bear an extraordinary preſſure of ſail; or after they may have ſuſtained ſome damage from a former occaſion.

FISH-PONDS, thoſe made for the breeding or feeding of fiſh.

Fiſh-ponds are no ſmall improvement of watery and boggy lands, many of which are fit for no other uſe. In making of a pond, its head ſhould be at the loweſt part of the ground, that the trench of the flood-gate or ſluice, having a good fall, may not be too long in emptying. The beſt method of making the head ſecure, is to drive in two or three rows of ſtakes above ſix feet long, at about four feet diſtance from each other, the whole length of the pond-head, whereof the firſt row ſhould be rammed at leaſt about four feet deep. If the bottom is falſe, the foundation may be laid with quick-lime, which ſlacking, will make it as hard as a ſtone. Some lay a layer of lime, and another of earth dug out of the pond, among the piles and ſtakes; and when theſe are well covered, drive in others, as they ſee occaſion, ramming in the earth as before, till the pond-head be of the height deſigned.

The dam ſhould be made ſloping on each ſide, leaving a waſte to carry off the over-abundance of water in times of floods or rains; and as to the depth of the pond, the deepeſt part need not exceed ſix feet, riſing gradually in ſhoals towards the ſides, for the fiſh to ſun themſelves, and lay their ſpawn. Gravelly and ſandy bottoms, eſpecially the latter, are beſt for breeding; and a rich ſoil with a white fat water, as the waſhing of hills, commons, ſtreets, ſinks, &c. is beſt for fattening all ſorts of fiſh. For ſtoring a pond, carp is to be preferred for its goodneſs, quick growth, and great increaſe, as breeding five or ſix times a year. A pond of an acre, if it be a feeding and not breeding one, will every year feed two hundred carps of three years old, three hundred of two years old, and four hundred of a year old. Carps delight in ponds

that have marl or clay bottoms, with plenty of weeds and graſs, whereon they feed in hot months.

Your pond ſhould be drained every three or four years, and your fiſh ſorted. If it is a breeding one, the ſmaller ones are to be taken out to ſtore other ponds with, leaving a good ſtock of females, at leaſt eight or nine years old, as they never breed before that age. In feeding ponds it is beſt to keep them pretty near of a ſize.

FISHERY, a place where great numbers of fiſh are caught.

The principal fiſheries for ſalmon, herring, mackrel, pilchards, &c. are along the coaſts of England, Scotland, and Ireland; for cod, on the banks of Newfoundland; for whales, about Greenland; and for pearls, in the Eaſt and Weſt Indies.

FISHERY denotes alſo the commerce of fiſh, more particularly the catching them for ſale.

FISSURE, *Fiſſura*, a chap or crack, in ſurgery, is either natural or morbid: thus, the mouth, &c. is frequently called a natural fiſſure: morbid fiſſures are either thoſe of the cranium or other bones, or chaps of the ſkin, which ſometimes happen about the lips, anus, and other parts of the body.

The word is Latin, *fiſſura*, and derived from *findo*, to ſplit or cleave.

FISSURE, in philoſophy, is frequently applied to thoſe diviſions that are to be met with between layers of different kinds of earth or ſtone.

FISTULA, in ſurgery, a deep, narrow, and callous ulcer, generally ariſing from abſceſſes or ulcers.

The word is Latin, and literally ſignifies a pipe; this diſorder being ſo called from its reſemblance to a pipe or reed.

The ſeat of a fiſtula is always in the membrana adipoſa; nor have we any well vouched obſervations of fiſtulas penetrating what we properly call the ſubſtance of the muſcles. But if we conſider that pus, collected in the membrana celluloſa, and attenuated therein, may be lodged upon the muſcles, it is obvious that this pus muſt, by the action of theſe muſcles, be propelled through all the adjacent parts, and produce deep ſinuſes and fiſtulas of the worſt kind, eſpecially when it inſinuates into the inteſtines of the muſcles: the thicker, therefore, the membrana adipoſa is, or the more ſtrata of muſcles that lie in the ſuppurated part, the more miſchief the retained pus may do.

When there is an external aperture on the ſurface of the body, a ſinus or fiſtula may be eaſily diſcovered. Celſus informs us, that it is above all things highly expedient to introduce a probe into the fiſtula, to know its depth and its direction; whereby we may know whether it has penetrated to the bone or not; and whether the bone is carious or ſound. But the beſt method of diſcovering them is with a ſyringe to inject tepid water, which will eaſily inſinuate into all their windings.

But when ſinuſes are not yet opened, they are with greater difficulty diſcovered, eſpecially when deep ſeated. All the light we can then receive is from the ſymptoms of the preceding inflammation, and the nature of the ſubſequent ſuppuration; beſides, that no conſiderable ſuppuration can happen without being ſoon after accompanied with a ſlight hectic fever.

When fiſtulas, not yet become callous, are complicated with ulcers, and diſcovered either by the eye, the aſſiſtance of the probe, or any other means, the moſt expeditious method of relief is to make an inciſion to the very bottom, if it can be done without danger, after which they are to be deterged and conſolidated. But, becauſe patients are unwilling to ſubject themſelves to this operation, it is expedient previouſly to cleanſe them by ſome proper injection, or by means of lint covered with ſome digeſtive ointment. As the hardneſs of tents thruſt into fiſtulas, or perhaps their too great length, may produce a callous, or inflammation, or excite a commotion of the humours, or at leaſt protract the cure, I do not think the uſe of tents ſafe: Belloſte and Cæſar Magatus, both ſkilful ſurgeons, having, on this account, entirely rejected them; only in caſes where the conglutination of the mouth of narrow fiſtulas is to be prevented; and even then they ought to be very ſhort and ſoft. Belloſte abſolutely diſcards not only all tents but injections.

Another ſtep in the cure of fiſtulas is duly to preſs their bottoms towards their orifices or apertures: for this purpoſe, a narrow compreſs, or ſlip of plaſter in that form, is, after the ulcer is cleanſed, and proper medicines put into the fiſtula, to be applied to its bottom, and ſecured with lint, plaſters, and bandage. It is moſt expedient to apply the bandage firſt to the bottom of the fiſtula, or at leaſt make it tighteſt there, that the peccant matter may be propelled from the bottom to the mouth of the fiſtula, whereby the bottom will be conglutinated before the reſt of the fiſtula. This generally happens ſooner in fiſtulas of the arms or legs, than in thoſe of other parts, eſpecially if their bottoms lie towards the ſuperior and their mouths towards the inferior parts of the members.

When fiſtulas lie too deep to have their moſt remote cavities commodiouſly cleanſed, detergent medicines are to be injected to waſh out the ſordes; ſuch as decoctions of agrimony or birthwort, mixed with honey of roſes, or eſſence of myrrh and aloes; or, which Belloſte greatly commends, a decoction of the leaves of the walnut-tree, with an admixture of ſugar.

But, if the method of cure already directed ſhould prove inſufficient both for cleanſing and conglutinating fiſtulas, greater relief is generally obtained from manual operation, eſpecially when the fiſtulas are directed downwards, or too winding, or when their bottoms cannot be ſufficiently compreſſed: and, in theſe caſes, an inciſion is to be made from their mouths to their very bottoms.

Some grooved probe is, therefore, to be gently paſſed into the cavity of the fiſtula, and introducing a knife into the groove, as much of the ſkin and fleſh is to be cut, as is thought ſafe or ſufficient to anſwer the end; that not only the corrupted matter may be more expeditiouſly diſcharged, but medicines more commodiouſly applied.

If, upon making an inciſion into a fiſtula, a large quantity of blood ſhould be diſcharged, the wound is, in the firſt dreſſing, to be filled with dry lint, and duly dreſſed: then a digeſtive ointment, in conjunction with the Egyptian ointments, or red precipitate, is to be applied till the ulcer is ſufficiently deterged. The other meaſures to be taken are the ſame as in recent ulcers. *Heiſter's Surgery.*

FISTULA *in Ano*, in ſurgery, an abſceſs running upon or into the inteſtinum rectum; though an abſceſs in this part, when once ruptured, does generally, if neglected, grow callous in its cavity and edges, and becomes, at laſt, what is properly called a fiſtula.

That the anus is ſo often expoſed to this malady, in any criſis of the conſtitution, is chiefly aſcribed to the depending ſituation of the part; but what very much conduce to it likewiſe, are the great quantities of fat ſurrounding the rectum, and the preſſure the hæmorrhoidal veſſels are liable to, which, being ſuſtained upon very looſe membranes, will be leſs able to reſiſt any effort, that nature ſhall exert, to fling off a ſurcharge; and from one ſtep to another, that is, from inflammation to ſuppuration, lead on to the diſtemper we are treating of.

That the fat is the proper ſubject of abceſſes, may be learned from an inflammation of the ſkin affecting the membrana adipoſa, and producing matter there; in which caſe, a ſuppuration runs from cell to cell, and in a few days lays bare a great quantity of fleſh underneath, without affecting the fleſh itſelf: nay, I think it may be doubted, whether, in thoſe abſceſſes which are eſteemed ſuppurations of the muſcles, the inflammation and matter are not abſolutely firſt formed in this membrane, where it is inſinuated between the interſtices of their fibres.

The piles, which are little tumours formed about the verge of the anus, immediately within the membrana interna of the rectum, do ſometimes ſuppurate, and become the forerunners of a large abſceſs; alſo external injuries here, as in every other part of the body, may produce it; but, from whatever cauſe the abſceſs ariſes, the manner of operating upon it will be according to the nature and direction of its cavity.

If the ſurgeon has the firſt management of the abſceſs, and there appears an external inflammation upon one ſide of the buttock only; after having waited for the proper maturity, let him, with a knife, make an inciſion the whole

whole length of it; and, in all probability, even though the bladder be affected, the largeneſs of the wound, and the proper application of doſſils lightly preſſed in, will prevent the putrefaction of the inteſtine, and make the cavity fill up like impoſthumations of other parts.

If the ſinus is continued to the other buttock, almoſt ſurrounding the inteſtine, the whole courſe of it muſt be dilated in like manner; ſince, in ſuch ſpongy cavities, a generation of fleſh cannot be procured but by large openings; whence alſo, if the ſkin is very thin, lying looſe and flabby over the ſinus, it is abſolutely neceſſary to cut it quite away, or the patient will be apt to ſink under the diſcharge, which, in the circumſtance here deſcribed, is ſometimes exceſſive. By this method, which cannot be two much recommended, it is amazing how happy the event is likely to be; whereas, from neglecting it, and truſting only to a narrow opening, if the diſcharge does not deſtroy the patient, at leaſt the matter, by being confined, corrupts the gut, and, inſinuating itſelf about it, forms many other channels, which, running in various directions, often baffle an operator, and have been the cauſe of a fiſtula being ſo generally eſteemed very difficult of cure.

Here I have conſidered the impoſthumation as poſſeſſing a great part of the buttock; but it more frequently happens, that the matter points with a ſmall extent of inflamation on the ſkin, and the direction of the ſinus is even with the gut: in this caſe, having made a puncture, you may, with a probe, learn if it has penetrated into the inteſtine, paſſing your finger up it, and feeling the probe introduced through the wound into its cavity; though, for the moſt part, it may be known by a diſcharge of matter from the anus. When this is the ſtate of the fiſtula, there is no heſitation to be made, but, immediately putting one blade of the ſciſſars up the gut, and the other up the wound, ſnip the whole length of it. This proceſs is as adviſeable when the inteſtine is not perforated, if the ſinus is narrow, and runs upon or very near it; for, if the abſceſs be tented, which is the only way of dreſſing it, while the external orifice is ſmall, as I have here ſuppoſed, it will almoſt certainly grow callous; ſo that the ſureſt means of cure will be opening the gut, that proper applications may be laid to the bottom of the wound. However, it ſhould be well attended to, that ſome ſinuſes, pretty near the inteſtine, neither run into nor upon it, in which caſe they muſt be opened, according to the courſe of their penetration. There are abundance of inſtances, where the inteſtine is ſo much ulcerated as to give free iſſue to the matter of the abſceſs by the anus; but I believe there are none where there is not, by the thinneſs and diſcolouration of the ſkin, or an induration to be perceived through the ſkin, ſome mark of its direction; which, if diſcovered, may be opened into with a lancet, and then it becomes the ſame caſe as if the matter had fairly pointed.

If the ſinuſes into and about the gut are not complicated with an induration, and you can follow their courſe, the mere opening with ſciſſars, or a knife guided on a director, will ſometimes ſuffice; but it is generally ſafer to cut the piece of fleſh, ſurrounded by theſe inciſions, quite away, and, when it is callous it is abſolutely neceſſary, or the calloſities muſt be waſted afterwards by eſcharotic medicines, which is a tedious and cruel method of cure.

When the fiſtula is of long ſtanding, and we have a choice of time for opening it, a doſe of rhubarb the day before the operation will be very convenient, as it not only will empty the bowels, but alſo prove an aſtringent for a while, and prevent the miſchief of removing the dreſſings in order to go to ſtool.

It ſometimes happens that the orifices are ſo ſmall as not to admit the entrance of the ſciſſars, in which caſe ſponge tents muſt be employed for their dilation.

In performing theſe operations on the anus, I do not think, in general, any inſtrument ſo handy as the knife and ſciſſars: almoſt all the others which have been invented to facilitate the work, are not only difficult to manage, but more painful to the patient: however, in thoſe inſtances where the fiſtula is very narrow, and opens into the inteſtines, juſt within the verge of the anus, the ſyringotomy may be uſed with advantage: but, when the opening into the gut is high, it cannot be employed without giving great pain. I do not caution againſt cutting the whole length of the ſphincter, experience having ſhewn it may be done with little danger of an incontinence of excrement; and, in fact, the muſcle is ſo ſhort, that it muſt generally be done in dilatations of the inteſtine.

The worſt ſpecies of fiſtula, is that communicating with the urethra, and ſometimes, through the proſtrate glands, with the bladder itſelf. This generally takes its riſe from a former gonorrhœa, and appears externally firſt in peritonæo, and afterwards increaſing more towards the anus, and even ſometimes into the groin, burſts out in various orifices, through the ſkin, which ſoon become callous and rotten; and the urine paſſing partly through thoſe orifices, will often excite as much pain, and of the ſame kind, as a ſtone in the bladder.

This ſpecies of fiſtula, taking its uſe from ſtrictures of the urethra, is only manageable by the bougie: for, ſo long as the urethra is obſtructed, the cure of the fiſtula will be imperfect; but, if the canal is opened by this application, it is amazing what obſtinate indurations and foul ſinuſes will in conſequence diſappear; though there are ſome ſo callous and rotten, as to demand the knife and skilful dreſſings, notwithſtanding the urethra ſhould be dilated by the uſe of bougies. *Sharpe's Surgery.*

FISTULA LACHRYMALIS, a diſeaſe which attacks the great caruncle in the inward corner of the eye. See the article EYE.

The firſt degree of this diſeaſe ſtops up the natural paſſage of the tears, and forces them to run down the cheek; the ſecond is when pus is mixed with the tears, which proceeds ſometimes from an opening in the skin, between the noſe and the great corner of the eye; the laſt is when the pus has not only corroded the neighbouring parts, which are ſoft, but has affected the bone which lies underneath. This laſt ſort of fiſtula ſometimes turns cancerous, and Riverius adviſes not to meddle with it at all.

Whatever may be the cauſe of this diſorder, whether the ſmall-pox, or French diſeaſe, it always ſtops up the naſal conduit.

If the abſceſs is not open, a time muſt be choſen when it is fulleſt of pus. For this reaſon, the eye of the patient muſt be cloſed, and ſmall long pieces of plaſter muſt be put one upon another, acroſs the eye-lids, from the puncta lachrymalia to the great angle of the eye. The ſuperior branches of the canal being thus compreſſed, that nothing can paſs that way, it will be amaſſed in the ſack, and a place proper for an inciſion ſhould then be pointed out. If the abſceſs is already open, the orifice and the probe will ſhew where it is to be dilated, which muſt be done by the biſtoury, both above and below, from the ſuperior part of the ſack to the edge of the orbit. The ſack being opened, it muſt be filled with dry lint, which may be taken away next day, and a pledgit dipt in a mild digeſtive applied, which muſt be repeated once or twice a day, according to the quantity of ſuppuration: when the ſuppuration begins to diminiſh at every dreſſing, a ſmall probe muſt be introduced into the naſal canal, to dilate it a little, and to leave a paſſage for the tears and the pus.

This method muſt be continued till the ſuppuration is almoſt ended, then it may be dreſſed ſuperficially, with dry lint, or with a deſiccative, which will complete the cure: after which it will be proper to wear a compreſſing bandage a few weeks longer to prevent its return. When the bone lies open, and it is neceſſary to penetrate into it, you muſt direct the inſtrument towards the noſe, and not towards the naſal canal, for fear of entering the ſinus maxillaris.

FISTULAR, or FISTULOUS, appellations given by ſurgeons to wounds and ulcers, which degenerate into fiſtulas. See the article FISTULA.

FISTULAR, among botaniſts, is applied to leaves and flowers that are tubular, or reſemble a hollow pipe.

FIT, in medicine, denotes much the ſame with paroxyſm. See PAROXYSM.

FITS *of eaſy Reflection and Tranſmiſſion*, in optics. See the articles REFLECTION and TRANSMISSON.

FITCHEE, in heraldry, a term applied to a croſs, when the lower end of it is ſharpened into a point.

FITTING-OUT, in the ſea-language, the act of providing a ſhip with a ſufficient number of men to navigate her; alſo with proviſions of all ſorts, artillery, ammunition, maſts, yards, ſails, cordage, anchors, and other furniture: alſo the rigging and ſecuring her maſts againſt the dangers of the wind and ſea.

FIXATION, in chemiſtry, the rendering any volatile ſubſtance fixed, ſo as not to fly off upon being expoſed to a great heat; hence,

FIXED BODIES are thoſe which bear a conſiderable degree of heat without evaporating, or loſing any of their weight.

FLACCIDITY, among phyſicians, a diſorder of the ſolids, cured by aſtringent and cardiac medicines, joined with exerciſe and good air.

FLAG, in the ſea-language, the banners or colours by which an admiral is diſtinguiſhed at ſea.

FLAGS *in the Britiſh Navy*, are either red, white, or blue; and they are hoiſted either at the heads of the main-maſt, fore-maſt, or mizen-maſt.

Flags, when diſplayed from the top of the main-maſt, are the diſtinguiſhing marks of admirals; when from the fore-maſt of vice-admirals; and when from the mizen-maſt, of rear-admirals.

The higheſt flag in the Britiſh navy is the anchor and rope, which is only diſplayed when the lord-high admiral or lords commiſſioners of the admiralty are aboard; the next is the union, the diſtinction peculiar to the ſecond officer, called admiral of the fleet; and the loweſt flag is the blue at the mizen-maſt.

FLAGELLANTES, WHIPPERS, in church hiſtory, certain enthuſiaſts in the thirteenth century, who maintained that there was no remiſſion of ſins without flagellation, or whipping. Accordingly they walked in proceſſion, preceded by prieſts carrying the croſs, and publicly laſhed themſelves, till the blood dropped from their naked backs.

FLAGEOLET, or FLAJEOLET, a little flute, uſed chiefly by ſhepherds and country people. It is made of box, or other hard wood, and ſometimes of ivory, and has ſix holes beſides that at the bottom, the mouth-piece, and that behind the neck. See FLUTE.

FLAIL, an inſtrument for threſhing corn. See CORN and THRESHING.

FLAKE, among gardeners, a kind of ſtriped carnations, with only two colours.

FLAMBEAU, a kind of large taper, made of hempen wicks, by pouring melted wax on their top, and letting it run down to the bottom. This done, they lay them to dry; after which they roll them on a table, and join four of them together by means of red-hot iron; and then pour on more wax, till the flambeau is brought to the ſize required.

FLAME, *Flamma*, in phyſiology, the ſmall parts of an inflammable or conſiderably unctuous body, that are ſet on fire, or briſkly agitated and thrown off, with a certain vibrative motion at the ſurface of that body into the open air: or, in Sir Iſaac Newton's words, the flame of a body is only the ſmoke thereof heated red-hot; and the ſmoke is only the volatile part of the body ſeparated by the fire. See FIRE and SMOKE.

FLAMEN, in Roman antiquity, the name of an order of prieſts, inſtituted by Romulus or Numa; authors not being agreed on this head.

They were originally only three, viz. the flamen dialis, flamen martialis, and flamen quirinus. They were choſen by the people, and inſtalled by the ſovereign pontiff: afterwards, their number was increaſed to fifteen; the three firſt of whom were ſenators, and called flamines majores; the other twelve, taken from among the people, being denominated flamines minores.

The flamen dialis, or prieſt of Jupiter, was a conſiderable perſon at Rome; the flamen martialis, or prieſt of Mars, was the ſecond in dignity; and the flamen quirinalis, was the next to him.

The greater flamens wore the robe edged with purple, like that of the greater magiſtrates, had an ivory-chain, and ſat in the ſenate. They wore a little band of thread, filamen, about their head; from whence, according to Varro, they had their name.

FLANCH, FLANQUE, or FLASQUE, in heraldry, an ordinary always borne double, being the ſegment of a circular ſuperficies.

FLANDERS, a province of the Netherlands, bounded by the German ſea and the United Provinces, on the north; by the province of Brabant, on the eaſt; by Hainault and Artois, on the ſouth; and by another part of Artois and the German ſea, on the weſt; being about ſixty miles long, and fifty broad, and divided between the Auſtrians, the French, and the Dutch.

Flanders is a perfectly champaign country, with not a riſing ground or hill in it, and watered with many fine rivers and canals. Its chief commodities are fine lace, linen, and tapeſtry.

FLANNEL, or FLANEL, a looſe ſort of woollen ſtuff not croſſed, and wove on a loom with two treddles, like bays.

FLANK, in the menage, the ſide of a horſe between the ribs and haunches.

FLANKS *of an Army*, are the troops encamped on the right and left, as the flanks of a battalion are the files on the right and left.

FLANK *of a Baſtion*, in fortification, that part which joins the face to the curtain. See the article BASTION.

Oblique FLANK, or *Second* FLANK, that part of the curtain from whence the face of the oppoſite baſtion may be diſcovered.

Retired FLANK, or *Low* FLANK, or *Covered* FLANK, one of the platforms of the cazemate. See the article CAZEMATE.

Theſe retired flanks are a great defence to the oppoſite baſtion, and to the paſſage of the moat, becauſe the beſiegers cannot ſee nor eaſily diſmount their guns. The curtain is eſteemed the ſtrongeſt part of a fortification, becauſe flanked at both ends; and the face is accounted the weakeſt, as having only one defence from the oppoſite flank.

FLANKED ANGLE, in fortification, that formed by the two faces of a baſtion.

FLANKING ANGLE, or *Angle of the* TENAILLE, that compoſed of the two lines of defence, and pointing towards the curtain. See the article TENAILLE.

FLANKING *Line of Defence*. See the article LINE *of Defence*.

FLATS, in muſic, a kind of additional notes, which, together with ſharps, ſerve to remedy the defects of muſical inſtruments, wherein temperament is required. See TEMPERAMENT and SHARP.

FLATULENCY, in medicine, a diſorder of the bowels ariſing from a weak ſtomach, and crude flatulent aliment, as peaſe, beans, lentils, coleworts, hard fat fleſh, &c. which degenerate into wind, creating great anxiety if not evacuated, and difficulty of breathing.

Another cauſe of flatulencies are congeſtions of blood in the branches of the vena porta; whence proceed anxieties of the præcordia, difficult breathing, colic pains, heart-burn, head-achs, vertigo, and watchfulneſs.

If the flatulency ariſes from crudities in the ſtomach, evacuations are firſt of all neceſſary; after which may be given bitters, aromatics, carminatives, and ſtrengtheners, with a ſpare diet and exerciſe. If it proceeds from congeſtions of blood, as is the caſe of hypochondriacs, a vein muſt be opened; and if the body is coſtive, an emollient clyſter or a gentle laxative will be proper. If theſe fail, chalybeate medicines are to be called in, as tincture of vitriol of iron, ſteel-filings finely powdered, from ſix to ten grains, or oil of cinnamon with ſugar or bitters, ſpaw-waters, and conſtant exerciſe.

FLAX, *Linum*, in botany, a plant from which linen is manufactured.

There are ſeveral ſpecies of this plant, which are preſerved in ſome curious gardens of plants for variety ſake; but, as they are of little uſe or beauty, it would be needleſs to expatiate on them in this place.

The linum ſativum, or manured flax, is that which is cultivated for uſe in divers parts of Europe, and is reckoned an excellent commodity: the right tilling and ordering of which is eſteemed a good piece of huſbandry.

This ſhould be cultivated upon a rich ſoil that has not been ploughed for ſeveral years, upon which flax always makes the beſt improvement: but, as it draws greatly from the ſoil, it ſhould not be ſown two years together

upon the ſame ground. The land muſt be well ploughed, laid flat and even, upon which the ſeeds ſhould be ſown about the middle of March, when the weather is mild and warm. During the ſpring, you muſt carefully weed it; which if neglected, eſpecially in a moiſt ſeaſon, the weeds will over-grow and deſtroy the crop. There are ſome perſons who recommend the feeding of ſheep with flax, when it is a good height; and ſay, they will eat away the weeds and graſs, and do the flax good; and if they ſhould lie in it, and beat it down, or flatten it, the next rain that falls it will riſe again: but this muſt not be practiſed but in a moiſt ſeaſon, and upon a rich ſoil; for if the ground be poor, or the ſpring dry, it will not riſe again to any conſiderable height.

The beſt ſeed is that which comes from the Eaſt country, and is known by the name of Riga flax; for if the Engliſh ſeed be ſown three or four times, it is very apt to degenerate. If the ſeed be good, two buſhels will be enough to ſow an acre; but if it be but middling, there ſhould be a greater allowance. Towards the latter end of Auguſt the flax will begin to ripen, when you muſt be careful that it grow not over ripe; therefore you muſt pull it up as ſoon as the heads begin to change brown, and hang downwards, otherwiſe the ſeeds will ſoon ſcatter, and be loſt; ſo that the pluckers muſt be nimble, and tie it up in handfuls, ſetting them upright till they be perfectly dry, and then houſe them. If the flax be pulled when it firſt begins to flower, it will be whiter and ſtronger than if it ſtand till the ſeed is ripe; but then the ſeed will be loſt.

This is a plant of the greateſt uſe in ſeveral of the moſt eſſential parts of life: from the ſeeds an expreſſed oil is drawn, which is of great uſe in medicine, painting, &c. from the bark of the ſtalks is made linen, and from the rags of linen is made paper: ſo that this plant may be eſteemed as one of the moſt valuable and neceſſary in many of the principal conveniencies of life. *Miller's Gard. Dict.*

This plant has a more oily taſte than mallow, and is the chief of the emollient tribe. The ſeeds afford an excellent medicine, ſince from them is expreſſed an oil, which is anodyne, demulcent, and extremely adapted to all manner of aſperities; it relaxes, and diſſolves acridities, whence it is of extraordinary ſervice in the moſt deſperate cholics. The ſtiff and rigid limbs, being anointed with this oil, are relaxed and rendered flexible. This oil, when freſh drawn, and taken at the mouth, is very good in a pleuriſy, and a cough, to help expectoration; and, injected in clyſters, is very proper in the hæmorrhoids, and indurated fæces, whence proceeds the cholic; mixed with ſealed and japan earth, it is a great arcanum in the dyſentery: an emulſion of the ſeeds is of ſervice in the pleuriſy and peripneumony; the oil is a very good remedy againſt the ſtone: the ſeeds reduced to a meal, and boiled and prepared in the form of a cataplaſm, are applied to tumors and abſceſſes, in order to mollify and ripen them. The ſeed, boiled in water, makes a mild oily decoction, preſcribed to be drank as an anodyne in inflammations of the ſmall inteſtines, the diarrhœa, the dyſentery, nephritic pains, and retention of urine. The oil, boiled with honey, clears the face and ſkin of ſpots, and all cutaneous blemiſhes. The leaves are emollient, and the ſmell of the flowers is not poiſonous, as ſome authors have written. To cloſe all, we ſhall obſerve, that whereas cotton can never be uſed about wounds, on account of its denticulated parts, which diſpoſe to inflammations; linen, the manufactured produce of this plant, is, by its extraordinary ſoftneſs, ſmoothneſs, and flexibility, of all other things, the beſt adapted to ſuch purpoſes. *Hiſt. Plant. aſcript. Boerhaave.*

As it is agreed that the lighteſt loams and the thickeſt crop afford the fineſt flax, it may be of uſe to let the farmer know how he may ſave ſuch crops from lodging, as they generally do. The method is a little expenſive; but if it anſwers, it will quit coſt very well. When the flax is in the ground, divide your field into equal ſquares, the ſides of which may be four or five feet long; and at each angle thruſt a forked ſtick ſteady in the ground. When your flax is ſome inches high, lay from ſtick to ſtick a light croſs pole; and this will ſupport the flax, and hinder it from lodging. Some uſe ropes inſtead of poles; but they yield too much, and anſwer but imperfectly.

High winds are ſo common in this country, that there is reaſon to apprehend, that the Dutch method of laying flax looſe upon the ground would be attended with conſiderable inconveniency. The following method is much ſafer: tie gently each handful as cloſe as may be to the heads; and then, ſpreading out the ends, ſet it upright on the ground. Three or four of theſe, together, make one ſtook; and into ſuch ſmall ſtooks divide all the flax you have. They dry ſoon, becauſe the wind has free acceſs to the ſtalks, as the ſun has to the heads, and the rain cannot lodge in any quantity upon them.

Rippling comes next. Two men may work at every inſtrument, by fixing it on a bench, that one may ſit at either end. Let them take ſmall handfuls at a time, and draw the flax through the ripple without violence. Two women to each bench are neceſſary to hand the flax in bundles to the ripplers, to receive it from them again, to ſort it according to their ſeveral degrees of length, ſtrength, ripeneſs, and fineneſs, and to tie it looſely in little ſheaves.

After rippling, the ſeed muſt be carried to the granary, and the flax laid down to water. If poſſible, diſpoſe of the whole into your ponds together. The ſummer, which draws haſtily towards an end, is your fitteſt ſeaſon, and ſhould be huſbanded with care: however, let nothing tempt you to uſe bog-holes and running waters. It is better to delay to the next ſeaſon, than diſcolour or damage all your flax.

Cover your flax, to keep it down, with your ſlutch or mire at the bottom of your ponds, or, till that be gathered in ſufficient quantities, with clay, ruſhes, fern, or timber. From four to twelve or thirteen days is the time requiſite for watering. After the fourth, examine your flax daily, and be particularly careful not to let it lie too long. It is a miſtake, on the ſafer ſide, to draw it off the ſooneſt.

In graſſing, the ſhorteſt graſs ſhould be preferred. Dry ſand-banks do well. On either the flax muſt be turned every ſecond day, and generally lies from a fortnight to three weeks.

To dry your flax, heat your oven thoroughly; then let it cool, till a man can ſtand in it without uneaſineſs; fill it over night, and your flax will be ready for the break next morning. The dirt and ſtraws ſcutched out of the flax, in one day, will heat the oven for the next.

When you break your flax, take ſheaf by ſheaf out of the oven, as you uſe it: it comes criſp under the engine, works the better and more eaſily. It is an error to lay the flax, as we do, as far as may be from the joint. The nearer it is placed to the center of motion in the break, the more readily it ſplits, and the leſs damage it receives.

In ſcutching, chuſe the broad round ſcutch: the ſquare and narrow one, in uſe among us, cuts and deſtroys the flax.

By the time the flax is ſcutched, and about the middle of October, it will be time to threſh the ſeed.

This may be done by driving horſes backwards and forwards on the bows, or by drawing over them a heavy rolling-ſtone upon a ſmooth hard floor.

Cleaning it requires more nicety. To do it thoroughly, it muſt firſt go through the winnow, which ſeparates it from the bows; through the riddle next, to take out ſtraws, ſtones, and larger dirt; then ſucceſſively through two different ſieves; the firſt bored with oval holes, to let through the ſeed and nothing elſe of greater bulk; the ſecond cloſer, to retain the ſeed, and afford a paſſage to all ſmaller bodies; and laſtly, through the ſcreen or wire-harp, which frees it from all duſt. When the flax-dreſſer has thus cleaned his ſeed, he ſhould return to his flax, and put it through the fining-mills. The wheel in theſe turns alternately from right to left, and from left to right, twice each way; and, according to the number of theſe double turns, the flax comes out the finer, the ſmoother, and the ſofter. Fourſcore ſuch turns is the moſt that any flax requires, and probably as much as it will bear.

N B. For want of theſe fining-mills in Scotland, beating of flax is directed.

In hackling, women and children ſhould be employed from choice. They work with greater gentleneſs than men; and care and tenderneſs are the main excellencies

in

in this buſineſs. For the beſt flax, four ſets of hackles will be requiſite, each of them of a different fineneſs: through theſe it may be drawn ſucceſſively, and every time with proportionable caution. The laſt, whoſe teeth is like the fineſt needles, requires the utmoſt ſkill, and ſhould be truſted with few hands.

FLEA, *Pulex*, in zoology, a genus of inſects without wings, of a roundiſh, compreſſed figure: the legs are three pair, and formed for leaping; the eyes are two, and ſimple; the mouth is bent downwards: the colour is a deep purple, approaching to black.

FLEA-BITTEN, that colour of a horſe, which is white or grey, ſpotted all over with dark reddiſh ſpots. See HORSE.

FLEAM, in ſurgery and farriery, an inſtrument for letting a man or horſe blood.

FLEECE, the covering of wool, ſhorn off the bodies of ſheep. See WOOL.

Order of the Golden FLEECE, an order of knighthood inſtituted by Philip II. duke of Burgundy. Theſe knights were at firſt twenty-four, beſides the duke himſelf, who reſerved the nomination of ſix more; but Charles V. increaſed them to fifty. He gave the guardianſhip of this order to his ſon Philip, king of Spain, ſince which the Spaniſh monarchs are chiefs of this order. The knights had three different mantles ordained them; at the grand ſolemnity, the collar and fleece.

FLEET, in naval affairs, a company of ſhips of war, or merchantmen, or both, bound on any particular expedition or voyage.

As the ſecurity, wealth, and glory of theſe kingdoms principally depend on the reſolution and ſkill with which our fleets are conducted, it may be thought neceſſary to give our readers, who are unacquainted with this ſubject, a clearer idea of the operations of fleets and ſquadrons than they may have formed before; this we more chearfully attempt, as it ſeems to have been wholly neglected hitherto in works of this kind.

The principal article to be conſidered in a fleet at ſea is order, by which is meant the different methods of ranging or drawing it up in the ſeveral lines and forms for which it may be deſigned: in which two things are to be conſidered; firſt, the poſition of each ſhip with regard to the wind; ſecond, the poſition of each ſhip with reſpect to the fleet. We cannot make any alteration in either of the circumſtances without changing the whole poſition of the line, which will otherwiſe remain complete. See the article LINE.

When a fleet engages, it ought to be drawn up in a different form from that in which it ſails. A fleet that ſails in ſight of an enemy muſt alter its poſition from that it would maintain, were there none in view, or none to be expected. When a fleet ſails before the wind, it has likewiſe its particular form of ſailing, as it has alſo when it chaces an enemy, makes a retreat, guards a ſtreight or paſſage, or is obliged to force through one; or whether at anchor in a road or harbour, or going into either, to inſult or attack an enemy. In this variety of circumſtances proper regard muſt be had to the moſt advantageous poſition or form the fleet can be ranged in, before it enters upon action.

There are three things to be conſidered before we can judge of the good form or diſpoſition of a fleet. 1. If that form puts it into the beſt diſpoſition of executing the admiral's deſign; ſuch as the moſt expeditious as well as moſt commodious order of ſailing on any enterprize, &c. or if when obliged to retreat, ſuch arrangement ſecures it beſt from the attacks or purſuit of an enemy. 2. If that order cloſes the fleet more or leſs; becauſe the cloſer the ſhips are, they are the leſs liable to be ſeparated; the ſeveral commanders can better aid and aſſiſt each other upon any occaſion, and have the eaſier communication with their reſpective admirals and commanding officers. 3. If from this order the line of battle may be eaſieſt formed; becauſe all orders muſt tend principally to that, as the only one to engage to advantage. See EVOLUTION.

In a naval engagement, as we ſhall fully explain in that article, the ſhips are drawn up in a line of battle in two columns parallel to each other, cloſe upon a wind. See CLOSE-HAULED.

There are ſeveral advantages which reſult from being to windward, as 1. The fleet to windward can edge down on the enemy, when and as near as ſhall be judged convenient; conſequently regulates the time and diſtance moſt advantageous to come to action. 2. If the fleet to windward is more in number, it may eaſily detach ſome ſhips to ſend after the rear of the enemy, which muſt undoubtedly throw them into confuſion. 3. If any of the ſhips of the fleet to leeward ſhould be diſabled, whether in the van or rear, or even in the centre; the fleet to windward may with the greater eaſe ſend down their fire-ſhips upon them, or ſend a detachment after any part of the flying enemy. 4. We muſt alſo attribute amidſt other advantages of being to windward, that of being ſooner freed from the inconvenience of the ſmoke of the enemy, as well as of our own; for the wind repelling the ſmoke of the cannon back again into the ſhip, ſo greatly incommodes thoſe who are quartered at the guns as to deprive them totally for ſome time of the ſight of the enemy.

On the other hand the advantages of being to lee-ward are likewiſe conſiderable, inſomuch that there are who maintain they are at leaſt equal to thoſe of being to windward; but if all circumſtances are duly conſidered, they will certainly find the advantages of being to windward the greateſt a fleet can poſſibly have, whether ſuperior or inferior to the enemy; though we muſt allow that on ſome occaſions, as when the wind blows hard, it may be more adviſeable to get to leeward, if we can, eſpecially if the ſea runs ſo high that the weather, or windward fleet, cannot open its loweſt tier, when obliged to engage a greater number of ſhips, or in an action between two ſingle ſhips.

1. The fleet to leeward fire to windward, and conſequently the ſhips may make uſe of their lower tier of guns, without being under apprehenſion that any ſudden ſquall of wind ſhould over-power them by the water ruſhing in irreſiſtably between decks; an advantage which the Engliſh fleet, under ſir Edward Hawke, had in ſome meaſure over the French fleet, commanded by monſ. Conflans, in that memorable action off Belliſle, Nov. 20, 1759, where they fatally experienced our ſuperior ſkill, reſolution, and ſeamanſhip. This circumſtance is certainly the greateſt advantage a fleet to leeward can have; for it is difficult to conceive the confuſion and terror which ſudden guſts of wind occaſion amongſt the men between decks, when the waves pour in and lay the ſhip on her broadſide, ſo as often to endanger her overturning, or ſinking before the ports can be ſecured.

2. The fleet to leeward may eaſier cover any of their ſhips which are diſabled in action, which the fleet to windward cannot effect without great difficulty, and even the riſk of being deſtroyed in the attempt.

3. The fleet to leeward may more eaſily make a retreat if defeated, whereas the fleet to windward cannot ſo well eſcape, without being reduced to the neceſſity of forcing its way through the enemy's line, which muſt be attended with the moſt fatal conſequences.

When a fleet is obliged to retreat in ſight of an enemy, the beſt way to ſecure its retreat will be by ſailing in a ſort of half moon, the admiral being in the center, the fleet divided and ranged in order, one half on the ſtarboard, and the other half ſtretching out on the larboard ſide, and keeping the fireſhips, tranſports, &c. in the middle. This manner of ranging a fleet ſeems the moſt adviſeable, becauſe the enemy can never approach thoſe that endeavour to eſcape, without expoſing themſelves at the ſame time to the fire of the ſhips to windward. If the admiral thinks this form gives too great an extent to his fleet, he may eaſily cloſe his wings or quarters, and make the half-moon more complete; in the midſt of which he may place his convoy in ſafety.

The moſt natural courſe, however, in this form of ſailing, is to ſteer away before the wind: but if neceſſary, the ſhips may bear away large on either tack, or even may keep cloſe upon a wind.

In chacing a fleet that endeavours to eſcape, the beſt cruiſers are detached after them, in order to pick up the ſtragglers or force them to action: the body of the victorious fleet ſhould keep the ſame order or line with the enemy, as nigh as poſſible, to be ready for action if neceſſary. This however is only to be underſtood when the fleet that is chaced may not be ſo inferior to the other,

but that it may hazard an action; for if the one bears no proportion to the other, they muſt bear down upon them in the ſame manner as a conquering army aſhore carries all before it when it has forced an enemy's camp: otherwiſe, were the conquerors to wait drawing up in form, the enemy would undoubtedly take the advantage of ſuch an opportunity to make their eſcape.

In order to protect the entrance of a ſtreight or paſſage in the moſt effectual manner, there ſhould be a fleet nearly double in number to that which would force its way through; there muſt then be two diviſions made, the one to keep one ſide while the other is ranged along the other, that when the enemy preſents themſelves at the entrance, the weathermoſt ſquadron may crowd all the ſail it can before the wind upon them, at the ſame time that the leeward ſquadron keeps its wind to intercept them: ſo that in this manner it will be impoſſible for the enemy to eſcape by any manœuvre it may attempt. The eſſential point of the commanding officer who attempts to force a paſſage, is to avail himſelf of the reigning winds which may beſt favour his deſigns, and poſſibly it would be moſt expedient to range his ſquadron in the form of a retreat, by cloſing the wings or quarters a little, to give them the leſs extent; in this the ſquadron can never be attacked without being able to defend itſelf from all quarters to greater advantage than in the former poſition.

When a fleet comes to an anchor, there are five circumſtances to be conſidered: 1. That the ground be good and holding. 2. That the place be well ſheltered againſt the reigning winds which blow on that coaſt. 3. That the ſhips may eaſily get under ſail with the ſame wind that may ſerve an enemy, and at the ſame time be able to diſpute the advantage of the wind with them. 4. That they may readily form the line as ſoon as they get under ſail. 5. That the ſhips may have room to keep clear of each other in getting under way, in order to which they ſhould be regularly anchored in one or many lines, about three cables length aſunder, and one hundred and twenty fathoms between each ſhip.

When a fleet is under a neceſſity of continuing at ſea in bad weather, it ſhould form itſelf into three columns, leaving a great interval between each ſhip, without at the ſame time widening the diſtance between the columns; ſo that it may be in this manner leſs liable to be ſeparated, and the ſhips in leſs danger of falling aboard each other.

If the ſhips have a good offing and ſea-room enough to drive, they will lie to under their courſes; which will ſubject them to labour leſs, and not ſtrain ſo much on their maſts, rigging, &c. but if they ſhould not have drift enough, they muſt lie to under their main-ſails, or mizens only, which will ſtill keep them much eaſier than if they were under no ſail at all.

Laſtly, if a fleet deſigns to force into an harbour, wind, weather, &c. permitting, ſome ſhips ſhould be ordered to divert the out-forts, by coming to an anchor and placing themſelves in ſuch a manner as to bring their broadſides to bear upon them: when that is accompliſhed, the briſk and continued fire of a ſhip will greatly diſtreſs the enemy; but more eſpecially againſt ſtone-works, which fly about and do great execution, whilſt the main body of the fleet puſhes into harbour.

FLEETING, among ſailors, changing the ſituation of a tackle, when the blocks or pullies are drawn together: the uſe of fleeting is to ſeparate the powers which produce any great effort, that the force may be increaſed, which is deſtroyed by their meeting.

FLEMISH, or the FLEMISH-TONGUE, is that which we otherwiſe call Low Dutch, to diſtinguiſh it from the German, of which it is a corruption, and a kind of dialect. See GERMAN.

It differs from the Walloon, which is a corruption of the French language. The Flemiſh is uſed through all the provinces of the Netherlands.

FLEMISH BRICKS, a neat, ſtrong, yellow kind of bricks, brought from Flanders, and commonly uſed in paving yards, ſtables, &c. being preferable for ſuch purpoſes to the common bricks. See BRICK.

FLESH, *Caro*, in anatomy, a ſimilar fibrous part of an animal body, ſoft and bloody, being that of which moſt of the other parts are compoſed, and whereby they are connected together; or more properly, it is ſuch parts of the body where the blood-veſſels are ſo ſmall, as only to retain blood enough to preſerve their colour red.

FLESH, among botaniſts, is all the ſubſtance of any fruit that is between the outer rind and the ſtone; or that part of any root that is fit to be eaten.

FLESH-COLOUR. See CARNATION.

FLEUR DE LISE, in heraldry, the ſame with flory. See the article FLORY.

FLEXIBLE, in phyſics, a term applied to bodies capable of being bent or diverted from their natural figure or direction.

FLEXION, in anatomy, is applied to the motion by which the arm or any other member of the body is bent. It is alſo applied to the muſcles, nerves, &c.

FLEXOR, in anatomy, a name applied to ſeveral muſcles, which are ſo called from their office, which is to bend the part to which they belong, in oppoſition to the extenſors, which open or ſtretch them, as 1. Flexors of the head, which are the maſtoidæus, the rectus major anticus, and the rectus minor anticus. 2. Flexors of the neck, viz. the ſcalenus and longus. 3. Flexors of the back and loins, the quadratus lumborum, the pſoas parvus, the intertranſverſales lumborum. 4. Flexors of the cubitus, the brachiæus externus, and brachiæus internus. 5. Flexors of the carpus, the radiæus internus, the ulnaris internus, and the palmaris. 6. Flexors of the firſt, ſecond, and third phalanx of the fingers, viz. the four lumbricales, the ſublimis or perforatus, and the perforans or profundus. 7. Flexors of the thigh, called alſo elevators, the pſoas magnus, the iliacus, and the pectinæus, called alſo lividus. 8. Flexors of the tibia, the gracilis, the ſemimembranoſus, the ſeminervoſus, the biceps, and the poplitæus. 9. Flexors of the tarſus or foot, the tibialis anticus, and the peronæus anticus. 10. Flexors of the phalanges of the toes, the lumbricales, the perforatus, the perforans, and the flexor longus of the great toe, whoſe origin is in the poſterior part of the fibula, and its termination in the lower part of the laſt phalanx, together with the flexor brevis, the origin of which is from the middle os cuneiforme, and its termination at the two ſeſamoide bones of the great toe, which are joined by ligaments to its firſt phalanx. See the articles MASTOIDÆUS, RECTUS, SCALENUS BRACHIÆUS, &c. &c.

FLINT, *Silex*, in natural hiſtory, a ſemipellucid ſtone, compoſed of cryſtal debaſed with earth, of one uniform ſubſtance, and free from veins; but of different degrees of colour, according to the quantity of earth it contains, and naturally ſurrounded with a whitiſh cruſt.

Flint is a ſtone of an extremely fine, compact, and firm texture, and very various, both in ſize and figure. It is of all the degrees of grey, from nearly quite black to almoſt quite white. It breaks with a fine, even, gloſſy ſurface; and is moderately tranſparent, very hard, and capable of a fine poliſh. It readily ſtrikes fire with ſteel, and makes not the leaſt effervеſcence with aquafortis, and burns to a whiteneſs. Its uſes in glaſs-making, &c. are too well known to need a particular recital.

It is not uncommon to find on our ſhores fine, pellucid, flinty bodies, ſtreaked or veined with white, black, brown, &c. Theſe are the agates of this country, and anſwer in every particular, but fineneſs, to the gem. See the article AGAT.

The manner of preparing flints for the nicer operations in the glaſs-trade, is this: after freeing them from the white cruſts with which they are commonly ſurrounded, calcine them in a ſtrong fire; then powdering them in an iron mortar, ſift the powder through a very fine ſieve: pour upon this powder ſome weak aquafortis, to diſſolve any particles of iron it may have got from the mortar; then, after ſtanding ſome time, waſh it well with hot water, and dry it for uſe.

Oil of FLINTS, a name given to the liquor obtained from a mixture of four ounces of calcined and powdered flints, with twelve ounces of ſalt of tartar: this being melted together in a ſtrong fire, runs into glaſs; which is to be powdered and ſet in a cellar, where it runs into an oil per deliquium.

FLOAT *of a Fiſhing-Line*, the cork or quill that floats or ſwims above water. See the article FISHING.

FLOAT alſo ſignifies a certain quantity of timber bound together

together with rafters, athwart, and put into a river to be conveyed down the ſtream; and even ſometimes to carry burdens down a river.

FLOAT-BOARDS, thoſe boards fixed to water-wheels of under-ſhot mills, ſerving to receive the impulſe of the ſtream, whereby the wheel is carried round. See the article WHEEL and MILL.

It is no advantage to have too great a number of float-boards, becauſe, when they are all ſtruck by the water in the beſt manner that it can be brought to come againſt them, the ſum of all the impulſes will be but equal to the impulſe made againſt one float-board at right angles, by all the water coming out of the penſtock through the opening, ſo as to take place on the float-board. The beſt rule in this caſe is to have juſt ſo many, that each of them may come out of the water as ſoon as poſſible, after it has received and acted with its full impulſe. As to the length of the float-board, it may be regulated according to the breadth of the ſtream. See the article MILL.

FLOATAGES, all things floating on the top of the ſea or any water: a word much uſed in the commiſſions of water-bailiffs.

FLOATINGS, in huſbandry, the drowning or watering of meadows.

FLOATING *of Cheeſe*, among houſewives, ſeparating the whey from the curd. See CHEESE.

FLOOD, a deluge or inundation of waters. See the article DELUGE.

FLOOKING, among miners, a term uſed to expreſs a peculiarity in the load of a mine. The load or quantity of ore is frequently intercepted in its courſe by the croſſing of a vein of earth or ſtone, or ſome different metallic ſubſtance; as in which caſe the load is moved to one ſide, and this tranſient part of the land is called a flooking.

FLOOR, in architecture, the under ſide of a room, or that part we walk on.

Floors are of ſeveral ſorts, ſome of earth, ſome of brick, ſome of ſtone, and ſome of wood.

Earthen floors are commonly made of loam, and ſometimes, when they are deſigned to make malt on, of lime and brook-ſand, and gun-duſt, or anvil-duſt, from the forge.

The manner of making theſe floors for plain country inhabitants, is as follows.—Take two thirds of lime, and one of coal-aſhes well ſifted, with a ſmall quantity of loamy clay; mix the whole together, and temper it well with water, making it up into a heap: let it lie a week or ten days; then temper it well over again: after which heap it up for three or four days, and repeat the tempering very high, till it become ſmooth, yielding, tough and glewy. Then the ground being levelled, lay your floor therewith, about two and a half or three inches thick, making it ſmooth with a trowel: the hotter the ſeaſon is, the better; and when it is thoroughly dried, it will make the beſt floor for houſes, eſpecially for malt-houſes.

If any one would chooſe to have their floors look better, let them take lime made of rag-ſtones, well tempered with whites of eggs, covering the floor about a quarter or half an inch thick with it, before the under-flooring be too dry. If this is well done, and thoroughly dried, it will look, when rubbed with a little oil, as tranſparent as metal or glaſs.

For brick and ſtone floors, ſee the article PAVING.

Carpenters, by the word floor, underſtand as well the framed work of timber, as the boarding over it.

Concerning boarded floors, it is to be obſerved, that the carpenters never floor rooms with boards, till the carcaſe of the houſe is ſet up, and alſo is incloſed with walls, leſt the weather ſhould wrong the flooring; yet they generally rough-plane the boards for flooring, before they begin any thing elſe about the building, that they may ſet them by to ſeaſon; which is done by laying them flat upon three or four balks, each board about the breadth of a board aſunder, the whole length of the balks: then, by laying another lay of boards athwart the laſt, and ſo on till they have laid them all in this manner, by which means they lie hollow for the air to play between them.

The beſt way of placing the principal timbers in a floor, is not to lay them over doors or windows, nor too near chimnies: the boards ſhould all lie one way, which is generally the way that you have the beſt viſto.

FLOOR, in ſhip-building, the bottom of a ſhip, or all that part on each ſide of the keel, which approaches nearer to an horizontal than a perpendicular ſituation; whence it is common to ſay, a ſharp floor, a flat floor, a long floor, &c. whence

FLOOR-TIMBERS, are thoſe which are placed immediately acroſs the keel, upon which the bottom of the ſhip is framed, and the upper-parts of the timbers are conſtructed. See TIMBER.

FLORAL, in general, ſomething belonging to a flower. See FLOWER.

Thus floral leaves are thoſe found only near flowers.

FLORAL GAMES, in Roman antiquity, annual games inſtituted in honour of the goddeſs Flora, which began to be celebrated on the fourth of the calends of May, or the twenty-eighth of April, and were continued to the calends, or firſt of May.

The floralia, or floral games, were celebrated in the Campus Martius, being firſt proclaimed by ſound of trumpet; and during the celebration, the ædiles ſcattered all manner of pulſe among the people. It is alſo ſaid, that during the floralia, harlots danced naked, playing a thouſand laſcivious tricks. They were firſt inſtituted in the 513th year of Rome.

FLORID STYLE is that too much inriched with figures and flowers of rhetoric.

FLORIDA, in geography, a name firſt given by the Spaniards to all that part of North America which lies north of the gulph of Mexico. However, all that retains the name Florida, at preſent, is the Peninſula between the colony of Georgia and Cape Florida, viz. between 25° and 30° of north latitude, and between 81° and 85° weſt longitude.

FLORILEGE, *Florilegium*, a name the Latins have given to what the Greeks call ἀνθολογία, anthology. See the article ANTHOLOGION.

FLORIN, is ſometimes uſed for a coin, and ſometimes for a money of account.

Florin, as a coin, is of different values, according to the different metals and different countries where it is ſtruck. The gold florins are moſt of them of a very coarſe alloy, ſome of them not exceeding thirteen or fourteen carrats, and none of them ſeventeen and a half. As to ſilver florins, thoſe of Holland are worth about 1 s. 8 d. thoſe of Genoa were worth 8 ½ d. ſterling.

Florin, as a money of account, is uſed by the Italian, Dutch, and German merchants and bankers, but admits of different diviſions in different places: in Holland it is on the footing of the coin of that name, containing twenty ſtivers. At Frankfort and Nuremberg it is equivalent to 3 s. ſterling, and is divided into creutzers, and pfinnings. At Liege it is equivalent to 2 s. 3 d. At Straſbourg, to 1 s. 8 d. In Savoy, to 11 d. At Genoa, to 8 ¼ d. And at Geneva, to 6 ½ d. See the article COIN.

FLORINIANS, *Floriniani*, in church hiſtory, a ſect of heretics, of the ſecond century, ſo denominated from their leader Florinus, who made God the author of evil.

They are a ſpecies of the gnoſtics, but deny the judgment and reſurrection, and hold that our Saviour was not born of a virgin. They were alſo called borborites. See the article BORBORITES.

FLORIST, *Floriſta*, according to Linnæus, is an author, or botaniſt, who writes a treatiſe called Flora, comprehending only the plants and trees to be found growing naturally in any place. However, in the more common acceptation of the word, floriſt ſignifies a perſon well ſkilled in flowers, their kinds and cultivation. See the article FLOWER.

FLORY, FLOWRY, or FLEURY, in heraldry, a croſs that has the flowers at the end circumflex and turning down, differing from the potence, inaſmuch as the latter ſtretches out more like that which is called patee. See the article POTENCE and PATEE.

FLOS, or FLOWER, in botany. See the article FLOWER.

FLOS, in chemiſtry, the moſt ſubtile part of bodies ſeparated from the more groſs parts by ſublimation, in a dry form.

FLOSCULOUS, among botaniſts, an appellation given to compound flowers made up of a number of leſſer ones, all incloſed in the ſame common cup.

The plants with floſculous flowers make one of Tournefort's claſſes, called by Linnæus ſyngeneſia. See the articles BOTANY and SYNGENESIA.

FLOUNDER, the Engliſh name of a well known fiſh, called by ichthyologiſts the pleuronectes with the eyes in the right ſide, the lateral or ſide lines rough, and ſmall ſpines at the fins.

FLOUR, the meal of wheat-corn, finely ground and ſifted. See MEAL.

FLOWER, *Flos*, among botaniſts and gardeners, the moſt beautiful part of trees and plants, containing the organs or parts of fructification. See the article FRUCTIFICATION.

The parts of a flower are the ovary or piſtil, the corolla or flower-petals, the ſtamina or chives, the empalement or calyx, the perianthium, pericarpium, and fruit. See the articles PISTIL, COROLLA, STAMINA, &c.

According to the number of petals, or flower-leaves, flowers are called monopetalous or one-leaved, dipetalous or two-leaved, tripetalous or three leaved, &c. Flowers are again diſtinguiſhed into male, female, and hermaphrodite: the male flowers are thoſe containing ſtamina, without any piſtil or fruit, commonly called ſtamineous flowers. The female flowers are ſuch as contain the piſtil, which is ſucceeded with fruit; theſe are called fruitful or knitting flowers. The hermaphrodites are thoſe which contain the organs of both ſexes, viz. ſtamina and piſtils; and theſe are by far the moſt numerous.

From the different figures and diſpoſition of the flower-leaves of plants, Mr. Tournefort has eſtabliſhed a ſyſtem of botany; whereas that of Linnæus is chiefly founded on the number and diſpoſition of the ſtamina. See BOTANY.

Flowers were in great requeſt among the ancients: they adorned their temples, houſes, and even tombs with them; but their principal uſe ſeems to have been at entertainments, where the gueſts were always decked with flowers, and even the room ſtrewed with them.

Quincy tells us, that flowers, deſigned for medicinal uſe, ſhould be plucked when they are moderately blown, and on a clear day before noon: and that for conſerves, roſes muſt be taken in the bud.

For the method of preſerving ſpecimens of flowers, ſee the article HORTUS SICCUS.

Eternal FLOWER, the Engliſh name of the xeranthemum. See XERANTHEMUM.

Everlaſting FLOWER, the Engliſh name of the gnaphalium. See GNAPHALIUM.

FLOWER-FENCE, the Engliſh name of the poinciana. See POINCIANA.

FLOWER-DE-LUCE, the ſame with the iris. See the article IRIS.

Sultan-FLOWER, the ſame with the cyanus. See the article CYANUS.

Sun-FLOWER, the Engliſh name of the helianthus. See HELIANTHUS.

Trumpet-FLOWER, the ſame with the bignonia. See the article BIGNONIA.

Wind-FLOWER, the ſame with the anemone. See the article ANEMONE.

FLOWERS, in chemiſtry. See the article FLOS.

FLOWER-DE-LIS, or FLOWER-DE-LUCE, in heraldry, a bearing repreſenting the lilly, called the queen of flowers, and the true hieroglyphic of royal majeſty; but of late it is become more common, being borne in ſome coats one, in others three, in others five, and in ſome ſemee, or ſpread all over the eſcutcheon in great numbers.

The arms of France are, three flowers de lis or, in a field azure.

FLOWING SHEET, in the ſea-language; the ſheets are ropes faſtened to the lower corners of the ſails, and they are ſaid to be flowing when the wind is fair or large, as it is termed by ſeamen, as the ſheets are at this time not drawn ſo tight as when the ſhips are cloſe-hauled.

A ſhip is ſaid to have a flowing ſheet when the wind croſſes the line of her courſe at right-angles, that is to ſay, a ſhip ſteering north, with the wind at eaſt, has a flowing ſheet; for if ſhe were cloſe-hauled, ſhe would ſteer two points nearer the wind, viz. N. N. E. See the article CLOSE-HAULED.

FLOX, among dyers, ſignifies well cleaned wool, uſed to abſorb the colours of cochineal.

FLUENT, in fluxions, the flowing quantity, or that which is continually either increaſing, or decreaſing, whether line, ſurface, ſolid, &c. See FLUXION.

It is eaſy to find the fluxions, where the fluents are given; but, on the contrary, it is very difficult to find the fluents of given fluxions.

FLUID, in phyſiology, an appellation given to all bodies, whoſe particles eaſily yield to the leaſt partial preſſure, or force impreſſed.

Some philoſophers make the following diſtinction in fluids; thoſe which flow or ſpread themſelves till their ſurfaces become level or horizontal, they call liquid; in contradiſtinction to flame, ſmoke, vapour, &c. which are alſo fluids, but do not acquire ſuch a ſurface. Thoſe which are capable of exciting in us the idea of moiſtneſs, as water, &c. they call humid, diſtinguiſhing them thereby from air, quickſilver, and melted metals. But theſe diſtinctions are quite unneceſſary in a philoſophical ſenſe; the ſurfaces of all fluids being level, or horizontal, when not prevented by the bodies about them: and humidity is only a relative quality; for though quickſilver will not moiſten or ſtick to a man's finger, it will to ſilver or gold. See FLAME, SMOKE, LIQUID, &c.

The nature of a fluid, as diſtinguiſhed from that of a ſolid, or hard body, conſiſts in this, that its particles are ſo looſely connected together; that they readily move out of their places when preſſed with the leaſt force one way more than another. From whence philoſophers conclude, that theſe particles are exceedingly minute, ſmooth, and round, it being otherwiſe impoſſible they ſhould move with ſuch freedom upon the leaſt inequality of preſſure.

Thoſe particles conſidered ſeparately, are endued with all the common properties of matter, and are ſubject to the ſame laws of motion and gravitation with larger bodies. To enquire, therefore, into the nature of fluids, is to conſider what appearances a collection of very ſmall round bodies, ſubject to theſe laws, will exhibit under different circumſtances.

Laws and Properties of FLUIDS.—1. All fluids have little degree of compreſſibility, except air; or they cannot, by any force, be compreſſed into a much leſs ſpace than what they naturally poſſeſs, as is proved by the Florentine experiment, of filling a globe of gold with water, which, when preſſed with great force, cauſes the water to tranſude or iſſue through the pores of the gold, in form of a dew all over its ſurface. See WATER.

2. All fluids gravitate, or weigh in proportion to their quantity of matter, and that not only in the air, but *in proprio loco*: or, a fluid weighs the ſame, communicating with a quantity of that fluid, as *in vacuo*; which all philoſophers, till very lately, have denied.

The reaſon was this, becauſe philoſophers found that a bucket of water, in water, weighed nothing, that is, that becauſe there was no relative gravity in water, they very ſtrangely inferred there was no abſolute gravity in any part or particle of water, whilſt it remained in water, but only became heavy when taken out or ſeparated from the reſt. But their miſtake is eaſily evinced by the following experiment: let a bottle, or phial, with ſhot in it, to make it ſink in water when cloſe ſtopped, be hung at the end of a nice ballance, and then immerſed into a jar of water; while thus hanging in water, let it be counterpoiſed very exactly by weights put into the ſcale at the other end; then, pulling out the cork, the water will ruſh into the bottle, and deſtroy the equilibrium, by cauſing the ballance to deſcend; which will be a plain proof that water has weight in water.

That fluids gravitate, or are heavy, in the ſame manner with ſolids, is evident; becauſe the earth's attraction, which is the center of gravity, equally affects the particles of all ſorts of matter, and therefore excites the ſame endeavour, or tendency, towards the center of the earth, in the particles of a fluid, as in thoſe of a ſolid body; and this is what we call abſolute gravity. See GRAVITY.

Now ſince in fluids of the ſame kind as water, all the particles are reaſonably ſuppoſed equal and alike in all circumſtances,

cumſtances, they will be all equally affected by attraction, and therefore have, among themſelves, an equal tendency towards the earth's center; whence, ſince they gravitate equally, if they are equally obſtructed in their deſcent, as by the bottoms of the veſſels, &c. they will all retain the ſame poſition among themſelves, as if they were affected by no power at all; and thus they are ſaid to be relatively at reſt, or in a ſtate of quietus among themſelves; ſince no one particle of the ſame fluid has a greater ſhare of attracting power than another, no one will tend to deſcend before another; and therefore, among the particles of the ſame fluid, there is no ſuch thing as what we call relative or reſidual gravity, which is nothing but the exceſs of gravity, by which one body tends downwards more than another.

3. From the gravity of fluids ariſe their preſſure, which is always proportional thereto: and ſince we may ſuppoſe all the particles of a fluid to have equal bulk and weight, the gravity of the fluid, and conſequently the preſſure, will be always proportional to the altitude or depth thereof; whence the weight and preſſure of fluids on the bottoms of veſſels, &c. muſt be equal.

4. The preſſure of fluids upwards is equal to the preſſure downwards, at any given depth. To illuſtrate this and the foregoing propoſition, let ABCD (plate LXIII. *fig.* 8.) be a veſſel of water, whoſe altitude EF ſuppoſe to conſiſt of a column of 10 aqueous particles; then, it is evident, the firſt or uppermoſt particle 1 can affect the next particle 2, only by its weight and preſſure, which therefore is as 1; and ſince that particle 2 is immoveable, and action and re-action equal and contrary, the ſaid particle 2 will re-act upwards upon the particle 1, with a force which is as 1. In the ſame manner the particle 2 acts on the particle 3, by preſſure downwards, with two degrees of force, ariſing from its own weight and from that of the particle above it; and accordingly it is preſſed upwards with an equal force by the re-action of the particle 3. And ſo of all the reſt: wherefore the propoſitions are manifeſt.

5. The preſſure is upon all particles of the fluid, at the ſame depth, equal in every part; or the particles of a fluid, at the ſame depth, preſs each other, every way and in all directions, equally. For if any particle were preſſed more on one part than another, it muſt give way and yield, till the preſſure becomes every way equal; otherwiſe an inceſſant inteſtine motion of the particles muſt enſue, which is abſurd, and contrary to experience.

6. From the mutual preſſure and equal action of the particles, it follows, that the ſurface of a fluid muſt be perfectly ſmooth and even; for ſhould any part ſtand higher than the reſt, by any force, as attraction, &c. it would immediately ſubſide to a level with the other part, by the force of its own gravity, when that force is removed.

7. The figure of the ſurface of all fluids is ſpherical or convex; for all the particles equally gravitating towards the center of the earth, will take their places from it at equal diſtances at the ſurface, and ſo form a part of the ſuperficies of a ſphere, equal to the bulk of the earth.

Beſides the reaſon of the thing, we know from experiment, that the ſurface of large waters, as thoſe of the ſea or ocean, is convex; for a perſon ſtanding on the ſhore, and viewing a ſhip under ſail, directly before him, will loſe ſight thereof by degrees, the hull or body of the ſhip firſt diſappearing, then the lower parts of the maſt, then the top of the lower maſts, and laſtly, the top of the talleſt maſt. This is more fully explained in determining the figure of the earth. See the article EARTH.

8. Since fluids preſs equally every way, the preſſure of each particle againſt the ſide of a veſſel will be proportional to its altitude, and conſequently the preſſures of the particles 1, 2, 3, 4, &c. of a perpendicular column againſt the ſide BC (*fig.* 9.) will be a ſeries of numbers in arithmetical progreſſion, whoſe firſt term is 0; therefore the ſum of all the preſſures is equal to the number of preſſures multiplied by half the greateſt preſſure: but the number of preſſures is as the number of particles, or altitude of the fluid BC; alſo the greateſt preſſure is as the ſame altitude; wherefore the total preſſure againſt the ſide of a veſſel, is as the ſquare of the altitude of the fluid. See the article PROGRESSION.

This way of conſidering the quantity of lateral preſſure, by the arithmetical ſeries, is univerſal; whereas the common method reſtrains it to the property of an equicrural right-angled triangle, and to a veſſel of a cubical form, which we ſhall here give, for the ſake of proving it ſeveral ways: ſuppoſe ABCD (*fig.* 10.) a veſſel of a cubical form, that is, whoſe ſide BC is equal to the length of the bottom CD. If the diagonal BD be drawn, we ſhall have the lines 1 *a*=B 1, 2 *b*=B 2, 3 *c*=B 3, 4 *d*=B 4, &c. but B 1, B 2, B 3, B 4, &c. being as the altitudes of the fluid, will repreſent the lateral preſſures in the points, 1, 2, 3, 4, &c. therefore alſo the lines *a* 1, *b* 2, *c* 3, *d* 4, &c. will repreſent the ſame lateral preſſures; hence when the diſtances B 1, 12, 23, &c. are indefinitely ſmall, the lines *a* 1, *b* 2, *c* 3, *d* 4, &c. will be infinitely near each other; and ſo all thoſe lines drawn in the triangle BCD, will make the area of that triangle: therefore the ſum of all the lateral preſſure againſt the ſide BC, will be as the area of that triangle. But the area of the triangle BCD is as the ſquare of the ſide BC; conſequently, the ſum of all the lateral preſſures is as the ſquare of the altitude of the fluid BC.

9. Hence, if the veſſel AC (*fig.* 11.) be of a cubical form, the preſſure againſt a ſide BC, is half that upon the bottom CD, and conſequently the total preſſure againſt the ſides and bottom is equal to three times the weight of the fluid on the bottom of ſuch a veſſel.

10. The weight, preſſure, or effect of a fluid, upon the bottom DE (*fig.* 12.) of any veſſel ACDEF, is proportional to the altitude AE only, and not to the quantity of the fluid in the veſſel. For every column of particles GH, which preſſes downwards on the ſide of the veſſel EF, has its force deſtroyed by the equal reaction of the ſubjacent particle H in the ſide, and ſo cannot at all affect the bottom of the veſſel. Again, the preſſure of any column of particles LM upwards, againſt the ſide of any veſſel CD, is equally reached by the particle of the veſſel over it, and ſo its force or preſſure on the bottom muſt be the ſame as that of another column of particles AB of equal altitude with the fluid: whence the propoſition is evident.

11. Hence, a very ſmall quantity of fluid APRS may be made to counterbalance, or be equivalent to the weight or force of any given quantity TKGV, how great ſoever.

12. When any body is immerſed in a fluid, it loſes juſt ſo much of its weight as is equal to the weight of an equal bulk of the fluid; but the weight loſt by the body is gained by the fluid, which will be ſo much heavier than before.

This is the fundamental principle of every hydroſtatic proceſs, particularly of the whole doctrine of ſpecific gravities, which therefore cannot be made too plain and eaſy to be underſtood.

To this end, let ABCD (*fig.* 13.) be a veſſel filled with water, to the height EF; and let I be a cylindric body, heavier than water, to be immerſed therein, as at L. By this immerſion of the body I, a quantity of the fluid *abcd*, equal in bulk to the body, will be diſplaced by the ſuperior force, or greater gravity of the ſolid; and this quantity of fluid muſt aſcend, as being confined towards the bottom and ſides; and ſo riſe the ſurface of the liquor from EF to GH, and then will the quantity EFGH be equal to the bulk of the immerſed ſolid *abcd*. But as the ſolid comes to enter the fluid, each particle of the fluid, by its vis inertiæ, will reſiſt the ſolid, or endeavour to oppoſe its deſcent with all its power; and ſo the whole body of the fluid, that is removed or diſplaced by the ſolid, will reſiſt it by the united force of all the particles; but this force is equal to the gravity of the fluid removed, as is evident from hence, that the fluid ſo removed is obliged to aſcend or move in a direction quite contrary to gravity, wherefore the ſolid in its deſcent will be reſiſted by a force equal to the gravity of an equal bulk of the fluid.

And ſince the force which reſiſts the deſcent of ſolids is proportioned to their bulk only, it follows, that equal

bodies

bodies immerſed in fluids, loſe equal part of their weights; and therefore, a lighter body loſes more of its abſolute weight than a heavier one of the ſame bulk; and conſequently, if two bodies of an equal bulk are in equilibrio in the air, that equilibrium will be deſtroyed on their being immerſed in the fluid, becauſe that which has the largeſt bulk will loſe moſt weight in the fluid.

Again, it is plain, the weight of the fluid is augmented in the ſame proportion as that of the immerſed ſolid is diminiſhed; for the force or action of the fluid, on the bottom of the veſſel C D, is before immerſion to that afterwards, as the altitudes C F to C H; or to the bulks of the fluid E F C D, and G H C D. And ſince thoſe bulks act only by their gravity, it is plain the action of the fluid is increaſed only by the additional gravity of the quantities G H F E, which is equal to that which the ſolid loſes by immerſion. See GRAVITY.

13. If any body, E (*fig.* 14.) could be found without gravity it would, if placed on the ſurface A B, float thereon, without any part immerſed; for being devoid of gravity, it could have no force to diſplace any particles of the fluid, and ſink therein.

14 If an heavy body, F, lighter than an equal bulk of the fluid, be placed on its ſurface, it will ſink, or deſcend therein, till it has removed or diſplaced ſo much of the fluid whoſe weight is equal to that of the body. For there the preſſure upwards and downwards on the ſurface of the body is equal, and conſequently, the body will be there quieſcent, or in equilibrio with the fluid. Hence the whole ſolid is to the immerſed part as the ſpecific gravity of the fluid is to that of the ſolid. See the article HYDROSTATIC BALLANCE.

This caſe is not ſtrictly true, but in vacuo; for in the air ſuch a body may be conſidered as ſuſtained by two mediums, viz. air and water, in one of which it will ſink, or deſcend, and in the other, riſe.

15. If a ſolid, as G, equal in weight to an equal bulk of the fluid, be immerſed therein, it will take any ſituation indifferently on any part of the fluid, as at G, H, I, without any tendency to aſcend or deſcend therein; for being totally immerſed, it muſt remove a parcel of the fluid of equal bulk and weight, and conſequently the preſſure upwards is equal to the tendency downwards, on the lower ſurface every where; and therefore it can have no power to ſink. Alſo the preſſure downwards muſt be equal to the preſſure upwards, on the upper ſurface, whence it can have no tendency to riſe or ſwim; it will therefore remain at reſt in any poſition G, H, I, whereſoever in the fluid.

16. Laſtly, if a body K, or L, (*fig.* 15.) heavier than an equal bulk of the fluid, be immerſed therein, it will deſcend by the exceſs of its gravity above that of the fluid; for when immerſed, it will be reſiſted by the force of an equal bulk of the fluid, which therefore will deſtroy ſo much of the gravity of the ſolid; and conſequently the reſidue, or exceſs of gravity in the ſolid, is that alone by which it muſt deſcend.

The relative gravity of ſolids, by which they ſink or ſwim, is uſually illuſtrated by the deſcent and aſcent of glaſs images, and bubbles included in a jar of water, covered over with a bladder, ſo as to include a ſmall quantity of air between the bladder and water: the images, &c. have ſmall holes in the bottom of their feet through which ſome water is put into their bodies, and that in ſuch quantities as will render them but very little ſpecifically lighter than water; but ſome more ſo than others, that they may not begin to move altogether. See the repreſentation in *fig.* 16. The images being thus put to float in water, and the bladder tied down, if the hand be laid on the bladder, and gently compreſſes the air beneath, the air, by its ſpring, will act upon the water, and cauſe it to compreſs the air in the bodies of the images, by which means more water will be driven into their bodies; and when ſo much is got in as will make them ſpecifically heavier than the water, then they will begin to deſcend one after another; and by varying the degree of preſſure, you may keep them ſuſpended in any part of the fluid as you pleaſe.

From what has been premiſed of the nature of fluids, it will be eaſy to underſtand, that the lighteſt body P, (*fig.* 17.) may be depreſſed in the heavieſt fluid by any contrivance to keep the ſaid fluid from preſſing on the under ſurface of the light body, by which means only light bodies are made to ſwim. Thus cork, or wood, will abide at the bottom of a veſſel filled with quick-ſilver.

Again: on the other hand, the heavieſt body M may be made to ſwim in the lighteſt fluid, by keeping the ſaid fluid from preſſing on its upper ſurface, by means of the tube N O: for when by this means it is immerſed ſo deep as to keep off an equal weight of the fluid, the preſſure then of the fluid acting upon its under ſurface upwards, will be equal to the weight of the ſolid tending downwards; and therefore, if the ſolid be ſunk ever ſo little deeper, it muſt ſwim by the ſuperior force or preſſure of the fluid upwards.

Thus, for inſtance, if the body M be five times heavier than water of an equal bulk, and if by means of the tube N O, placed on its upper ſurface, the water be kept from preſſing thereon, that it be immerſed to ſeven times its thickneſs below the ſurface of the water, it is plain the preſſure on the under ſurface will be as ſeven, but downwards only as five; and therefore, ſince there is the exceſs of two degrees of preſſure upwards, it is plain the body cannot deſcend; but may very properly be ſaid to ſwim on the water: hence alſo the reaſon of trying the different gravity, denſity, or ſtrength of divers fluids, or ſpirituous liquors, by the hydrometer, or water-poiſe. See the article HYDROMETER.

Motion of FLUIDS. The motion of fluids, viz. their deſcent or riſe below or above the common ſurface or level of the ſource or fountain, is cauſed either, 1. by the natural gravity or preſſure of the fluid contained in the reſervoir, or fountain: or, 2. by the preſſure or weight of the air on the ſurface of the fluid in the reſervoir, when it is at the ſame time either taken off or diminiſhed on ſome part in aqueducts, or pipes of conduit. 3. By the ſpring, or elaſtic power of compreſſed or condenſed air, as in the common water engine. 4. By the force of piſtons, as in all kinds of forcing pumps, &c. 5. By the power of attraction, as in the caſe of tides, &c.

1. The moſt natural motion of fluids is that ariſing from the force of their own gravity, by which thoſe parts which ſtand higheſt preſs upon others below them, till by that means they riſe to the ſame horizontal level. Thus water in a fountain A B C D (*fig.* 18.) by its preſſure, raiſes that in the aqueduct F G H to the ſame height I K L M in every direction or poſition of the duct G H, or G N; unleſs the orifice of the ſaid duct be below that level, in which caſe the water will continually flow from the ſame. The reaſon hereof is evident from the principles already laid down, viz. that the preſſure of fluids was in proportion to the altitude only, and not according to the quantity thereof, and therefore the effect or riſe of the fluid in the duct muſt be equal thereto.

Hence we have conduits often ſupplied with water from ſprings, which lie above them; and cocks to ſupply the inhabitants of a town with water by pipes from a reſervoir, in a ſituation above the higheſt part of the town: hence alſo the deſcent of water in rivers, ſtreams, and canals from ſprings and ſources above the common ſurface of the earth; and the breaking out of ſprings at the bottoms and on the ſides of hills; from ciſterns and reſervoirs in the internal parts above them, which receive their water from rain, dew, condenſed vapour, melted ſnow, &c. diſtilling, or percolating through the pores or crevices and chaſms of the upper part of the earth. See the articles FOUNTAIN, SYPHON, CONDUIT, TANTALUS's CUP, JET D'EAU, RESERVOIRS, CANAL, SPRING, CISTERN, &c.

2. The ſecond cauſe of the riſe or motion of fluids is the preſſure of the air on the ſurface of that in the fountain or reſervoir: thus if a ſyphon or crane be immerſed with the ſhorter leg in water, and the air ſucked out of the inſtrument, the fluid will aſcend into the vacuous ſpace by the preſſure of the air on the water, and fill the whole cavity of the tube; and becauſe there is a greater column of water in the longeſt leg, it will preponderate and deſcend through it, and will keep flowing out till the veſſel is exhauſted to the orifice of the ſhorter leg. The effect of the common pump is from the ſame principle. See the article PUMP.

3. The third cauſe of the riſe and motion of fluids is by the

the ſpring or elaſtic power of condenſed air, upon which principle water-engines are contrived. See the article ENGINE.

4. The fourth cauſe is the force or preſſure of piſtons, upon which principle a variety of water-engines are conſtructed, as may be ſeen under the articles already referred to.

5. The laſt cauſe of the motion of fluids which we mentioned was that of attraction. We have elſewhere ſhewn how by this means any fluid will aſcend above the common ſurface in capillary tubes, &c. See the article CAPILLARY.

But the moſt notable and obvious motion of fluids ariſing from attraction, is that of the tides; the waters of the immenſe ocean, forgetful, as it were, of their natural quietus, move and roll in ſwelling tides obſequious to the ſovereign power of the moon, and weaker influence of the ſun. See the article TIDES.

Momenta and velocities of FLUIDS. The momenta of fluids, as well as of ſolids, is compounded of the quantity of matter and velocity; but in ſpouting fluids, the quantity of the fluid iſſuing through the ſame hole, in the ſame time, is always as the celerity of its motion, as is eaſy to conceive. Whence the momenta of ſpouting fluids, are proportional to the ſquares of the velocities, or quantities of matter iſſuing out in a given time. But ſince the momenta are the effect of preſſure, it is evident the velocity or quantity of ſpouting fluids is ever proportional to the ſquare root of the preſſure, or altitude of the fluid. From hence it appears, that the velocity of a fluid ſpouting at any depth below the ſurface is equal to the velocity a heavy body would acquire by falling from the ſame height; becauſe the velocity, as was obſerved, is always as the ſquare root of the ſpace deſcended through. If therefore on the altitude of the fluid A K, (*fig.* 19.) as a diameter, we deſcribe the ſemicircle A F K, and from any point therein, as I, we draw the perpendicular I H, that ſhall be proportional to the diſtance to which the fluid will ſpout from an adjutage at H: for the velocity will be, as the ſquare root of A H; and the time, as the ſquare root of H K; whence the product of theſe two will expreſs both the ſpace paſſed over by the projected body, and alſo the line H I.

Hence it follows, that a fluid will ſpout from a hole or adjutage D, in the center of the ſemicircle, or middle part of the altitude A K, to the greateſt horizontal diſtance K M poſſible; becauſe the perpendicular F D is the greateſt that can be drawn to the diameter A K. Alſo it is evident, that from two holes B and H, equally diſtant above and below the middle altitude D, the jets of water will be made to the ſame horizontal diſtance K N; becauſe the perpendiculars to theſe two points, viz. C and I H, are equal. Moreover, the horizontal diſtance K M, to which the water ſpouts from D the center, is equal to the diameter or altitude A K, or twice D F. For ſince the velocity of the jet at Q is equal to that acquired by falling through the height A D, or D K, it will, as being uniform, carry the fluid in an horizontal direction over twice the ſpace D K, or D F in the ſame time. And therefore, ſince the diſtances of jets from D and B are as D F to B C, and the diſtance of the jet from B will be alſo equal to twice B C, or K N = 2 B C. From what has been ſaid, it is eaſy to obſerve, that the motion of a ſpouting fluid is every way ſimilar to that of a projected ſolid. The path of the fluid is a parabola, becauſe it is impelled by two forces, one horizontal, the other of gravity in the perpendicular, in the ſame manner as in the projected ſolid. See PROJECTILE.

The impetus of the jets B, D, H, E, is as the height of the reſervoir A B, A D, A H, A E; the greateſt horizontal random K M, is that from the jet D, directed to the middle point F of the ſemi-circle; and any two jets equally diſtant as B, H, go to the ſame diſtance K N on the horizon. If the adjutage be horizontal, the jet will be a ſemiparabola; if oblique, it will be a whole parabola. See PARABOLA.

FLUOR, in phyſics, a fluid, or more properly, the ſtate of a body that was before hard or ſolid, but is now reduced by fuſion, or fire, into a ſtate of fluidity.

FLUOR, in mineralogy, implies a ſort of mineral concretion, frequently found amongſt ores and ſtones, in mines and quarries.

FLUOR ALBUS, or WHITES, in medicine, is a diſcharge of whitiſh gleety matter by the natural parts of the fair ſex. This humour iſſues ſometimes from the veſſels of the uterus, and ſometimes from the glands of the vagina. In the former caſe the diſcharge is ſuppreſſed during the time of the menſtrual courſes; in the latter, it ſubſiſts with them, and continues even in the time of pregnancy.

In both ſpecies of the diſeaſe, the principal intention ought to be directed towards mending the habit of body, from ſome fault in which they derive their origin: but when the ſeat of the diſtemper is in the vagina, it will, however, require topical applications.

Wherefore, generally ſpeaking, it will be proper to begin the cure by giving a vomit, eſpecially with ipecacuanha wine; frequent purging is indicated, chiefly with rhubarb; which may be taken either in ſubſtance, with the addition of aromatics, and in ſome caſes of a little calomel now and then; or in the tincture of rhubarb in wine. And the laxity of the fibres requires aſtringents, particularly ſuch as have ſteel in their compoſition.

As to external or topical remedies, which I have ſaid are neceſſary, when the vagina is the ſeat of the diſeaſe; we ought carefully to avoid applying all ſuch as are powerful repellers of the peccant humours: for thoſe only are ſerviceable which deterge and heal the little ulcers of that membrane. For my part, I have often with great ſucceſs, ordered the patient to inject a ſmall quantity of Bates's aqua aluminoſa, or of the camphorated vitriolic water, with a little Egyptian honey added to either, into the vagina through a proper ſyringe, at repeated times: and it will be of ſome ſervice to fumigate the vagina now and then with a powder made with equal parts of frankincenſe, maſtich, amber, and cinnabar of antimony, thrown on burning coals. *Mead's Monita Præcepta.*

FLUSH-DECK, or deck fluſh fore and aft, in ſhipbuilding, the upper-deck of a ſhip, which has no riſing at either end, only the common curve, or gradual aſcent from the middle towards the ſtem and ſtern, called by ſailors the ſheer.

FLUTE, *fiſtula*, an inſtrument of muſic, the ſimpleſt of all thoſe of the wind kind. It is played on by blowing it with the mouth, and the tones or notes are changed by ſtopping and opening the holes diſpoſed for that purpoſe along its ſide. The ancient fiſtulæ, or flutes, were made of reeds, afterwards of wood, and laſt of metal: but how they were blown, whether as our flutes, or as hautboys, does not appear.

German FLUTE, is an inſtrument entirely different from the common flute. It is not, like that, put into the mouth to be played, but the end is ſtopt with a tompion, or plug; and the lower lip is applied to a hole about two inches and a half, or three inches diſtant from the end. This inſtrument is uſually about a foot and a half long; rather bigger at the upper end than the lower; and perforated with holes, beſides that for the mouth, the loweſt of which is ſtopped and opened by the little finger's preſſing on a braſs, or ſometimes, a ſilver key, like thoſe in hautboys, baſſoons, &c. It is found exceeding ſweet and agreeable, and ſerves as a treble in a concert.

FLUTES or FLUTINGS, in architecture, perpendicular channels, or cavities, cut along the ſhaft of a column, or pilaſter. They are chiefly affected in the Ionic order, where they had their firſt riſe; though, indeed, they are uſed in all the richer orders, as the Corinthian and Compoſite; but ſeldom in the Doric, and ſcarce ever in the Tuſcan.

Each column has twenty-four flutes, and each flute is hollowed in exactly a quadrant of a circle; but the Doric has but twenty. Between the flutes are little ſpaces that ſeparate them, which Vitruvius calls ſtria, and we liſts: though, in the Doric, the flutes are frequently made to join to one another without any intermediate ſpace at all; the liſt being ſharpened off to a thin edge, which forms a part of each flute.

Sometimes the flutings are made flat, and are called facettes; but theſe have never ſuch a good effect as the others. Vitruvius ſays, that when there are flutings in

the column, there ought alſo to be eggs and anchors in the quarter-round of the capital, and even pearls and olives, in a baguette, to be made underneath, inſtead of annulets. Theſe eggs and olives ought to be in the ſame number with the flutings, and to be regularly diſtributed.

FLUX, in medicine, an extraordinary iſſue, or evacuation, of ſome humours of the body.

Flux of the urine. See Diabetes.

Flux, in hydrography. See Tide.

Flux, in metallurgy, whatever can cauſe any body, otherwiſe not at all, or hardly, fuſible by fire, to melt.

Fluxes, ſays Dr. Shaw, ſeem reducible to two general kinds, viz. the vitreous and the ſaline. By the vitreous we underſtand all thoſe which either have of themſelves, or readily aſſume, a glaſſy form in the fire; among the principal of which are reckoned the glaſs of lead, the glaſs of antimony, and borax. By the ſaline kind of fluxes are underſtood all thoſe that are compoſed of ſalts, whether tartar, nitre, fixed alcali, or the like. Among the principal of this kind we reckon the black flux, ſandiver, kelp, &c. See the articles Sandiver and Kelp.

The method of making the black flux is as follows. Take one part nitre, and two parts common tartar, and reducing each to powder, mix them together: deflagrate the whole in a crucible, by lighting the mixture a-top, which thus turns to a kind of alcaline coal, that is to be pulverized and kept cloſe in a glaſs, to prevent its diſſolving, as it would do in a moiſt air.

Some of the moſt powerful and cheap ſimple fluxes hitherto known, are dried wine-lees, dried cow-dung, and horſe-dung, dried river-mud, fuller's-earth, iron-filings, common ſalt, glaſs, kelp, or pot-aſhes, ſandiver, &c. which may be uſed in the larger work, as nitre, tartar, borax, ſal ammoniac, mercury ſublimate, &c. may in the ſmaller, or for the making of aſſays.

As for compound fluxes, they are numerous; almoſt every operator having his favourite flux. And, certainly, ſome fluxes are better adapted than others to certain ores. But perhaps a few general ones might be fixed upon, which ſhould ſerve inſtead of all thoſe hitherto commonly known and uſed, we will here recommend three, which are powerful, almoſt general, and not expenſive.

1. Take of nitre, prepared by long boiling it in lime-water; of ſea-ſalt, melted in the fire; ſandiver, and dry wine-lees, each one part; glaſs of lead, three parts; and powdered glaſs, eight parts; mix them all well together. This flux added in an equal weight, will fuſe a very ſtubborn ore.

2. For a ſtill ſtronger, take equal parts of white tartar, common ſalt and nitre, prepared as above: calcine them to a white powder; and mix therewith its own weight of glaſs and lead; and of this flux add two parts to one of the moſt ſtubborn ore.

3. For a powerful ſaline flux. Take of the ſtrongeſt ſoapboiler's lees, four pounds; white tartar, and common ſalt melted in the fire, each one pound: boil them together with five gallons of human urine, to a dry ſalt. This flux is particularly proper where ſulphur and cobalt abound, and render the ore very refractory.

But the great ſecret in making and adapting fluxes, is not only to ſeparate the metal already ripened in the ore, but even to mature and ripen the crude and immature part of the ore in the fire: ſomething of this kind, we apprehend, may be effected, as having reaſon to believe, that certain fluxes will obtain a larger yield of metal from certain ores, than other fluxes in common uſe, though eſteemed of the beſt, and though they are perhaps of the deareſt kind. Thus clean iron-filings will often do more than borax. But as the ſcales and crocus, or ruſt of iron, have been commonly uſed, inſtead of pure and perfect iron itſelf, for a flux, few operators appear acquainted with the excellence of perfect iron employed for this purpoſe. And many advantages are now obtained, by a prudent mixing of one ore with another of the ſame denomination, and with the ſlags or recrements of metals, in this way of flux.

The melting of gold and ſilver, and of their calxes, is greatly promoted by glaſs of lead, alkaline ſalts, &c. but when gold and ſilver, in the fuſion itſelf, are to be purged from other metals and ſemimetals, it is proper to uſe nitre only; or if not ſo, nitre always muſt be mixed with the other ſalts; for the ſemimetals and the four leſs perfect metals are deſtroyed by nitre.

In this operation, nitre, by its detonation with their ſulphurs, is in part alkaliſed, and, by the help of a gentle fire, turns their calxes into a vitreous, and much attenuated ſcoriæ.

From hence, the reaſon is plain why gold and ſilver, when made brittle, are readily reſtored to their malleability by nitre; for the ſame metals, and among the metals lead and tin moſt of all, communicate this fault to gold and ſilver: but theſe being changed, as before obſerved, by nitre, are then rejected by gold and ſilver in a ſimple fuſion, ſo that they can no longer mix with theſe metals, unleſs they are themſelves firſt again reduced to their metallic ſtate; and there is beſides theſe, no other body that can be mixed with ſilver and gold, to render them brittle, unleſs crude charcoal, happening to fall into the veſſel wherein theſe metals are melted, ſhould impregnate them with ſomething arſenical; there being ſome arſenic contained in coals of this kind, as has been demonſtrated by Stahl and Hoffman.

The leſs perfect metals, and ſemimetals, melt more eaſily by adding ſalts to them, than of themſelves: they always, however, loſe a great deal of their ſubſtance by this means; and this is is more particularly the caſe in regard to copper and iron. To amend this, it is neceſſary to add ſome kind of fat body, which prevents the deſtruction, and even reduces the metals already deſtroyed; and this is more neceſſary when the calxes, prepared either by burning, or by a detonation with nitre, are to be reduced.

A caution, very neceſſary to be obſerved, is, that all fluxes muſt be kept and uſed very dry, for moiſt ſalts foam very much; and when the operations are made in cloſe veſſels, if the fire is quickly increaſed, not being able to get rid of the moiſture, the veſſels will ſplit and break.

Fluxes being greatly attenuated, though confined in cloſe veſſels, part with their oily principle, and their alcaline ſalt remaining, begin to corrode and conſume the veſſels, of what matter ſoever they are made, and finally make their way through them, and get out. The firſt of theſe accidents is prevented by adding coal-duſt, which will never part with its oil without the help of a free air; and the others by an admixture of common glaſs, made of a due mixture of flints, and fixed alcali; for this is ſufficiently fuſible and melts with the fluxes; and by its viſcidity in ſome ſort coagulates and holds the ſalt of the flux together, and prevents it from eaſily corroding the veſſels.

FLUXIONS, in mathematics, are the velocities of the increments of variable or indeterminate quantities, conſidered not as actually generated, but as ariſing or beginning to be generated: and to form a juſt and adequate notion of them, we are to conſider mathematical quantities, not as made up of an infinite number of very ſmall conſtituent parts, but as generated or deſcribed by a continued uninterrupted motion or regular flux. A line is deſcribed, and in that deſcription is generated, not by the appoſition of parts, but by the continual motion of a point. A ſurface is generated by the uninterrupted motion of a line, moving in any direction except that of its length, and a ſolid by the conſtant motion of a ſuperfices, moving in any direction provided it be not in the plane of the ſaid ſuperfices. An angle by the rotation of one of its legs. And the quantities thus generated in equal ſpaces of time, become equal, greater or leſſer, according as the celerities of the motions, by which they were generated, are equal, greater, or leſſer.

For example, if the point A (plate LXIV. *fig.* 1.) move or be carried forward with an equal and uniform motion from A towards C, according to the direction of the line A C, and the point B move or be carried forward with an equal and uniform motion from B towards D, according to the direction of the line B D; and the velocity of the point A be equal to the velocity of the point B; the line A C, generated by the point A, will be equal to the line B D, generated by the point B in the ſame time.

PLATE LXIV.

Facing Fluxions.

Fluxions Fig. 1.

Fig. 2.

Fluxions.

Fig. 3.

Fluxions

Fig. 4.

Fluxions.

Fig. 4. Evolute.

Foci.
Fig. 6.

Fig. 5. Extreme and mean Proportion.

Fig. 6.

Fig. 7.

Fore Staff.

Eye

Fig. 5.

Fluxions.

Fig. 7.

Fig. 8.

Fore Staff

Fig. 12.

Fluid.

Fig. 12.

Fluid.

Fig. 8, 9, 10, 11.

Fig. 14, 15, 17. Fluid.

Fig. 16.

Fig. 10.

Fig. 18 Fluid.

Equation of Time

Fig. 2.

Fig. 3.

Equation of Time.

5 JA 59

time. If the velocity of the point A be double to the velocity of the point B, the line AC will be double to the line BD, each generated in the ſame time; and if the velocity of the point A be triple of the velocity of the point B, the line AC deſcribed by the point A, in any ſpace of time, will be triple of the line BD, deſcribed by the point B in the ſame part of time; and univerſally if U repreſent the velocity of the point A, and *u* the velocity of the point B, the line deſcribed by the point A will be to the line deſcribed by the point B, in any time *t*, as U to *u*; and theſe velocities U and *u*, with which the generating or deſcribing points are carried, are called the fluxions of the lines AC and BD, as the lines AC and BD, thus deſcribed, are called the fluents.

Again, if the whole line AB (*fig.* 2.) be ſuppoſed to be carried along the line BD from B towards D, conſtantly perpendicular to BD, and parallel to itſelf; and at the ſame time the point A be imagined to move according to the direction of the line AB, it will by this compound motion, one according to the direction AC, and the other according to the direction AB, deſcribe either a right line, or a curve line, according as the velocities of it in each direction are adjuſted or proportioned to each other; as will the line AB, for the ſame reaſon, deſcribe a rectilineal or a curvilineal ſuperficies.

If the points A and B move with an equable and uniform velocity; that is, if, in time the point A with an equable velocity moves to P, the point B is carried with an uniform velocity to *b*, ſo that the ſpace AP, deſcribed in any given time by the point A, is to the ſpace deſcribed by the point B in the ſame time, as the whole ſpace AB deſcribed by the point A in a certain time, to the whole ſpace BD deſcribed by the point B, in the ſame time; the point A, by this compound motion, will deſcribe the right-line A*a*D, as will the whole line AB generate the parallelogrammic ſpace ABDC, while the ſame line AB, diminiſhing according to the velocity of the point A, deſcribes the triangular ſpace ABD.

For inaſmuch as in the ſame time that the line AB is ſuppoſed, with an uniform velocity, to have moved into the place A*b*, the point A is ſuppoſed to have moved with an equable velocity through the ſpace A*a* equal to AP, it is manifeſt that the point A will be found in *a*; and becauſe AP is, in every point P, to the whole line AB, as *a*P or AA is to the whole line BD or AC, the points *a a a* will be in a ſtraight line; and conſequently the point A, by the compound motion, will deſcribe the right-line A*a a a*D in the ſame time as the whole line AB ſhall have generated the parallelogram ABDC, and the ſame line AB, diminiſhing in the ratio of the velocity of the point A, ſhall have deſcribed the triangle ABD. But if in the time that the point B (*fig.* 3.) by the uniform motion of the line AB, moves over equal ſpaces B*b*, *bb*, &c. in equal times, the point A moves through ſpaces A*a*, A*a*, &c. equal to AP, AP, &c. which ſhall be to each other in a duplicate ratio of the ſpaces B*b*, B*b*, &c. run through by the point B in the ſame time, the point A will, by this compound motion, deſcribe the parabolic curve A*a a a*D, as will the whole line AB, the parallelogrammic ſpace ABDC, and the line *a b*, *a b*, the parabolic ſpace ABD*a*A.

For becauſe it is as $AB : AP :: BD^2 : P\rho^2$, whereſoever the point P be taken, the curve A*a a a*D will be a parabola. Or, if while the point B (*fig.* 4.) by the uniform motion of the line BA along the line DB, deſcribes equal ſpaces *Bb*, *bb*, *bb*, &c. in equal times, the point A deſcends through ſpaces AP, AP, AP, &c. which ſhall be to each other in a ſubduplicate ratio of the ſpaces B*b*, B*b*, B*b*, &c. the curve, deſcribed by this compound motion of the point A, will be a parabola convex towards AB, and the ſpace ABD is the ſupplemental part wherein the lines P*a*, P*a*, P*a*, which, in the former caſe, were the abſciſſa, now become the ordinates; and the lines AP, AP, AP, which before were equal to the ordinates, become now the abſciſſa. But if, inſtead of imagining the line AB to be carried along the line BD parallel to itſelf, we conceive the ſame line AB to revolve about the point B, fixed as a center, whilſt the point A moves in the direction AB, from A towards B, as before; then the point A, by theſe two motions, will deſcribe ſome one of the radial or ſpiral curves; and as all curves whatſoever ariſe from the different velocities of one or both of the points A and B, it will be eaſy from hence to conceive how any one, or all, of the infinite variety of curves may be generated.

From the generation of curves thus explained, the nature of fluxions will more evidently appear: For let A P *p* D (*fig.* 5.) repreſent any given curve, AB its axis, PM, *p m*, ordinates applied, and draw the lines P*b*, *p b*, parallel to the axis AB. Now inaſmuch as the points P and *b*, *p* and *b*, repreſent the ſeveral poſitions of the points A and B in the regular and orderly formation of the curve, ſo the lines P*b*, *p b*, which repreſent the ſeveral diſtances of theſe points aſunder at thoſe ſeveral moments of time, are very properly and ſignificantly called the ſeveral flowing values of the line AB; and as there is no imaginable moment of time wherein the points A and B are ſuppoſed to be at reſt, ſo there is no imaginable time wherein the line AB continues of the ſame length, but is conſtantly in a ſtate of change, and flowing into a new value; and, for the ſame reaſon, the ordinates PM, *p m*, &c. equal in length to the diſtances B*b*, B*b*, the ſpaces run through by the point B, being in a continual flux and change, are called the ſeveral flowing values of the baſe BD. In the generation or formation of any curve, if one of the points, B, for example, move with an equable and uniform motion, the other point A muſt neceſſarily move with an accelerated motion, according to ſuch degrees of acceleration as the nature of the curve required; for if the velocities of the generating points were equable, the path deſcribed would be a ſtraight line, and conſequently the velocity of the generating point A muſt be variable in every point of the curve. For as the motion of the point A towards B is a continued uninterrupted motion; ſo, being at the ſame time an accelerated one, the acceleration itſelf muſt be without the leaſt intermiſſion: and for the acceleration to be without intermiſſion is to undergo infinite and indeterminate variations. Again, if the unequal particles of the curve P*p* and *p*Q are generated in equal particles of time, there muſt be infinite variations of the velocity of the generating point A, between the points P and *p*, as alſo between the points *p* and Q; and as the point B may be conceived to move with an accelerated motion towards D, the velocity of the point B, in every conceivable part of the line BD, muſt be accelerated; and conſequently there muſt be the infinite variations of velocity between the points *p* and R, and Q and *r*, while thoſe increments *p*R, Q*r*, of the ordinates *p m*, QN, are generated.

Inaſmuch therefore as an infinite variety of velocities is requiſite to the production or formation of any increment or generated quantity, ſuch as P*p* or *p*R, &c. how ſmall ſoever, ſo in order to compare theſe increments together, it is abſolutely neceſſary to conſider them in their ariſing ſtate, or before they begin to be; and theſe velocities are accurately and exactly, in the firſt ratio of the increments, conſidered as ariſing. So that to find the fluxions of flowing or determinate quantities is to find the velocities with which they begin to be generated in the firſt moments of formation. And the ſame way of reaſoning obtains, whether we conſider the firſt or laſt ratio's of the velocities of the incremental parts; that is, whether we conſider them in their firſt ratio's, as ariſing, or whether we conſider them in their laſt ratio's, as vaniſhing and ceaſing to be.

From what has been ſaid, it is manifeſt, that the progreſſion of fluxions is without end, that is, that there are fluxions of fluxions, and fluxions of fluxions, &c. in infinitum.

Notation of FLUXIONS. — Conſtant, or determinate quantities, that is, ſuch as never increaſe or decreaſe, but perpetually remain the ſame, are uſually, for the ſake of diſtinction, and to avoid confuſion, denoted by the firſt letters of the alphabet, as *a*, *b*, *c*, *d*, &c.

Indeterminate or flowing quantities, that is, ſuch quantities as are formerly increaſing or decreaſing by a perpetual and regular flux of motion, are commonly expreſſed by the latter letters of the alphabet, ſuch as *u*, *x*, *y*, *z*; and their fluxions, or celerities of increaſe or decreaſe, by the ſame letters, with a dot over the head; thus, $\dot{u}$, $\dot{x}$, $\dot{y}$, $\dot{z}$, repreſent the fluxions of the quantities *u*, *x*, *y*, *z*: and, inaſmuch as theſe fluxions may be conſidered as fluents, and conſequently have their fluxions of celerity, and

and increaſe or decreaſe, theſe are uſually denoted by the ſame letters with two points or tittles over the head; thus, $\ddot{u}, \ddot{x}, \ddot{y}, \ddot{z}$, are the fluxions of u, x, y, z; and after the ſame manner, the fluxions of theſe, conſidered as fluents, are denoted by the ſame letters with three tittles, or points over the head; thus, $\dddot{u}, \dddot{x}, \dddot{y}, \dddot{z}$, and the fluxions of theſe with four points or tittles, thus, $\ddddot{u}, \ddddot{x}, \ddddot{y}, \ddddot{z}$, &c. and theſe are called firſt, ſecond, third, and fourth fluxions.

Thus, $\ddot{u}, \ddot{x}, \ddot{y}, \ddot{z}$, which are the firſt fluxions of $\dot{u}, \dot{x}, \dot{y}, \dot{z}$, are the ſecond fluxions of u, x, y, z, and $\dddot{u}, \dddot{x}, \dddot{y}, \dddot{z}$, which are the firſt fluxions of $\ddot{u}, \ddot{x}, \ddot{y}, \ddot{z}$, are the ſecond fluxions of $\dot{u}, \dot{x}, \dot{y}, \dot{z}$, and the third fluxions of u, x, y, z. In like manner $\ddddot{u}, \ddddot{x}, \ddddot{y}, \ddddot{z}$, are the firſt fluxions of $\dddot{u}, \dddot{x}, \dddot{y}, \dddot{z}$, the ſecond fluxions of $\ddot{u}, \ddot{x}, \ddot{y}, \ddot{z}$, the third fluxions of $\dot{u}, \dot{x}, \dot{y}, \dot{z}$, and fourth fluxions of u, x, y, z, &c.

And the fluxions of fractions, as well as their ſecond, third, fourth, &c. fluxions, are denoted by 1, 2, 3, or 4, &c. points placed horizontally in the break of the line that ſeparates the numerator from the denominator.

Thus, $\frac{a\dot{z}+z\dot{z}}{a-z}$, $\frac{a\ddot{z}+z\ddot{z}}{a-z}$, $\frac{a\dddot{z}+z\dddot{z}}{a-z}$ and $\frac{a\ddddot{z}+z\ddddot{z}}{a-z}$ are firſt, ſecond, third, and fourth fluxions of the quantity $\frac{az+zz}{a-z}$.

In like manner, if the quantity $az+zz$ be a root, or ſurd quantity, then its firſt, ſecond, third, and fourth, &c. fluxions are expreſſed by one, two, three, four, &c. points in the break of the vinculum.

Thus, $\sqrt[n]{\dot{a}z+z\dot{z}}$, $\sqrt[n]{\ddot{a}z+z\ddot{z}}$, $\sqrt[n]{\dddot{a}z+z\dddot{z}}$, $\sqrt[n]{\ddddot{a}z+z\ddddot{z}}$, denote the firſt, ſecond, third, and fourth fluxions of the quantity of $\sqrt[n]{az+zz}$, or $az+zz^{\frac{1}{n}}$: and after the ſame manner may the firſt, ſecond, third, fourth, &c. fluxions of any other quantity of the ſame kind be expreſſed.

The direct Method of FLUXIONS, or the flowing quantity being given to find its fluxion.—1. When the quantities are added. In the room of every quantity ſubſtitute its fluxion, and connect them with the ſigns of their reſpective quantities, and the ſum will be the fluxion required. Thus $\dot{x}$ is the fluxion of x, and $\dot{y}$ the fluxion of y; therefore, $\dot{x}+\dot{y}$ is the fluxion of $x+y$, and $\dot{x}-\dot{y}$ the fluxion of $x-y$; for if, while x increaſes, y diminiſhes, as the fluxion of x is poſitive, the fluxion of y muſt be negative; and for the ſame reaſon the fluxion $x-y+z$ will be $\dot{x}-\dot{y}+\dot{x}$, and the fluxion of $a+x+y+u$ will be $\dot{x}+\dot{y}+\dot{u}$; for a, being ſuppoſed, by the former way of notation, to be a conſtant quantity never increaſing nor diminiſhing, cannot undergo any alteration or change, and has therefore no fluxion, and conſequently vaniſhes in the operation. In like manner the fluxion of $x+a+y+b-u$ is $\dot{x}+\dot{y}-\dot{u}$; and after the ſame manner may the fluxion of any aggregate, whether ſum or difference, be found.

2. To find the fluxions of the product of any number of flowing quantities, multiplied into one another.

In order to this, let x and y repreſent the length and breadth of any right-angled parallelogram; then if y be ſuppoſed conſtant, the fluxion of the parallelogram will, from what has been already ſhewn, be $y\dot{x}$; and on the other hand, when y only flows, the fluxion of the parallelogram will be defined by $x\dot{y}$, conſtantly the total fluxion of the propoſed parallelogram, when both the length and breadth are in a flowing ſtate, will be truly expreſſed by $x\dot{y}+y\dot{x}$. Let it now be required to determine the fluxion of the product xyz; to do this, put $xy=u$, then will uz be equal to xyz, and the fluxion thereof equal to $u\dot{z}+z\dot{u}$, by what has been juſt now ſhewn; and alſo $x\dot{y}+y\dot{x}=\dot{u}$; hence, by ſubſtituting in $u\dot{z}+z\dot{u}$, the reſpective values of u and $\dot{u}$ in terms of x, y, z, and their fluxions, we ſhall at length have $u\dot{z}+z\dot{u}=xy\dot{z}+xz\dot{y}+yz\dot{x}$, for the required fluxion of the propoſed product xyz. Hence this general rule:

Multiply the fluxion of every particular flowing quantity by the product of the other quantities, and add the ſeveral products together, and the ſum will be the fluxion required.

3. To find the fluxions of quantities divided one by the other, or of fractions.

To inveſtigate a rule for this purpoſe; let $\frac{x}{y}$ be the fraction propoſed, and ſuppoſe $\frac{x}{y}=z$; then will $x=yz$; and conſequently $\dot{x}=y\dot{z}+z\dot{y}$; and $\dot{z}=\frac{\dot{x}-z\dot{y}}{y}$; for z ſubſtitute its value $\frac{x}{y}$, and we ſhall have $\dot{z}=\frac{\dot{x}-\frac{x}{y}\dot{y}}{y}$; $\frac{y\dot{x}-x\dot{y}}{y^2}$ for the fluxion of $\frac{x}{y}$. Hence this general rule.

Multiply the fluxion of the numerator by the denominator, and from the product ſubtract the fluxion of the denominator, multiplied into the numerator; then divide the remainder by the ſquare of the denominator, and the laſt quotient or fraction thence reſulting will be the fluxion of the quantity propoſed.

4. To find the fluxions of powers.

We have already ſhewn how to find the fluxion of the product of any number of flowing quantities; and therefore, if the quantities in any propoſed product be ſuppoſed equal among themſelves, a general rule for finding the fluxions of powers will from thence immediately emerge. Thus the fluxion of xy is $x\dot{y}+y\dot{x}$, and conſequently if $x=y$, then xy becomes xx, and $x\dot{y}+y\dot{x}$ becomes $2x\dot{x}$, for the fluxion of a ſquare xx. Again, the fluxion of xyz is $xy\dot{z}+xz\dot{y}+yz\dot{x}$; and when $x=y=z$, we have the fluxion of x^3 equal to $xx\dot{x}+xx\dot{x}+xx\dot{x}$, or $3x^2\dot{x}$. In the ſame manner the fluxion of x^4 will be found to be $4x^3\dot{x}$, and that of x^n, $nx^{n-1}\dot{x}$: whence this general rule for finding the fluxions of given powers.

Multiply the given power by its exponent; then leſſen the index of the power by unity; and laſtly, multiply the quantity thus produced by the fluxion of the root, and the laſt product will be the fluxion of the given power.

The inverſe Method of FLUXIONS, or having the fluxion given to find the flowing quantity or its fluent.

How from given fluxions to find the fluents, or flowing quantities themſelves, is a problem no leſs difficult than it is uſeful, and, in ſome caſes, almoſt impoſſible; and could it be completely and univerſally ſolved, it would, in a manner, render the ſcience of geometry complete, and ſet bounds to farther improvements.

Sir Iſaac Newton, the illuſtrious author of this diſcovery, tells us, in his Treatiſe of the Quadrature of Curves, that in order to find the fluents of given fluxions, we may aſſume a fluent at pleaſure; and that this aſſumption, which muſt be gathered from the conſideration of the nature of the fluxion itſelf, muſt be corrected, by putting the fluxion of the aſſumed fluent, equal to the fluxion propoſed, and comparing the homologous terms together: and after you have found the fluents of the given fluxions (if you doubt the truth of it), collect the fluxions of the fluents found, and compare them with the fluxions at firſt given; if they come out equal, the concluſion is right; if not, you muſt correct your fluents, ſo as to make their fluxions come out equal to the fluxion propoſed.

Now as the fluxions of flowing quantities are expreſſed by the ſame letters by which the fluents themſelves are with a tittle or point over them, ſo the fluents of the again are reſtored, by ſetting them down without it.

Thus, the fluent of the fluxion $b\dot{x}\pm c\dot{y}\pm d\dot{z}$, will b $bx\pm cy\pm dz\pm a$, where a denotes a conſtant quantity no determinate value, but taken at pleaſure.

For as a fluent may be either an expreſſion compoſed flowing quantities only, or may have, beſides, ſome co ſtant quantities, connected to it by the ſigns of + and − and as theſe conſtant quantities in bringing out the fluxi by the direct method, vaniſh and are loſt, their fluxio being equal to nothing; ſo it is neceſſary that the flu ſhould be expreſſed after ſuch a general manner, t it may repreſent indifferently any of all thoſe vari conſtant quantities, with which the flowing quanti themſelves might have been compounded, unleſs it known for certain that there are no ſuch quantities be connected, and then the fluent of the former flux will be ſimply $bx\pm cy\pm dz$; and in either caſe, if fluxions of theſe fluents be taken by the direct meth we ſhall have the fluxionary expreſſion firſt given, w ſhews that the aſſumptions are true.

Again, ſuppoſe it were required to find the fluent of this expreſſion $x\dot{y}+y\dot{x}$, aſſume it equal to $Axy \pm a$, where A repreſents any determinate quantity; then, by the direct method, the fluxion of $Axy \pm a$ will be $Ax\dot{y} \pm Ay\dot{x}$; and comparing this with the fluxion firſt given $x\dot{y} \pm y\dot{x}$, we ſhall find $A = 1$, whence xy is the fluent required.

Again, ſuppoſe the fluxionary expreſſion $xy\dot{z}+yz\dot{x}+zx\dot{y}$, were given, by aſſuming $Axyz \pm a$ for its fluent, and proceeding after the former manner, we ſhall find $A = 1$, whence xyz will be the fluent required; and hence ariſes this rule for finding the fluents of ſuch fluxionary products, where the fluxion of each particular flowing quantity is multiplied into the product of the reſt of the fluent quantities.

Rule.—Subſtitute, inſtead of each fluxion, its reſpective flowing quantity, and adding all the terms together, divide that ſum by the number of terms, and the quotient will give the fluent.

Hence the fluent $uxy\dot{z}+ux\dot{z}y+uyz\dot{x}+xyz\dot{u}$ will be found to be $uxyz$, by ſubſtituting u, x, y and z, in the room of $\dot{u}$, $\dot{x}$, $\dot{y}$ and $\dot{z}$ in the reſpective term, and dividing the ſum of the terms $uxyz+uxzy+uyzx+yzxu$, or $4xyuz$ by 4, the number of terms; and after the ſame way may the fluent of any ſuch fluxionary expreſſion be found.

Again, ſuppoſe the fluxionary quantity, whoſe fluent is required, were $nx^{n-1}\dot{x}$, aſſume Ax^n+a^n for the fluent required; then will its fluxion, by the direct method be $nAx^{n-1}\dot{x}$. Put this equal to the given fluxion, and we ſhall have $nAx^{n-1}\dot{x} = nx^{n-1}\dot{x}$; whence by comparing the homologous terms together, we ſhall find $A = 1$; whence the fluent will be $x^n \pm a^n$; and after the ſame manner the fluent of $mbz^{m-1}\dot{z}$ will be found to be $bz^m \pm a^m$, and by comparing theſe fluents with their reſpective fluxions, we may infer this general rule for finding the fluents of all fluxionary expreſſions that involve ſome power of the flowing quantity.

The rule.—Strike out the fluxionary letter, add unity to the exponent, and divide by the exponent ſo increaſed; the quotient is the fluent required.

Thus, if the fluxion $nx^{n-1}\dot{x}$ were propoſed, the fluent will be found to be x^n, by firſt rejecting the fluxionary letter; then adding unity to the exponent $n-1$, and dividing the whole by n, the exponent ſo increaſed.

And by comparing this, as well as the former methods, with the methods for finding the fluxions from given fluents, it will appear, that the fluents of ſimple fluxions, or ſuch as are not involved under a vinculum, are obtained by operations juſt the reverſe to theſe, whereby the fluxions are brought from their fluents; ſo that multiplication, depreſſing of powers of flowing quantities, and putting the fluxionary letters in the direct operation, are, in the inverſe operation, to be anſwered by diviſion, and that by the very ſame quantities as the multiplication was made, by the elevation of the flowing quantities, juſt as much as they are depreſſed, and by leaving out the ſame fluxionary letters as were in the former operations put in; and hence the fluent of $2x\dot{x}$ will be found to be x^2, of $4x^3\dot{x}$ to be x^4, of $x\dot{x}$, to be $\frac{xx}{2}$, of $x^3\dot{x}$ to be $\frac{x^4}{4}$ of $\frac{1}{2} \times x^{-\frac{1}{2}}\dot{x}$ to be $x^{\frac{1}{2}}$, of $\frac{3}{2} \times x^{\frac{1}{2}}\dot{x}$ to be $x^{\frac{3}{2}}$, of $\frac{5}{2} \times x^{\frac{3}{2}}\dot{x}$ to be $x^{\frac{5}{2}}$ of $\frac{x^2\dot{x}}{\sqrt{rx}}$, or $r \times x^{-\frac{1}{2}} \times x^2\dot{x}$, or $r^{-\frac{1}{2}} \times x^{\frac{3}{2}} \times \dot{x}$ to be $\frac{2}{5} \times r^{-\frac{1}{2}} + x^{\frac{5}{2}}$, or $\frac{2\sqrt{x^5}}{5\sqrt{r}}$.

And the ſame rules will hold good in finding the fluents of expreſſions, however compounded, where the terms conſiſt of certain powers of the flowing quantities multiplied into their reſpective fluxions.

Again, if the fluxional expreſſion be affected with a vinculum, that is, if there be ſome compound ſurd quantity multiplied into a fluxion, yet, if the fluxion ſtanding before the radical ſign, be the fluxion of the quantity contained under the radical ſign, the fluent, in this caſe, may be found by the general rules for powers already given. Thus, for example, if the fluxion propoſed be $\sqrt{ax-aa} \times a\dot{x}$, or $a\dot{x} \times \overline{ax-aa}^{\frac{1}{2}}$, becauſe the fluxion $a\dot{x}$, ſtanding before the radical ſign, is the fluxion of $ax-aa$, the quantity ſtanding under it, we muſt raiſe the quantity $\overline{ax-aa}^{\frac{1}{2}}$ to $\overline{ax-aa}^{\frac{1}{2}+1}$ or $\overline{ax-aa}^{\frac{3}{2}}$, and divide the quantity $\overline{ax-aa}^{\frac{3}{2}}$, thus elevated, by $\frac{3}{2}$, the index thus increaſed, and the quotient $\frac{2}{3}\overline{ax-aa}^{\frac{3}{2}}$, or $\frac{2ax-2aa}{3} \times \overline{ax-aa}^{\frac{1}{2}}$, or $\frac{2}{3} \times \overline{ax-aa} \times \sqrt{ax-aa}$, will be its fluent, or by putting z in the room of $\overline{ax-aa}^{\frac{1}{2}}$, the ſaid part of the fluxionary quantity given, we ſhall have $ax-aa = zz$, and $a\dot{x} = 2z\dot{z}$; whence $a\dot{x} \times \overline{ax-aa}^{\frac{1}{2}} = 2z^2\dot{z}$, and conſequently $\frac{2}{3}\overline{ax-aa}^{\frac{3}{2}}$, or $\frac{2}{3}\overline{ax-aa} \times \overline{ax-aa}^{\frac{1}{2}} = \frac{2}{3}z^3$ for the fluent of the given fluxion, the ſame as was before determined.

And although the fluxionary expreſſions, without the vinculum, be not the fluxions of the quantity contained under the vinculum, yet, if it has a conſtant ratio to it, the fluent may, notwithſtanding, be had in finite terms.

Thus, if the fluxionary quantity $x\dot{x} \times \overline{xx+aa}^{\frac{1}{2}}$ were given, were $x\dot{x}$ the fluxion without the vinculum, is to the quantity contained under the vinculum, as 1 to 2. If we put $\overline{xx+aa}^{\frac{1}{2}} = z$, we ſhall have $zz = xx+aa$, and by the direct method $2z\dot{z} = 2x\dot{x}$; whence $z\dot{z} = x\dot{x}$, and $z^2\dot{z} = x\dot{x} \times \overline{xx-aa}^{\frac{1}{2}}$, and conſequently $\frac{1}{3}z^3$, the flowing value of $z^2\dot{z}$, will be equal (by ſubſtituting $xx+aa$ in the room of zz, and $\overline{xx+aa}^{\frac{1}{2}}$, in the room of z) to $\frac{1}{3}\overline{xx+aa} \times \overline{x^2+a^2}^{\frac{1}{2}}$, the fluent of the given fluxion.

But if the fluxion without the vinculum be neither the fluxion of the quantity contained under it, nor bears any conſtant ratio to it; yet, notwithſtanding, in many forms of expreſſions the fluent may be had in finite terms.

Thus, if the fluxion $x^m \times \overline{a+x}^{\frac{1}{n}}$ were the expreſſions propoſed, if the exponent m be an integer, the fluent of the expreſſion may be had in finite terms.

And in all other caſes, when the flowing part of the quantity under the vinculum is raiſed to ſome power, and the fluxional expreſſion without the vinculum is only the fluxion of the root; in ſuch caſes the fluent itſelf cannot be had without having recourſe to an infinite ſeries.

After the ſame manner may the fluents of other fluxionary expreſſions of the ſame kind be found, by help of the general fluent.

The rules hitherto delivered for finding the fluents from firſt fluxions, will hold good in finding the fluents of ſecond, third, and fourth fluxions, &c. which likewiſe may be augmented or diminiſhed (and for the ſame reaſons as the fluents of the firſt fluxions were, by quantities that have no ſecond, third, fourth, &c. fluxions); and the ſame laws will obtain in all the ſuperior orders of quantities.

Several other methods might be ſhewn, for finding of fluents from given fluxions; but theſe that are exhibited are general, and properly adapted for the purpoſe.

FLY, in zoology, a large order of inſects, the diſtinguiſhing characteriſtic of which is, that their wings are tranſparent; by this they are diſtinguiſhed from beetles, butterflies, and graſshoppers. See the articles BEETLE, BUTTERFLY, &c.

FLY, in mechanics, a croſs with leaden weights at its ends, or rather a heavy wheel at right angles to the axis of a windlas, jack, or the like; by means of which the force of the power, whatever it be, is not only preſerved, but equally diſtributed in all parts of the revolution of the machine.

The fly may be applied to ſeveral ſorts of engines, whether moved by men, horſes, wind, or water, or any other animate or inanimate power; and is of great uſe in thoſe parts of an engine which have a quick circular motion, and where the power of reſiſtance act unequally in the different parts of a revolution. This has made ſome people imagine that the fly adds a new power; but though it may be truly ſaid to facilitate the motion, by making it more uniform, yet upon the whole it cauſes a loſs of power, and not an increaſe: for as the fly has no motion

of its own, it certainly requires a conſtant force to keep it in motion; not to mention the friction of the pivots of the axis, and the reſiſtance of the air. The reaſon, therefore, why the fly becomes uſeful in many engines, is not that it adds a new force to them, but becauſe, in caſes where the power acts unequally, it ſerves as a moderator to make the motion of revolution almoſt every where equal: for as the fly has accumulated in itſelf a great degree of power, which it equally and gradually exerts, and as equally and gradually receives, it makes the motion in all parts of the revolution pretty nearly equal and uniform. The conſequence of this is, that the engine becomes more eaſy and convenient to be acted and moved by the impelling force; and this is the only benefit obtained by the fly.

The beſt form for a fly is that of a heavy wheel or circle, of a fit ſize, as this will not only meet with leſs reſiſtance from the air, but being continuous, and the weight every where equally diſtributed through the perimeter of the wheel, the motion will be more eaſy, uniform, and regular. In this form, the fly is moſt aptly applied to the perpendicular drill, which it likewiſe ſerves to keep upright by its centrifugal force; alſo to a windlas or common winch, where the motion is quick; for in pulling upwards from the lower part, a perſon can exercife more power than in thruſting forward in the upper quarter; where, of courſe, part of his force would be loſt, were it not accumulated and conſerved in the equable motion of the fly. Hence, by this means, a man may work all day in drawing up a weight of forty pounds, whereas thirty pounds would create him more labour in a day without the fly.

FLY-BOAT, or FLIGHT, in the Dutch marine, certain merchant-ſhips of a very clumſy, uncouth built, nearly ſimilar to the genius of the builders: they are generally from four to ſix hundred tons, and diſtinguiſhed by a very high ſtern, like a Gothic turret above, and very broad buttocks below. See BUTTOCK.

FLYERS, in architecture, ſuch ſtairs as go ſtraight, and do not wind round; nor have the ſteps made tapering, but the fore and back part of each ſtair, and the ends, reſpectively parallel to one another; ſo that if one flight do not carry you to your intended height, there is a broad half ſpace, from whence you begin to fly again, with ſteps every where of the ſame length and breadth as before.

FLYING, the progreſſive motion of a bird, or other winged animal, in the liquid air. The parts of birds chiefly concerned in flying, are the wings, by which they are ſuſtained or waſted along. The tail, meſſrs. Willughby, Ray, and many others, imagine to be principally employed in ſteering and turning the body in the air, as a rudder: but Borelli has put it beyond all doubt, that this is the leaſt uſe of it, which is chiefly to aſſiſt the bird in its aſcent and deſcent in the air; and to obviate the vacillations of the body and wings; for as to turning to this or that ſide, it is performed by the wings, and inclinations of the body, and but very little by the help of the tail. The flying of a bird, in effect, is quite a different thing from the rowing of a veſſel. Birds do not vibrate their wings towards the tail, as oars are ſtruck towards the ſtern, but waft them downwards: nor does the tail of the bird cut the air at right angles, as the rudder does the water; but is diſpoſed horizontally, and preſerves the ſame ſituation what way ſoever the bird turns.

In effect, as a veſſel is turned about on its center of gravity to the right, by a briſk application of the oars to the left, ſo a bird in beating the air with its right wing alone, towards the tail, will turn its fore part to the left. Thus pigeons, changing their courſe to the left, would labour it with their right wing, keeping the other almoſt at reſt. Birds of a long neck alter their courſe by the inclinations of their head and neck, which altering the courſe of gravity, the bird will proceed in a new direction.

Artificial FLYING, that attempted by men, by the aſſiſtance of mechanics.

The art of flying has been attempted by ſeveral perſons in all ages. The Leucadians, out of ſuperſtition, are reported to have had a cuſtom of precipitating a man from a high cliff into the ſea, firſt fixing feathers, variouſly expanded, round his body, in order to break his fall. Friar Bacon, who lived five hundred years ago, not only affirms the art of flying poſſible, but aſſures us, that he himſelf knew how to make an engine wherein a man ſitting might be able to convey himſelf through the air, like a bird; and further adds, that there was then one who had tried it with ſucceſs; but this method, which conſiſted of a couple of large, thin, hollow copper globes, exhauſted of the air, and ſuſtaining a perſon who ſat thereon, Dr. Hook ſhews to be impracticable. The philoſophers of king Charles the Second's reign, were mightily buſied about this art. The famous biſhop Wilkins was ſo confident of ſucceſs in it, that he ſays, he does not queſtion but, in future ages, it will be as uſual to hear a man call for his wings, when he is going a journey, as it is now to call for his boots.

FLYING-ARMY, a ſmall body under a lieutenant or major general, ſent to harraſs the country, intercept convoys, prevent the enemy's incurſions, cover its own garriſons, and keep the enemy in continual alarm.

FLYING-BRIDGE. See the article BRIDGE.

FLYING-CAMP. See the article CAMP.

FLYING-FISH, a name given by the Engliſh writers to ſeveral ſpecies of fiſh, which, by means of their long fins, have a method of keeping themſelves out of the water a long time.

FLYING-PINION is part of a clock, having a fly, or fan, whereby to gather air, and ſo bridle the rapidity of the clock's motion, when the weight deſcends in the ſtriking part. See the article CLOCK.

FOAL, or COLT, the young of the horſe kind. The word colt, among the dealers, is underſtood of the male kind.

Foals are uſually foaled about the beginning of ſummer, and it is the cuſtom to let them run till Michaelmas with the mare, at which time they are to be weaned. Some however are of opinion, that a foal is rendered much ſooner fit for ſervice by being allowed to ſuck the whole winter, and weaned about Candlemas or Shrovetide. When firſt weaned, they muſt be kept in a convenient houſe, with a low rack and manger for hay and oats; the hay muſt be very ſweet and fine, eſpecially at firſt, and a little wheat bran ſhould be mixed with their oats, in order to keep their bodies open, and make them eat and drink freely.

When foals are kept up in the winter, they are not continually to be immured in the ſtable; but in the middle of the day, when the ſun ſhines warm, they ſhould always be allowed to play about for an hour or two, and when the winter is ſpent, they ſhould be turned into ſome dry ground where the graſs is ſweet and ſhort, and where there is good water, that they may drink at pleaſure. The winter after this, they may be kept in the ſtable without any further care than that which is taken of other horſes; but after the firſt year, the mare foals and horſe foals are not to be kept together.

There is no difficulty to know the ſhape a foal is like to be of; for the ſame ſhape he carries at a month, he will carry at ſix years old, if he be not abuſed in after keeping. As for his heighth, it is obſerved that a large ſhin bone, long from the knee to the paſtern, ſhews a tall horſe; for which another way is to ſee what ſpace he has between his knee and his withers, which being doubled, it will be his height when he is a full aged horſe. There are alſo means of knowing their goodneſs; for if they are of ſtirring ſpirits, free from frights, wanton of diſpoſition, and very active in leaping and running, and ſtriving for maſtery, they prove generally good mettled horſes. It is a good mark alſo if their hoofs be ſtrong, deep, tough, ſmooth, upright ſtanding, and hollow. For the manner of breaking them, ſee the article HORSE.

FOCUS, in geometry and conic ſections, is applied to certain points in the parabola, wherein the rays reflected from all parts of theſe curves meet and concur.

The word is Latin, and literally ſignifies a fire-hearth.

FOCI *of an Ellipſis*, are two points as F *f* (plate LXIV. *fig.* 6.) in the longeſt axis of the ellipſis; from each of which, if any two right-lines are drawn, meeting each other in the periphery of the ellipſis, as *f* N, F N, or *f* L, F L, their ſum will be always equal to the longeſt axis; and therefore, when an ellipſis and its two principal axis are

are given, and the foci are required, you need only take half of the longeſt, or tranſverſe axis, in your compaſſes, and ſetting one foot in the point where the ſhorteſt, or conjugate diameter, cuts the periphery, and the other foot will cut the longeſt axis in the foci required. See ELLIPSIS.

FOCUS *of an Hyperbola* is that point in the axis through which the latus rectum paſſes. See CONIC *Sections* and HYPERBOLA.

FOCUS *of a Parabola* is that point in the axis wherein the ſemi-ordinate is equal to the ſemi-parameter; or it is that point through which the latus rectum paſſes. See CONIC *Sections* and PARABOLA.

FOCUS, in optics, is the point wherein the rays are collected, after they have undergone refraction. See MIRROR and LENS.

It is ſo called becauſe the ſun's rays being united within a very ſmall compaſs or circle, are greatly conſtipated and condenſed; by which means their action or heat is proportionally increaſed, and therefore objects poſited in that point will be greatly heated, burnt, or melted.

Virtual FOCUS, in dioptrics, is the point from which refracted rays, when they are rendered divergent by refraction, begin to diverge.

FODDER, any kind of meat for horſes, or other cattle. In ſome places, hay and ſtraw, mingled together, is peculiarly denominated fodder.

FODDER, in the civil law, is uſed for a prerogative that the prince has, to be provided of corn and other meats for his horſes, by the ſubjects, in his warlike expeditions.

FODDER, in mining, a meaſure containing twenty-two hundred and an half weight, though in London but twenty hundred weight.

FODINA, in anatomy, the labyrinth of the ear. See EAR.

FOECUNDITY, or FECUNDITY, the ſame with fertility. See the article FERTILITY.

FOENICULUM, *Fennel*, in botany, an umbelliferous plant, with dark green leaves divided into long capillary ſegments: the umbels are ſomewhat concave, and have no leaves or cup at their origin: the ſeeds oval, flatted on one ſide, and naked with prominent ſtriæ on the other: the root oblong, ſtraight, white, and about the thickneſs of the finger.

FOENICULUM DULCE, ſweet fennel, with whitiſh or pale greeniſh yellow ſeeds, generally crooked. It is annual, a native of the warmer climates, and cultivated in our gardens. The ſhops are commonly ſupplied, from Germany, with ſeeds, ſuperior to thoſe of our own growth.

Sweet fennel ſeeds are an uſeful ſtomachic and carminative, of an agreeable aromatic ſmell, and a moderately warm ſweetiſh taſte. They are ſometimes given in powder, from a ſcruple to a dram; and ſometimes candied.

FOENICULUM VULGARE, common fennel, or finckle, with ſmaller dark coloured, almoſt blackiſh, ſeeds. It is perennial, a native of ſome of the ſouthern parts of Europe, and cultivated in our gardens.

The ſeeds of this ſpecies are warmer and more pungent, but leſs ſweet, and of a leſs grateful flavour than thoſe of the preceding; and the ſame difference obtains in the diſtilled waters, diſtilled oils, and the ſpirituous extracts of the two kinds.

The roots, taken up early in the ſpring, have a pleaſant ſweetiſh taſte, with a ſlight aromatic warmth; but nothing of the peculiar ſtrong flavour of the leaves and ſeeds. They are ranked among the aperient roots, and ſuppoſed by ſome to be equivalent in virtue to the celebrated ginſeng of the Chineſe, from which however they differ conſiderably in their ſenſible qualities. See GINSENG.

FOENUGREEK, *Fœnum Græcum*, in botany, a plant with oblong or roundiſh leaves, ſet three on a pedicle; and whitiſh papilionaceous flowers, which are followed by long crooked flattiſh pods, containing yellowiſh rhomboidal ſeeds furrowed from angle to angle. It is ſown annually in the ſouthern parts of Europe, from whence the ſeeds are brought to us.

The principal uſe of theſe ſeeds is in cataplaſms and fomentations, for ſoftening, maturating, and diſcuſſing tumours; and in emollient and carminative clyſters.

FOETOR, in medicine, ſtinking or fœtid effluvia, ariſing from the body, or any part thereof.

FOETUS, in phyſiology, denotes the child while it is contained in the mother's womb, but particularly after it is formed, till which time it is more properly called embryo. See the article GENERATION.

Formation of a FOETUS. The formation of the bones in a fœtus, is very gradually and regularly performed. In the firſt two months, there is nothing of a bony nature in the whole. After this, the hardneſs of the parts, where the principal bones are to be ſituated, becomes, by degrees, perceptible. Dr. Kerkring deſcribes the progreſs of the oſſification from ſkeletons, which he had prepared from fœtuſes of two months, and thence up to nine. In the firſt two months, or to the end of that time, there appears not any thing bony. After this, in the third and fourth months, the ſeveral parts, one after another, acquire their bony nature. In the firſt ſtages, every thing is membranous, where the bones are to be: theſe, by degrees tranſmigrate into cartilages; and from theſe, by the ſame ſort of change continued, the bones themſelves are by degrees formed. All this is done by nature, by ſuch ſlow though ſuch certain progreſſions, that the niceſt eye can never ſee it doing, though it eaſily ſees it when done.

Fœtuſes increaſe proportionably leſs, the longer they continue in the womb. Mauriceau pretends, that the increaſe of a fœtus is ſixty-four times its own weight in triple the time. Thus, he ſays, that, at the birth, a child weighs twelve pounds, of ſixteen ounces each; at the three months, it weighs three ounces; at one month, $\frac{3}{8}$ of a drachm; and at ten days leſs than half a grain.

FOG, or MIST, a meteor, conſiſting of groſs vapours, floating near the ſurface of the earth.

Miſts, according to lord Bacon, are imperfect condenſations of the air, conſiſting of a large proportion of the air, and a ſmall one of the aqueous vapour; and theſe happen in the winter, about the change of the weather, from froſt to thaw, or from thaw to froſt: but in the ſummer and the ſpring, from the expanſion of the dew.

If the vapours, which are raiſed plentifully from the earth and waters, either by the ſolar or ſubterraneous heat, do, at their firſt entrance into the atmoſphere, meet with cold enough to condenſe them to a conſiderable degree, their ſpecific gravity is, by that means, encreaſed; and ſo they will be ſtopped from aſcending, and return back, either in form of dew, or drizzling rain; or remain ſuſpended ſome time in the form of a fog. Vapours may be ſeen on the high grounds as well as the low, but more eſpecially about marſhy places: they are eaſily diſſipated by the wind, as alſo by the heat of the ſun: they continue longeſt in the loweſt grounds, becauſe theſe places contain moſt moiſture, and are leaſt expoſed to the action of the wind.

Hence we may eaſily conceive, that fogs are only low clouds, or clouds in the loweſt region of the air; as clouds are no other than fogs, raiſed on high. See CLOUD.

When fogs ſtink, then the vapours are mixed with ſulphureous exhalations, which ſmell ſo. Objects viewed through fogs, appear larger and more remote than through the common air. Mr. Boyle obſerves, that upon the coaſt of Coromandel, and the moſt maritime parts of the Eaſt-Indies, there are, notwithſtanding the heat of the climate, annual fogs ſo thick, as to occaſion thoſe of other nations who reſide there, and even the more tender part of the natives, to keep their houſes cloſe ſhut up.

FOGAGE, in the foreſt law, is rank graſs not eaten up in ſummer.

FOIL, among glaſs-grinders, a ſheet of tin, with quickſilver or the like, laid on the backſide of a looking-glaſs, to make it reflect. See FOLIATING and LOOKING-GLASS.

FOIL, among jewellers, a thin leaf of metal placed under a precious ſtone, in order to make it look tranſparent and give it an agreeable different colour, either deep or pale: thus, if you want a ſtone to be made of a pale colour, put a foil of that colour under it; or if you would have it deep, lay a dark one under it.

Theſe foils are made either of copper, gold, or gold and

and ſilver together: the copper foils are commonly known by the name of Nuremberg or German foils; they are prepared as follows: procure the thinneſt copper plates you can get; beat theſe plates gently upon a well poliſhed anvil, with a poliſhed hammer, as thin as poſſible; and placing them between two iron plates as thin as writing-paper, heat them in the fire; then boil the foils, in a pipkin, with equal quantities of tartar and ſalt, conſtantly ſtirring them till by boiling they become white; after which, taking them out, and drying them, give them another hammering, till they are made fit for your purpoſe: however, care muſt be taken not to give the foils too much heat, for fear of melting, nor muſt they be too long boiled, for fear of attracting too much ſalt.

The manner of poliſhing theſe foils is as follows: take a plate of the beſt copper, one foot long and about five or ſix inches wide, poliſhed to the greateſt perfection; bend this to a long convex, faſten it upon a half roll, and fix it to a bench or table; then take ſome chalk, waſhed as clean as poſſible, and filtred through a fine linen cloth, till it be as fine as you can make it; and having laid ſome thereof on the roll, and wetted the copper all over, lay your foils upon it, and with a poliſhing ſtone and the chalk, poliſh your foils till they are as bright as looking-glaſs; after which they muſt be dried, and laid up ſecure from duſt.

FOLIATING *of Looking-Glaſſes* is performed by fixing quickſilver on the reverſe ſurface, by means of plates of tin; which amalgamating or combining with the quickſilver, takes away its fluidity, and renders it ſo tenacious, as to be compreſſed into a very thin coat or plate, capable of adhering to the ſurface of the glaſs.

There are ſeveral manners of laying the quickſilver and tin on the glaſs; and it is by ſome practiſed, to uſe the quickſilver alone; and by others, to compound with it tin and lead; and biſmuth has likewiſe been frequently uſed inſtead of them: but it is not neceſſary, when the operation is well conducted, to make any addition to the quickſilver. The following is one of the beſt methods hitherto practiſed.

"A proper number of ſheets of thin paper muſt be procured; which paper ſhould be of a ſoft ſpongy nature, like that called blotting paper. This paper muſt be ſpread on a table with a very level even ſurface, and fixed very firmly; or it is better to uſe a marble table or ſlab; but ſo much only of the table ſhould be covered, as may form an area of the ſame figure with that of the glaſs to be ſilvered, a little enlarged. Over the ſurface of the paper muſt be ſprinkled ſome powdered chalk; which ſhould be rolled or beaten very thin, muſt then be laid upon the paper ſprinkled with chalk, in the moſt ſmooth and even manner: and where there is occaſion, on account of the ſize of the glaſs, to uſe more than one, they ſhould be joined with great exactneſs, rather ſuffering nevertheleſs the edge of one to bear on the other, than leaving any deficiency; ſo that the whole ſurface of the paper may be perfectly covered. Quickſilver is then to be poured upon theſe leaves of tin; and ſpread over every part of it by a hare's foot, or the feathered part of a quill. The ſheets of every thin ſmooth paper, of which the kind called fan paper is beſt, muſt be then laid over the quickſilver, leaving a margin beyond the quickſilver; and upon this paper the glaſs muſt be gently laid: and then, being preſſed down with the one hand, the paper muſt be gently drawn from under it with the other, by taking hold of the margin left for that purpoſe. The upper ſurface of the glaſs muſt then be covered with thicker paper, and a conſiderable weight put over it, in order to preſs out all the quickſilver that is not fixed by the tin; as well as to make it adhere the more firmly to the glaſs. When no more quickſilver appears to drain off, the weights and paper may be removed; and the operation will be complete."

Some, who uſe the biſmuth, add half an ounce of it to an ounce of the quickſilver, and make the amalgamation by melting the biſmuth, and then taking it off the fire, putting in the quickſilver gradually; and ſtirring it with an iron rod, or a tobacco-pipe, till the whole be thoroughly incorporated: when the maſs ſhould be poured into cold water, to prevent the quickſilver from ſubliming with the remaining heat. It is proper, nevertheleſs, before this compoſition be uſed, to ſtrain it through a cloth; and what remains, and will not be preſſed through, may be added to the next quantity to be incorporated. The proportion of tin and lead, when they are uſed in the ſame manner, is generally a compound of equal parts, in the proportion, when together, of a fourth part of the weight of the quickſilver. It has been alſo formerly practiſed, to uſe a compoſition of two parts of biſmuth, and one part of tin, with the ſame quantity of lead, and ten parts of the quickſilver.

Where the glaſſes with angular ſurfaces, called diamond-cut, are to be ſilvered, a border muſt be formed on the table of the figure of the glaſs, which may be done by a moveable frame. The paper, leaves, &c. muſt be brought over this border, and the ſubſequent proceeding may be the ſame, as in the caſe of the plain ſurface; only taking great care that the glaſs be properly let down within the border, ſo as to bear every where both on that and the ſurface of the table.

Globes of glaſs may be ſilvered; but as no preſſure can be given, the plates of tin cannot be uſed; and the quickſilver muſt therefore be rendered of a proper conſiſtence, by amalgamating it with ſome of the other metallic ſubſtances. The moſt approved method of doing this is as follows.

"Take of quickſilver two parts, of biſmuth two parts, and of tin and lead each one part. Melt the tin and lead together, and when they are fluid, add the biſmuth; when that is melted likewiſe, take them from the fire, and put the quickſilver gradually to them; ſtirring the mixture till the whole be united. After the maſs is become ſo cool, as not to endanger its breaking the glaſs, pour it into the globe to be ſilvered; uſing a funnel, which will carry it to the bottom of the globe. Move the glaſs then gently about, ſo that the amalgamated matter may flow over every part, and adhere to it; which will effectually ſilver the globe. When every part is covered, pour out the redundant quantity, and keep the glaſs ſtill, till it be perfectly cool. If, during the operation, the mixture is ſet in the globe, and be not ſufficiently liquid to flow about, and cohere with the glaſs, a gentle heat muſt be adminiſtred, which will remedy this defect; and if, on the contrary, the matter appear too fluid, and have not ſufficient tenacity to fix itſelf to the glaſs, it muſt be taken out, and an additional quantity of the biſmuth, tin, and lead, added, by means of a proper heat."

FOLIATION, a term uſed by ſome botaniſts to denote the corolla, or flower-leaves. See FLOWER and COROLLA.

FOLIO, in merchant books, denotes a page, or rather both the right and left hand pages, theſe being expreſſed by the ſame figure, and correſponding to each other. See BOOK-KEEPING.

FOLIO, among printers and bookſellers, the largeſt form of books, when each ſheet is printed, that it may be bound up in two leaves only.

FOLLICLE, *Folliculus*, among botaniſts, denotes a kind of ſeed veſſel, like the conceptaculum. See CONCEPTACULUM.

FOMAHANT, or FOMALHANT, in aſtronomy, a ſtar of the firſt magnitude in Aquarius, whoſe latitude is 29°. 19'. 11". north, and longitude 27°. 23'. 24". of Capricornus, according to Mr. Flamſtead's catalogue.

FOMENTATION, in medicine, the ſame with a liquid epithema, if applied hot; and is the bathing of any part of the body in a proper liquor, commonly made by a decoction of herbs in water, wine, milk, &c. being generally applied by means of ſtupes or doubled flannels, dipped in the medicated decoction, and all the liquor, if very hot, expreſſed out of them, leſt it ſhould ſcald the part, raiſe bliſters, &c. And it is farther obſervable, that a certain degree of heat will diſſolve and diſſipate a tumour, whilſt a higher degree of it will harden and make it ſchirrous.

The word is Latin, *fomentatio*, and derived from *fomento*, to foment.

FONT, among eccleſiaſtical writers, a large baſon in which water is kept for the baptizing of infants, or other perſons.

It is ſo called probably becauſe baptiſm was uſually performed among the primitive Chriſtians at ſprings or fountains.

FONTANELLA, in anatomy, the quadrangular aperture, between the os frontis and oſſa ſincipitis, in infants juſt born, which is alſo called fons pulſatilis.

FONTICULUS, or FONTANELLA, in ſurgery, an iſſue, ſeton, or ſmall ulcer made in various parts of the body, in order to eliminate the latent corruption out of it. See ISSUE, SETON, &c.

FONTINALIA, in Roman antiquity, a religious feaſt celebrated on October 13, in honour of the nymphs of wells and fountains.

FOOD implies whatever aliments are taken into the body, to nouriſh it. See DIET, DRINK, ALIMENT, &c.

FOOT, *Pes*, a part of the body of moſt animals whereon they ſtand, walk, &c.

FOOT, *Pes Magnus*, or great foot, in anatomy, denotes the extent from the juncture of the hip to the toe ends; but the foot, or leſſer foot properly ſo called, is divided into three parts, that is, tarſus, metatarſus, and toes.

The tarſus is the ſpace between the bones of the leg and the metatarſus; it is compoſed of ſeven bones. The firſt is called aſtragalus or talus; in its upper part it has a convex head, which is articulated with the two ſociles of the leg by ginglymus, being divided by a little ſinus which receives the ſmall protuberance in the middle of the ſinus of the tibia. And without this articulation we muſt always, in walking, have trod upon the heel with our fore foot, and upon our toes with our hind foot. The fore part of the aſtragalus, which is alſo convex, is received into the ſinus of the os naviculare. Below, towards the hind part of its under ſide, it has a pretty large ſinus, which receives the upper and hind part of the os calcis. But towards the fore part of the ſame ſide it has a protuberance, which is received into the upper and fore part of the ſame bone. Betwixt this ſinus and this protuberance, there is a cavity which anſwers to another in the os calcis, in which is contained an oily and mucous ſort of ſubſtance for moiſtening the ligaments, and facilitating the obſcure motion of theſe bones when we walk.

The ſecond bone of the tarſus is the calcaneum, os calcis, or heel-bone; it is the largeſt of the bones of the tarſus. It lies under the aſtragalus, to which it is articulated by ginglymus, as we have already deſcribed. Behind it is a large protuberance, which forms the heel, and into which the tendo achillis is inſerted; and before it, is a cavity which receives a part of the os cubiforme.

The third is the os naviculare or cymbiforme; it lies between the aſtragalus and the three oſſa cuneiformia: behind it is a large ſinus, which receives the fore convex head of the firſt; and before it is convex, diſtinguiſhed into three heads, which are received into the ſinus's of the oſſa cuneiformia.

The fourth, fifth and ſixth are called oſſa cuneiformia, becauſe they are large above, and narrow below; they lie all three at the ſide of one another; their upper ſide is convex, and their under hollow, by which means the muſcles and tendons in the ſole of the foot are not preſſed when we walk. At one end they have each a ſinus, which receives the os naviculare, and at the other end they are joined to the three inner bones of the metatarſus; the inmoſt of theſe bones is the biggeſt, and that in the middle the leaſt.

The ſeventh bone is called the os cubiforme, becauſe of its figure; it lies in the ſame rank with the oſſa cuneiformia: behind it is joined to the os calcis, before to the two outer bones of the metatarſus, and on its inſide is joined to the third os cuneiforme.

The bones of the metatarſus are five; that which ſuſtains the great toe is the thickeſt, and that which ſuſtains the next toe is the longeſt, the reſt grow each ſhorter than the other. They are longer than the bones of the metacarpus; in other things they are like them, and they are articulated to the toes, as they are to the fingers.

The bones of the toes are fourteen. The great toe has two, and the reſt have each three; they are like the bones of the fingers, only they are ſhorter.

In the toes there are ſometimes found twelve oſſa ſeſamoïdæa, as in the fingers.

FOOT, in the Latin and Greek poetry, a metre or meaſure, compoſed of a certain number of long and ſhort ſyllables.

Theſe feet are commonly reckoned twenty-eight, of which ſome are ſimple, as conſiſting of two or three ſyllables, and therefore called diſyllabic or triſyllabic feet; others are compound, conſiſting of four ſyllables, and are therefore called tetraſyllabic feet.

The diſyllabic feet are four in number, viz. the pyrrhichius, ſpondeus, iambus, and trocheus. See PYRRHICHIUS, &c.

The triſyllabic feet are eight in number, viz. the dactylus, anapæſtus, tribrachys, moloſſus, amphybrachys, amphimacer, bacchius, and antibacchius. See DACTYL, &c.

The tetraſyllabic are in number ſixteen, viz. the procleuſmaticus, diſpondeus, coriambus, antiſpaſtus, diiambus, dichoreus, ionicus a majore, ionicus a minore, epitritus primus, epitritus ſecundus, epitritus tertius, epitritus quartus, pæon primus, pæon ſecundus, pæon tertius, and pæon quartus. See the articles PROCLEUSMATICUS, &c.

There are ſeveral other ſorts of feet invented by idle grammarians, of five, ſix, or more ſyllables, but they are not worth the reciting. The number of feet each ſort of verſe contains, will be found under that particular verſe. See the articles HEXAMETER, &c.

Even and odd FOOT, in poetry, is a foot ſo denominated in reſpect of its ſituation in the verſe: thus, the firſt, third, and fifth foot of the verſe are uneven. This denomination of feet chiefly obtains in iambic verſe. See IAMBIC.

FOOT is alſo a long meaſure, conſiſting of 12 inches. See the article INCH.

Geometricians divide the foot into 10 digits, and the digit into 10 lines. See the articles DIGIT and LINE.

FOOT *Square* is the ſame meaſure, both in breadth and length, containing 144 ſquare or ſuperficial inches.

Cubic or *Solid* FOOT is the ſame meaſure in all the three dimenſions, length, breadth, and depth or thickneſs, containing 1728 cubic inches.

The foot is of different lengths in different countries. The Paris royal foot exceeds the Engliſh by nine lines; the ancient Roman foot of the Capitol, conſiſted of 4 palms, equal to 11 $\frac{4}{10}$ inches Engliſh; Rhineland or Leyden foot, by which the northern nations go, is to the Roman foot as 950 to 1000. The proportions of the principal feet of ſeveral nations, compared with the Engliſh, are as follow.

The Engliſh foot being divided in 1000 parts, or into 12 inches, the other feet will be as follow:

	1000 parts.	Feet.	inch.	lines.
London-foot	1000	0	12	0
Amſterdam	942	0	11	3
Antwerp	946	0	11	2
Bologna	1204	1	2	4
Bremen	964	0	11	6
Cologne	954	0	11	4
Copenhagen	965	6	11	6
Dantzick	944	0	11	3
Dort	1184	1	2	2
Frankfort on the Main	948	0	11	4
The Greek	1007	1	0	1
Lorrain	958	0	11	4
Mantua	1569	1	6	8
Mechlin	919	0	11	0
Middleburg	991	0	11	9
Paris royal	1068	1	0	9
Prague	1026	1	0	3
Rhineland or Leyden	1033	1	0	4
Riga	1831	1	9	9
Roman	967	0	11	6
Old Roman	970	0	11	8
Scotch	1005	1	0	$\frac{5}{7}$
Straſburg	920	0	11	0
Toledo	899	0	10	7
Turin	1062	1	0	7
Venice	1162	1	1	9

FOOT-BANK, or FOOT-STEP, in fortification, the ſame with banquette. See the article BANQUETTE.

FOOT-HUSKS, among botaniſts, ſhort heads, out of which flowers grow.

FOOT-LEVEL, among artificers, an inſtrument that ſerves as a foot-rule, a ſquare, and a level. See the articles LEVEL, RULE, and SQUARE.

FOOT-PACE, or HALF-PACE, among carpenters, a pair of ſtairs, whereon, after four or ſix ſteps, you arrive at a broad place, where you may take two or three paces before you aſcend another ſtep. The deſign of which is to eaſe the legs in aſcending the reſt of the ſteps. See the article STAIR-CASE.

FOOT-ROPES, among ſailors, the ſame with the horſes of the yards. See the article HORSE.

FORAMEN, in anatomy, a name given to ſeveral apertures, or perforations in divers parts of the body; as, 1. The external and internal foramina of the cranium or ſkull. 2. The foramina in the upper and lower jaw. 3. Foramen lachrymale. 4. Foramen membranæ tympani.

FORAMEN OVALE, an oval aperture or paſſage through the heart of a fœtus, which cloſes up after birth. It ariſes above the coronal vein, near the right auricle, and paſſes directly into the left auricle of the heart, ſerving for the circulation of the blood in the fœtus, till ſuch time as the infant breathes and the lungs are open; it being generally reckoned one of the temporary parts of the fœtus, wherein it differs from an adult, although almoſt all anatomiſts, Mr. Cheſelden excepted, aſſure us, that the foramen ovale has ſometimes been found open in adults.

The foramen ovale therefore, and the canal of communication in the fœtus are in reality no other than a ſort of ſubſidiary parts to the lungs formed only for a certain time, and to become uſeleſs and diſappear when the act of reſpiration has given the turn to the circulation of the blood, which it is to retain through the whole life of the animal. Dr. Trew affirms, that the membrane of the foramen ovale is ſo placed, as to permit the blood to paſs freely from the right auricle to the left, during the diaſtole of the auricles, but never from the left auricle to the right. See Phil. Tranſ. N° 457.

FORCE *of Bodies in Motion.*—It has been a famous diſpute among philoſophers, "Whether the force of bodies in motion, ſtriking each other, be proportional to the ſimple velocity of the motion, or to the ſquare of the velocity?" The Engliſh and French maintain the former, the Dutch and Germans the latter.

This diſpute firſt commenced between Mr. Huygens and the abbot Catalan, about the force of oſcillating bodies; it continued ſome time between theſe two gentlemen; at length, another ſubject of the ſame kind engaged the ſaid abbot with the famous Leibnitz, who is to be eſteemed the firſt author that plainly declared, in expreſs words, "That the forces of bodies were as their maſſes multiplied by the ſquare of the velocity."

Catalan, and afterwards Mr. Papin, anſwered Leibnitz; he replied again, and ſeveral papers were written on the ſubject. It then became a matter of general enquiry, and the philoſophers of every nation began to conſider which ſide to be of, and whether they ſhould declare for the old or for the new opinion. However, they did here, as they do in religion, go by a whole nation together; the common herd of philoſophers following the dictates of their leaders. Thus Leibnitz, Polenus, s'Graveſande, and Muſchenbroek led the German and Dutch; Papin, Mairan, &c. the French; and Pemberton, Eames, Deſaguliers, Clarke, &c. the Engliſh.

As it uſually falls out in other caſes, ſo here, when men find themſelves preſſed with difficulties and abſurdities in their ſchemes and notions, they have recourſe to the ſubtilties of metaphyſical diſtinctions, though ſeldom to any good purpoſe. Thus when it appeared too plainly by all experiments, and even to common ſenſe, that the natural force of bodies was proportional to the ſimple velocity and maſs of matter conjointly; we were told it was neceſſary to diſtinguiſh the force of bodies into two kinds, viz. the vis viva or living force; and the vis mortua, or the dead force.

By this vis viva, or living force, we were to apprehend that which reſulted from the viſible action of one body upon another, as that of a falling weight; but the vis mortua or dead force was to be underſtood of that which was deſtroyed by a contrary agent, as a weight in one ſcale of a balance is kept from deſcending by a counterpoiſe in the other ſcale. But, unluckily for the author of this refinement, both thoſe forces appear, even by the balance, to be in the ratio of the ſimple velocity into the maſs.

Thus for the living force, if on the proportional balance you place 4 ℔. at the diſtance of ſix inches on one ſide, and 2 ℔. at the diſtance of twelve inches on the other ſide, and, if the balance be put into motion, they will each of them have a vis viva, or an active force, becauſe they will keep the beam in motion for ſome time, till, by militating, they murder or kill each other; and then ſurely enough they become vires mortuæ, or dead forces.

But let us ſee how they exerted their power, while living. One (A) acted againſt the other (B), with the gravity of every particle in a maſs of 4 ℔. and with the velocity in each ſtroke that ſix inches diſtance could give; but, ſince all allow the weight to be as the maſs of matter, and the velocity as the diſtance from the center of motion, therefore all the force which A exerted was as $4\times6=24$. In the ſame manner it is ſhewn the whole force of B acting againſt A was as $2\times12=24$; that is, in each caſe, the force was as the velocity into the maſs of matter: and, becauſe they were equal, they deſtroyed each other.

But, had thoſe combatants A and B been armed with forces proportioned to the ſquares of the velocities, that of A would have been but $4\times6\times6=144$; whilſt B would have had a force equal to $2\times12\times12=288$; by which he would have demoliſhed A at one ſingle ſtroke, and been the ſurviving conqueror.

Let us now conſider theſe two bodies A and B as dead, and ſee what forces they exert in that ſtate. In order to this they muſt be hanged upon the arms of the balance, one on each ſide, till they are dead, i. e. motionleſs; but this will not happen till their diſtances from the center of motion become reciprocally proportional to their maſſes of matter; and then it is plain the caſe is the ſame as before; for the dead force of A will be as $4\times6=24=2\times12=$ dead force of B. Whereas, if theſe forces were as the maſſes into the ſquare of the velocities, A of 4 ℔. and B of 2 ℔. ought to die at the diſtances 6 and 8, 4 inches from the center reſpectively; but, if the experiment be tried there, ſuch ſtrong ſymptoms of life will be found in A, as manifeſt the falſity of this hypotheſis.

Being driven from this ſubterfuge, they ſeek another in a critical diſtinction between force and preſſure. Preſſure, ſay they, is the power with which bodies act by means of inſtruments; thus a weight in one ſcale acts againſt the weight in another by preſſure; but the power by which bodies act on each other alone, is properly called Force, as when one ſtone ſtrikes another by falling on it, or a hammer ſtrikes an anvil. The former they allow is proportional to the velocity and maſs of matter conjointly; but the latter, they ſay, is as the maſs multiplied by the ſquare of the velocity.

But this eclairciſſement boots them as little as the former, if they mean a momentary impact or ſtroke, or ſuch whoſe effect is produced in a moment of time. For in ſuch a caſe we ſay, the ſtroke is in proportion to the maſs of matter, and alſo to the degree of velocity, and therefore as both conjointly; but we deny there is any other ſource of power from whence a body can derive any force for producing a momentary effect: nor have any of thoſe gentlemen been able to ſhew there is, though ſome, bewildered in the labyrinth, have attempted it, but in how weak and ridiculous a manner may be ſeen in a piece intitled, De conſervatione virium vivarum, &c. And it is worth the reader's while to ſee the jocular confutation of this ludicrous piece by Phileleutherus Londinenſis.

If they ſay, they would not be underſtood of momentaneous effects, but ſuch as are produced in time, then they have no antagoniſts. And, it is plain from their experiments, that this is their meaning, after all. For their experiments, which they ſo much inſiſt on, are ſuch as are made by letting bodies fall on ſoft ſubſtances, as clay, butter, &c. or by the action of bodies on yielding ſprings, or ſpringy bodies; in all which caſes, the effect

is

is not produced inſtantaneouſly, but in time; the clay takes time to recede, the ſpring to bend, &c.

If the time be taken into conſideration, then every body muſt know that the effect will be proportional to the intenſity of the cauſe, and the time of its continuance: thus, for example, the effect of gravity on bodies left to themſelves cauſes them to deſcend; their deſcent therefore will be proportionate to the power of gravity upon them, and therefore greater in thoſe which fall freely, than in others which deſcend on inclined planes in a given time, where part of the force of gravity is deſtroyed by the re-action of the plane. But, ſince the action of gravity is not inſtantaneous, but continual, therefore its effect, i. e. the deſcent of the body, will be greater in proportion to the time of its continuing to act on the body, ſeparately conſidered from its intrinſic force. But this force is as the velocity produced by it in a given time; alſo the time is as the velocity, when the force is given; therefore the effect, viz. the deſcent of the body, is as the ſquare of the velocity.

Or in ſymbols thus: let E = the effect produced by any power = P, acting in any ſpace of time = T, upon any body = Q, moving with any degree of velocity V. Then it is plain, E will be as Q = maſs of matter in the body, when P, T, and V are given; alſo the effect E will be as the intenſity of the power P, when T, Q, and V are given; again, when P, Q, T are given, E muſt be as V; and laſtly, we ſhall have E as T, when P, Q, V are given. Therefore, when neither of theſe are given, E : Q × P × V × T; and, in caſe of any different effect, let $e : q \times p \times v \times t$.

Then ſuppoſing the bodies equal, viz. $Q = q$, we have $E : e :: P V T : p v t$. Thus the ſame or two equal bodies, deſcending on two planes unequally inclined, will deſcend through ſpaces, which will be as the different powers of gravity P and p, as the different velocities V and v in any point of time, and as the different times T and t of their deſcent, conjointly.

If not only the bodies Q and q, but alſo the powers P and p which actuate them, be ſuppoſed equal, or $P = p$; then $E : e : T V : t v$. Thus, in equal bodies falling freely by gravity, the effect, or the ſpace which they deſcribe, will be as the time T and t of the falls, the velocities V and v at any point of time in the fall. And becauſe in this caſe the velocity is always proportional to the time, that is, $T : t :: V : v$; if we multiply each ratio by the ſame ratio $V : v$, the analogy will ſtill be the ſame. viz. $T V : t v :: V^2 : v^2$; whence $E : e :: V^2 : v^2$; or the effect of falling bodies, in deſcribing the ſpace, will be as the ſquare of the velocities.

If we ſuppoſe the times given, that is, $T = t$, then (the reſt as before) we have $E : e :: V : v$; that is, the forces or effects of equal bodies, falling in equal times, are proportional to the ſimple velocities.

If $V = v$, or the velocities given, then $E : e :: T : t$. Thus, if two equal bodies, lying on an horizontal plane, receive a ſtroke each from ſprings of equal force, then will the velocites be equal in every part of the motion, and the effects E and e, in this caſe, being the ſpaces deſcribed, will be as the times of their motion.

Hence we have ſeen every poſſible caſe wherein the forces of bodies or their effects can be ſuppoſed to vary; and it is plain there is none where the force is as the ſquare of the velocity but where the time is concerned; or where ſome one of the factors Q, P, V, T, is proportional to the velocity; thus in ſpouting-water, becauſe Q is always as V, therefore, though T be given, E will be as QV, or as V^2; for P alſo in this caſe is given, the power of gravity which gives motion to the particles of the fluid being always conſtant. Nor have they any experiment which ſhews the force or effects of bodies proportional to the ſquares of the velocities, but where the time in which the effect is produced ought to be conſidered. Thus in their famous experiment of cavities, formed in ſoft clay by falling bodies, it is true, thoſe cavities are the effect of the falling bodies, and proportional to the ſquares of the velocity. But what is this to the purpoſe, unleſs they will ſay, thoſe pits are inſtantaneouſly produced, which we preſume none will pretend to do?

It is evident, this cavity muſt be proportional to the quantity of matter put in motion in the clay, by the falling body; but this is proportional to the velocity on two accounts; the firſt is, that every particle which comes in contact with the ſtriking body, receives a ſtroke proportional to the velocity; therefore alſo the number of particles which each of theſe can move, will be as the force of the ſtroke, or as the velocity of the falling body. Secondly, among yielding particles, the number which the falling body can apply to in a given time, will be as the velocity; conſequently the whole number of particles which can be moved, both immediately by the body itſelf, and by the motion communicated to the particles, will be as the ſquare of the velocity; and therefore the cavity will be in the ſame ratio alſo.

We hence obſerve, the ſame method of reaſoning may be applied to ſoft and yielding ſubſtances, as has always been uſed in the caſe of unelaſtic fluids; and for this reaſon only, that, in every caſe of yielding particles, the effect of a body in ſtriking them is not deſtroyed momentaneouſly, but in time, which time, cæteris paribus, will be as the velocity; and therefore, E being as T V, and T, in all theſe caſes, being as V, it will be univerſally for all ſoft and yielding ſubſtances $E : V^2$.

Hence we may obſerve, that as bodies are more or leſs yielding or ſoft, ſo the effect will be more or leſs approaching to the ratio of the ſquare of the velocity. This conſideration is of great uſe in mechanical affairs. Thus a hammer with a double velocity will produce much more than a double effect in driving a nail; the ſame may be ſaid of a rammer driving a pile: hence the reaſon why a ſmaller hammer will by its velocity do more execution upon a red-hot iron, than the large hammer by its momentum. In ſhort, all theſe things are ſo plain and eaſy to be underſtood, that is ſurprizing to think how ſuch a diſpute could ſubſiſt ſo long, and occaſion ſo much to be ſaid about it.

The learned Dr. Jurin, in the Philoſophical Tranſactions, N° 476, propoſes the following experiment, which he looks upon as ſufficient to put a final end to his controverſy, which has now ſubſiſted above ſeventy years.

Upon an horizontal plane, at reſt, but moveable with the leaſt force, ſuppoſe upon a boat in a ſtagnant water, let there be placed, between two equal bodies, a bent ſpring, by the unbending of which the two bodies may be puſhed contrarywiſe.

In this caſe it is evident, that the velocities, which the two bodies receive from the ſpring, will be exactly equal and their moving forces will alſo be exactly equal; and that the plane they move upon, and alſo the boat upon which it lies, will have no motion given them either way. Let us call the velocity of each body 1, and the moving force alſo 1.

Now, let us ſuppoſe the ſpring to be bent afreſh to the ſame degree as before, and to be again placed between the two bodies lying at reſt; then let the plane, upon which the ſpring and the bodies lie, be carried uniformly forwards, in the direction of the length of the ſpring, with this ſame velocity 1. In this caſe it is manifeſt, that each of the bodies will have the velocity 1, and the moving force 1, both in the direction of the axis of the ſpring.

During this motion, let the ſpring again unbend, and puſh the two bodies contrary ways, as before, the one forwards, the other backwards: then the ſpring will give to each of theſe bodies the velocity 1, as before when the plane was at reſt.

By this means the hindmoſt body, or that which is puſhed backwards, will have its velocity 1, which it had before by the motion of the plane, now intirely deſtroyed, and will be abſolutely at reſt.

But the body, which is puſhed forwards, will now have the velocity 2, namely, 1 from the motion of the plane, and 1 from the action of the ſpring.

Thus far every body agrees in what will be the event of this experiment.

But the queſtion is, what will be the moving force of the foremoſt body, or of that which is puſhed forwards, and which has the velocity 2; viz. 1 from the motion of the plane, and 1 from the action of the ſpring?

By the Leibnitian doctrine, its moving force muſt be

4: and, if ſo, it muſt have received the moving force 3 from the action of the ſpring; for it had only the moving force 1 from the motion of the plane.

Let us examine, whether this be poſſible, or reconcileable to their own doctrine.

Their doctrine is, that equal ſprings, equally bent, will, by unbending themſelves, give equal moving forces to the bodies they act upon, whatever thoſe bodies are.

We agree to this, not generally indeed; but in the caſe before us, where the bodies are of equal maſſes or weights, we agree to it.

Let us therefore imagine the bent ſpring, which is placed between the two bodies, to be divided tranſverſly into two equal parts. In this caſe it is plain, that the two halves of the ſpring may be conſidered as two intire ſprings, equal, and equally bent, each of which reſts at one end in equilibrio againſt the other ſpring, and, at the oppoſite end, preſſes againſt the body it is to move.

Conſequently, by the Leibnitian doctrine, to which, in this particular caſe where the bodies are equal, we alſo agree, the two ſprings will give equal moving forces to the two bodies. But the moving force, received by the hindmoſt body from the hinder ſpring, was undoubtedly the moving force 1: for, by that force given it in the direction backwards, the moving force 1, which it had before from the motion of the plane in the direction forwards, is exactly balanced and deſtroyed, the body remaining, as was obſerved before, in abſolute reſt. Therefore the moving force, received by the foremoſt body from the foremoſt ſpring, was alſo the moving force 1. And this, added to the other moving force 1, which it had before from the motion of the plane, makes the moving force 2, and not the moving force 4, as the Leibnitian philoſophers pretend.

Conſequently, that body, which had before the velocity 1, and the moving force 1, and now has the velocity 2, has alſo the moving force 2: that is, the moving forces are proportional to the velocities.

Attractive FORCE, *Central* FORCE, *Centrifugal* FORCE, *Centripetal* FORCE, FORCE *of the Heart*, FORCE *of the Wind*, } See { ATTRACTION. CENTRAL *Force*. CENTRIFUGAL *Force*. CENTRIPETAL *Force*. HEART. ANEMOMETER.

FORCE, in law, ſignifies any unlawful violence offered to things or perſons.

FORCEPS, in ſurgery, &c. an inſtrument that is well known, of which there are ſeveral ſorts, adapted to various operations. Their uſes are to lay hold of any thing and extract it from the body.

FORCER, or FORCING-PUMP, in mechanics, is a kind of pump in which there is a forcer or piſton, without a valve. See PUMP.

FORCIBLE, in law, ſomething done illegally. See the article FORCE.

FORCING, among gardeners, ſignifies the making trees produce ripe fruit before their uſual time. This is done by planting them in a hot bed againſt a ſouth-wall, and likewiſe defending them from the injuries of the weather by a glaſs frame. They ſhould always be grown trees, as young ones are apt to be deſtroyed by this management. See HOT-BED.

The glaſſes muſt be taken off at proper ſeaſons, to admit the benefit of freſh air, and eſpecially of gentle ſhowers.

FORCING *of Wine*. See WINE.

FORE-CASTLE, in ſhip-building, a ſhort deck which reaches from the top of the ſtem to the after part of the fore-ſhrouds; or it commonly reaches as far behind, or abaft, the fore-maſt, as it is from the maſt to the upper part of the ſtem.

FORE-CLOSED, in law, ſignifies the being ſhut out, and excluded, or barred, the equity of redemption on mortgages, &c.

FORE-FOOT, in ſhip-building, a piece of crooked timber, the lower part of which is bolted to the fore-end of the keel, of which it is a part, and the upper part laid on and bolted to the foot of the ſtem, of which it is alſo a part. See this fully explained in the article SHIP-BUILDING.

FOREIGN, in general, is applied to a perſon born in ſome other prince's dominions, or any thing brought from thence, and is oppoſed to native. In phyſic it is applied to any preternatural ſubſtance, either from without, or generated internally in the human body.

FOREIGN *Appoſer*, or *Oppoſer*, an officer in the court of Exchequer, to whom all ſheriffs and bailiffs repair to be appoſed by him of their green wax, after they have been appoſed of their ſums out of the Pipe-Office; and from thence he draws down a charge upon one of them to the clerk of the Pipe. His buſineſs is alſo to examine the ſheriff's eſtreats with the record, and to aſk the ſheriff what he ſays to every particular ſum therein.

FOREIGN *Plea*, a refuſal of the judge as incompetent, becauſe the matter in hand was not within his precinct.

FOREIGN *Service*, is ſuch ſervice, whereby a mean lord holdeth of another, without the compaſs of his own fee; or that which a tenant performeth either to his own lord, or to the lord paramount of his own fee.

FOREIGNER, the natural born ſubject of ſome foreign prince.

FORE-JUDGED, in law, ſignifies a judgment, whereby one is deprived, or put by a thing in queſtion.

FORELAND, in the ſea-language, the ſame with a cape. See the article CAPE.

FORELAND in fortification, the ſame with liziere. See the article LIZIERE.

FORE-LOCKS, little wedges of iron thruſt to the ends of the bolts in a ſhip's ſide, to prevent them from drawing as the ſhip labours at ſea.

FORELORN-*Hope*, in the military art, ſignifies men detached from ſeveral regiments, or otherwiſe appointed, to make the firſt attack in day of battle; or at a ſiege, to ſtorm the counterſcarp, mount the breach, or the like.

They are ſo called from the great danger they are unavoidably expoſed to; but the word is old, and begins to be obſolete.

FORE-MAST. See the article MAST.

FORE-REACHING, or, in the ſea-language, the act of making a greater progreſs forward than another ſhip; as the Tartar fore-reaches on the Eagle, i. e. advances quicker, or gains ground of her.

FORE-SKIN, in anatomy, the ſame with prepuce. See the article PREPUCE.

FOREST, *Sylva*, in general, a great wood, or a large extent of ground covered with trees.

FORE-STAFF, or CROSS-STAFF, a mathematical inſtrument uſed to take the ſun's altitude.

This inſtrument conſiſts of a ſtaff and four croſſes, viz. the tenth croſs, the thirtieth croſs, the ſixtieth croſs, and the ninetieth croſs.

The ſtaff is a ſquare piece of wood on which the croſſes ſlide, each ſide being graduated into diviſions: the firſt ſide has from about three degrees to ten delineated on it; the ſecond from ten to thirty; the third from twenty to ſixty; and the fourth from thirty to ninety.

The tenth croſs, ſo called from its belonging to that ſide of the ſtaff, which is numbered from three to ten degrees, is the ſhorteſt of the four croſſes, and is to be uſed when the ſun's altitude is under ten degrees. Sometimes the breadth of the thirtieth croſs ſupplies its place.

The thirtieth croſs is longer than that of ten, and belongs to that ſide of the croſs which is numbered from ten to thirty, whence it has its name: when the ſun's altitude is between ten and thirty degrees, this croſs is to be uſed.

The third, or ſixtieth croſs, ſo termed from belonging to that ſide of the ſtaff, which is numbered from twenty to ſixty, is longer than the former, and is to be uſed when the ſun's altitude is between thirty and ſixty degrees.

The fourth croſs is called the ninetieth croſs, becauſe it belongs to that ſide of the ſtaff which is numbered from thirty to ninety degrees. This croſs is uſed when the ſun's altitude is between ſixty and ninety degrees.

The ſeveral diviſions on the ſtaff are conſtructed after the following manner.

Let

Let A B (plate LXIV. *fig.* 7.) repreſent the ſide of the ſtaff to be divided; with any convenient radius, ſetting one foot of the compaſſes in A, with the other deſcribe the ſemicircle D E C, and draw the diameter D A C, at right angles to A B: divide each quadrant into ninety equal parts or degrees; at the diſtance of half the length of the croſs, draw the lines F *f*, G *g*, parallel to A B, and from the center of the circle draw right lines through the ſeveral diviſions of the quadrants; and, from the interſections of thoſe right lines with the two parallel lines F *f*, G *g*, draw right lines interſecting the ſtaff A B, which will give the ſeveral diviſions: thus the line F G, interſecting the ſtaff A B, in the point *a*, will give the diviſion of twenty degrees, becauſe the angle F A G = twenty degrees: and after the ſame manner, and by making uſe of the length of the ſeveral croſſes, may the four ſides of the ſtaff be divided.

To take the ſun's altitude with the FORE-STAFF.—Having adapted the proper croſs to the ſtaff, apply the flat end of the ſtaff at A, (*fig.* 8.) to the outſide of the eye, the face being turned towards the ſun; look for the object at the upper end of the croſs at C, and at the lower end B for the horizon; but, if the ſky appear inſtead of the horizon, ſlide the croſs nearer to the eye; if the ſea appear, remove it farther from the eye, till the object appear at the end C, and, at the ſame time, the horizon at the end B; then will the croſs cut, on the ſide of the ſtaff proper to it, the degree and minute of altitude. But, if the meridian altitude be required, the obſervation muſt be continued, and as the object approaches the meridian, the ſky will appear at the end B, inſtead of the horizon; but, when the object begins to deſcend, the ſea will appear at the end B, and then is the obſervation finiſhed, and the croſs will cut the degrees, &c. of altitude.

FORESTALLER, a perſon who is guilty of foreſtalling.

FORESTALLING, in law, buying or bargaining for any corn, cattle, victuals, or merchandize, in the way as they come to fairs or markets to be ſold, before they get thither, with an intent to ſell the ſame again at a higher price.

FORESTER, a ſworn officer of the foreſt, appointed by the king's letters patent, to walk the foreſt at all hours, watch over the vert and veniſon; alſo to make attachments and true preſentments of all treſpaſſes committed within the foreſt.

FORE-TOP-MAST. See the article TOP-MAST.

FORFEITURE, properly ſignifies the effect of tranſgreſſing ſome penal law, and extends to lands or goods.

Forfeiture differs from confiſcation, in that the former is more general, whilſt confiſcation is particularly applied to ſuch things as become forfeited to the king's Exchequer; and goods confiſcated, are ſaid to be ſuch as no perſon claims.

FORFICULA, the ear-wig, in zoology, a troubleſome inſect, which takes its Engliſh name from its introducing itſelf into people's ears, where it cauſes a great deal of pain, and its Latin name, *forficula*, from its forked tail, which is a ſort of forceps, capable of pinching. The exterior wings are very ſhort or dimidiated, and wholly cover the inner ones. The antennæ are long and ſlender, conſiſting of thirteen or fourteen articulations.

FOREFIELD, among miners, the fartheſt place of a meer of ground.

FORGE, properly ſignifies a little furnace, wherein ſmiths, and other artificers of iron or ſteel, &c. heat their metals red hot, in order to ſoften and render them more malleable and manageable on the anvil. See FURNACE.

The forge uſed by the ſeveral operators in iron, is very ſimple: we ſhall inſtance in that of the blackſmiths, to which all the reſt are reducible, the conſtruction of which is as follows. The hearth or fire-place of the forge, marked A, (See plate of Smithery, *fig.* 9.) is to be built up from your floor with brick, about two feet and an half, or ſometimes more, according to the purpoſe you deſign to forge for: if your forge be intended for heavy work, your hearth muſt lie lower than it need be for light work: the forge may be of what breadth is thought convenient. It may be built with hollow arches underneath, to ſet ſeveral things out of the way: the back of it is built upright to the top of the cieling, and incloſed over the fire-place with a hovel, which ends in a chimney, to carry away the ſmoke, as at B. In the back of the forge, againſt the fire-place, is fixed a thick iron-plate, and a taper pipe in it, about five inches long, which pipe comes through the back of the forge at C. Into this taper pipe is placed the noſe or pipe of the bellows: the office of this tewel is to preſerve the pipe of the bellows and the back of the forge about the fire-place, from burning. Right before the back is placed, at about two feet diſtance, the trough, which reaches commonly the whole breadth of the forge, and is as broad as is thought neceſſary, as at D. The bellows is placed behind the back of the forge, having one of its boards ſo fixed, that it can neither move upwards nor downwards. At the ear of the upper board is faſtened a rope or chain at E, which reaches up to the rocker, and is faſtened there to the further end of the handle, at F. This handle is faſtened acroſs a rock-ſtaff, which moves between two cheeks upon the center pins, in two ſockets, at G; ſo that by drawing down this handle, the moving board of the bellows riſes; and by a conſiderable weight ſet on the top of its upper-board, ſinks down again, and by this agitation performs the office of a pair of bellows. See BELLOWS and SMITHERY.

FORGE is alſo uſed for a large furnace, wherein iron-ore, taken out of the mine, is melted down; or it is more properly applied to another kind of furnace, wherein the iron-ore, melted down and ſeparated in a former furnace, and then caſt into ſows and pigs, is heated and fuſed over again, and beaten afterwards with large hammers, and thus rendered more ſoft, pure, ductile, and fit for uſe.

Of theſe there are two kinds: the firſt is called the finery, where the pigs are worked into groſs iron, and prepared for the ſecond, which is called the chafery, where it is further wrought into bars fit for uſe. See the articles FORGING, FINERY, and CHAFERY.

FORGERY, in a legal ſenſe, is where a perſon fraudulently makes and publiſhes falſe writings to another's prejudice: or, it ſignifies the writ that lies againſt him who offends that way.

Forgery is either at common law, or by ſtatute; and is an offence puniſhable by indictment, information, &c. and not only where a perſon makes a falſe deed, but where any fraudulent alteration is made of a true one, in a material point thereof. Likewiſe a writing may be ſaid to be forged, where one being directed to draw up a will for another, does inſert ſome legacies therein falſely of his own head; though, in ſuch caſes, there is no forgery of the hand or ſeal of the party: but a perſon cannot regularly be guilty of this crime by an act of omiſſion, unleſs it alters the limitation of an eſtate to another, in which caſe it may be forgery. By a ſtatute of George II. c. 25. the forging or counterfeiting any deed, will, bond, bill, note, &c. with intent to defraud any perſon, or publiſhing ſuch falſe deed, bond, &c. knowingly, is declared to be felony; and the offender ſhall ſuffer death. The king may pardon the corporal puniſhment of forgery which tends to public example, though the plaintiff cannot releaſe it: yet, in an extraordinary caſe, a forgery has been compounded, and the defendant diſcharged on paying a ſmall fine.

FORGING, in ſmithery, the beating or hammering iron on the anvil, after having firſt made it red-hot in the forge, in order to extend it into various forms, and faſhion it into works. See FORGE.

There are two ways of forging and hammering iron; one is by the force of the hand, in which there are uſually ſeveral perſons employed, one of them turning the iron and hammering likewiſe, and the reſt only hammering. The other way is by the force of a water-mill, which raiſes and works ſeveral large hammers beyond the force of men; under the ſtrokes of which the workmen preſent large lumps, or pieces of iron, which are ſuſtained at one end by the anvils, and at the other by iron chains faſtened to the cieling of the forge. See MILL.

This laſt way of forging is only uſed in the largeſt works, as anchors for ſhips, &c. which uſually weigh

ſeveral thouſand pounds. For lighter works, a ſingle man ſerves to hold, heat, and turn with one hand, while he hammers with the other.

Each purpoſe the work is deſigned for, requires its proper heat; for if it be too cold, it will not feel the weight of the hammer, as the ſmiths call it, when it will not batter under the hammer; and if it be too hot, it will red-ſear, that is, break or crack under the hammer.

The ſeveral degrees of heats the ſmiths give their iron, are, firſt, a blood-red heat; ſecondly, a white flame heat; and thirdly, a ſparkling or welding heat. See the article HEAT.

FORM, *forma*, in phyſics, the eſſential or diſtinguiſhing modification of the matter whereof a natural body is compoſed, ſo as thereby to give it ſuch a particular manner of exiſtence, being that which conſtitutes it ſuch a particular body, and diſtinguiſhes it from every other body.

FORMS *of Syllogiſms*, or *Syllogiſtic* FORM, among logicians, a juſt diſpoſition both of the terms, in reſpect of predicate and ſubject; and of the propoſitions, in reſpect of quantity and quality: by which is only meant a diſpoſition wherein the concluſion follows duly and legitimately from the two premiſes; there being no form, where there is no concluſion. See the article SYLLOGISM.

FORM, in theology, is ſaid to be one of the eſſential parts of the ſacraments; being that which gives them their ſacramental nature and efficacy, and conſiſting in certain words, which the prieſt pronounces in adminiſtering them.

FORM is alſo uſed in a moral ſenſe, for the manner of being, or doing a thing according to rules; thus we ſay, a form of government, a form of argument, &c.

FORM, in law, the rules eſtabliſhed and requiſite to be obſerved in legal proceedings.

FORM, in carpentry, is uſed to denote the long ſeats or benches in the choirs of churches, or in ſchools, for the prieſts, prebendaries, religious, or ſcholars, to ſit on.

At ſchools, the word form is frequently applied to what is otherwiſe termed a claſs. See CLASS.

FORM alſo denotes the external appearance or ſurface of a body, or the diſpoſition of its parts, as to the length, breadth, and thickneſs. See the article FIGURE.

FORM is alſo uſed among mechanics, for a ſort of mould, whereon any thing is faſhioned or wrought: as the hatter's form, the paper-maker's form, &c. See the article HATTER, &c.

Printer's FORM, an aſſemblage of letters, words, and lines, ranged in order, and ſo diſpoſed into pages by the compoſitor, from which, by means of ink and a preſs, the printed ſheets are drawn.

Every form is incloſed in an iron chaſe, wherein it is firmly locked by a number of pieces of wood; ſome long and narrow, and others of the form of wedges. See PRINTING.

FORMA PAUPERIS, in law, is where a perſon has juſt cauſe of ſuit, but is ſo poor that he cannot defray the uſual charges of ſuing at law or in equity; in which caſe, on making oath that he is not worth five pounds in the world, on all his debts being paid, and producing a certificate from ſome lawyer that he has good cauſe of ſuit, the judge will admit him to ſue in forma pauperis; that is, without paying any fee to counſellors, attorneys, clerks, &c.

FORMATION, in philoſophy, an act whereby ſomething is formed or produced.

FORMATION, in grammar, ſignifies the manner of forming one word from another: thus accountantſhip is formed from accountant, and this laſt from account.

FORMERS, in gunnery, round pieces of wood, fitted to the diameter of the bore of a gun, chiefly uſed for making cartridges.

On theſe formers, the paper, parchment, or cotton, which is to make the cartridge, are rolled before it be ſewed.

FORMICA, the ant, in zoology. See the article ANT.

FORMICA-LEO, the ant-lion, or ant-eater, in zoology, an inſect ſo called from its devouring great numbers of ants. It is the caterpillar or worm of a fly, much reſembling the libellæ, or dragon-flies.

FORMING *he line*, in naval affairs, drawing up the ſhips of a ſquadron or diviſion in a ſtrait line, about an hundred and twenty fathoms diſtance from each other. See the article LINE *of Battle*.

FORMULA, or FORMULARY, a rule or model, or certain terms preſcribed or agreed by authority, for the form and manner of an act; inſtrument, proceeding, or the like.

FORMULA, in medicine, imports the conſtitution of medicines, either ſimple or compound, both with reſpect to their preſcription and conſiſtence. Paracelſus calls red and clear urine, formula urinæ.

FORNICATION, the act of incontinency between ſingle perſons; for when either of the parties is married, ſuch act is adultery. See ADULTERY.

FORNIX, in anatomy, a part of the brain placed under the ſeptum lucidum, and, like it, compoſed of a medullary ſubſtance. Its anterior part riſes with a double baſe, but the two parts ſoon unite: the hinder part is likewiſe bifid, and thence called crura fornicis, and by ſome, pedes hippocampi. See the article BRAIN.

FORRAGE, in the military art, denotes hay, oats, barley, wheat, graſs, clover, &c. brought into the camp by the troopers, for the ſuſtenance of their horſes.

Dry forage is the hay, oats, &c. delivered out of the magazines, to an army in garriſon, or when they take the field, before the green forage is ſufficiently grown up to ſupply the troops.

FORT, in the military art, a ſmall fortified place, environed on all ſides with a moat, rampart, and parapet. Its uſe is to ſecure ſome high ground, or the paſſage of a river, to make good an advantageous poſt, to defend the lines and quarters of a ſiege, &c.

FORTS are made of different figures and extents, according as the ground requires. Some are fortified with baſtions, others with demi-baſtions. Some again are in form of a ſquare, others of a pentagon. A fort differs from a citadel, as this laſt is built to command ſome town. See the article CITADEL.

Royal FORT, one whoſe line of defence is at leaſt twenty-ſix fathoms long.

To fortify a ſquare fort, having inſcribed the ſquare in a circle, 1. Divide each of its ſides A B, B D, &c. (plate LXV. *fig.* 1.) into two equal parts, in the point E. 2. From the center E, draw an indefinite line E F. 3. From the centre draw alſo the lines E A, E B, E D, E C, to the angles of the ſquare. 4. Divide the ſide A B into eight equal parts. 5 Let one of theſe parts be laid off from F to G, and from G draw the lines of defence A G, B G. 6. Divide another ſide of the ſquare into ſeven equal parts. 7. Lay off two of theſe parts from A to K, and from B to L, which will be the faces of the baſtions. 8. Take the diſtance K L in your compaſſes, and lay it off the lines of defence from K to H, and from L to I; and drawing H I, it will be the curtain; and the lines K H, L H, will be the flanks. See another method of fortifying a ſquare; alſo two different methods of fortifying a triangle, *fig.* 2.

Star-FORT, a redoubt formed by a number of re-entering and ſaliant angles, the ſides of which flank each other. See *fig.* 3.

To deſcribe a ſtar-fort, 1. Draw an hexagon *a* B C *de*[illegible] 2. Divide one of its ſides B C into four equal parts. 3. Upon the middle of this ſide, raiſe the perpendicular D A, equal to $\frac{1}{4}$ of the ſide B C, from D to A. 4. From the point A, draw the faces A C, A B. Let the ſame operations be performed with reſpect to the other ſides of the hexagon, and you will have the ſtar-fort required.

FORTIFICATION, the art of fortifying a town, or other place; or of putting them in ſuch a poſture of defence, that every one of its parts defends, and is defended by ſome other parts, by means of ramparts, parapets, moats, and other bulwarks; to the end, that a ſmall number of men within may be able to defend themſelves for a conſiderable time againſt the aſſaults of a numerous army without, ſo that the enemy, in attacking them, muſt of neceſſity ſuffer great loſs.

Fortification is either antient or modern, regular or irregular

Fig. 4 FORTIFICATION, according to Count PAGAN.

Fig. 1. Fort.

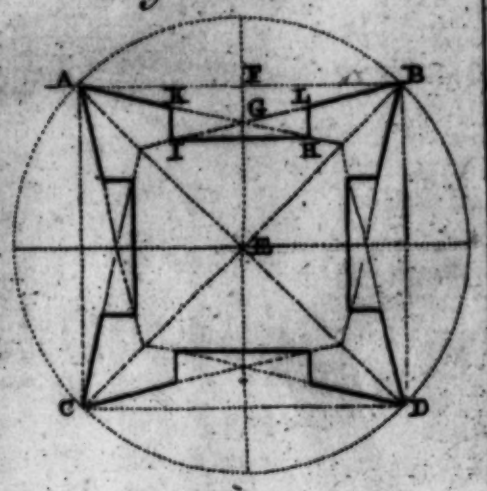


Fig. 3. Fort.

Fig. 5 FORTIFICATION according to M^r. BLONDEL.

Fig. 9 SCHEITERS Method of FORTIFICATION.

Fig. 2.

Fort.

Fort

M^r. VAUBAN'S Method of FORTIFICATION.

Fig. 8.

Fig. 7.

Fig. 6.

Fig. 10. Plan of a Regular FORTIFICATION.

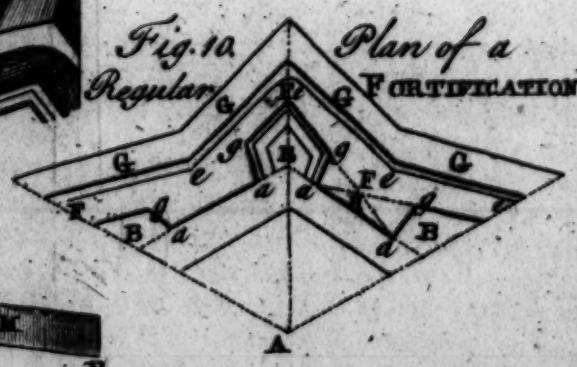
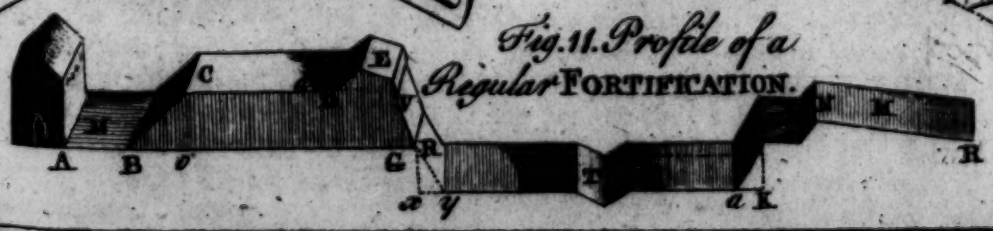


Fig. 11. Profile of a Regular FORTIFICATION.



5 1A 59

regular. Ancient fortification, at firſt, conſiſted of walls or defences made of trunks, and other branches of trees, mixed with earth, to ſecure them againſt the attacks of the enemy. This was afterwards altered to ſtone-walls, on which were raiſed breaſt-works, behind which they made uſe of their darts and arrows in ſecurity. Modern fortification, is that which is flanked and defended by baſtions and out-works, the ramparts of which are ſo ſolid, that they cannot be beat down but by the continual fire of ſeveral batteries of cannon.

Regular fortification, is that built in a regular polygon, the ſides and angles of which are all equal, being commonly about a muſket-ſhot from each other.

Irregular fortification, on the contrary, is that where the ſides and angles are not uniform, equidiſtant, or equal; which is owing to the irregularity of the ground, valleys, rivers, hills, and the like. See BASTION, &c.

The principal maxims of fortification are theſe: 1. That every part of the works be ſeen and defended by other parts, ſo that the enemy can lodge no where without being expoſed to the fire of the place. 2. A fortreſs ſhould command all places round it; and therefore all the out-works ought to be lower than the body of the place. 3. The works fartheſt from the center, ought always to be open to thoſe more near. 4. No line of defence ſhould exceed a point blank muſket-ſhot, which is about an hundred and twenty or an hundred and twenty-five fathoms. 5. The more acute the angle at the center is, the ſtronger will be the place. 6. In great places, dry trenches are preferable to thoſe filled with water, becauſe ſallies, retreats, and ſuccours are frequently neceſſary; but, in ſmall fortreſſes, water-trenches that cannot be drained, are beſt, as ſtanding in need of no ſallies, &c.

Different authors recommend different methods of fortification; but the principal are thoſe of Pagan, Blondel, Vauban, and Scheiter.

Fortification, according to the method of count Pagan, ſuppoſes the ſide A B (plate LXV. *fig.* 4.) of the external polygon, in larger fortifications, 100 perches; in the ſmaller, 80; and in thoſe of middle ſize, 90; with the correſponding faces, 30, 25, and 27 $\frac{1}{2}$; the perpendicular, C D, being in all of them 15. Here two of the flanks G F, H E, are perpendicular to the lines of defence, A E and B F: the flanks are alſo covered with an orillon, and are threefold. L M N is the boundary of the moat, parallel to the faces A G, B H. The curtain is defended by a double ravelin, O Q P being the external one, and *a c b* the internal; the faces of the baſtions being likewiſe defended by counter-guards, *g f*, *e d*.

This method, though received with great applauſe, is not without its defects. It is not only very expenſive, but its threefold flanks are too cloſe, ſo as to be too much expoſed to bombs; the largeneſs of the orillon is prejudicial to the length of the flanks, and the outer rampart is two thick.

Mr. Blondel's method of fortification has a great affinity with that of count Pagan, only that the lines and angles are otherwiſe determined. Thus by ſubtracting a right angle from that of the polygon, and adding 15 to a third part of the remainder, you find the quantity of the diminiſhed angle A B E. In the greater fortifications, the ſide A B (*fig.* 5.) of the outer polygon is 100 perches, in the leſſer only 85; and A B being divided into ten equal parts, ſeven of them give the lines of defence A F, B E. The faces of the baſtions A G, B H, are equal to half thoſe of the tenaille A D, B D. In theſe faces is a kind of flanking batteries Q R, to defend the faces of the ravelin *e c d*. The flanks H F, G E, are threefold, as in count Pagan's method; and in the middle of the moat is a deep trench *a d b*. The other out-works are as repreſented in *fig.* 6.

Fortification, according to Vauban's method, ſuppoſes the outer polygon to be 100 perches in larger places, 80 in ſmaller ones, and 90 in thoſe of a middle ſize. The faces are made $\frac{2}{7}$ of the ſame, the perpendicular $\frac{1}{8}$ in a ſquare, $\frac{1}{7}$ in a pentagon, and $\frac{1}{6}$ in other polygons. He alſo makes the complement of the face to the line of defence, equal to the diſtance of the epaule; uſes re-entering crooked flanks, and places a low tenaille before the curtain. See *fig.* 7.

This method of fortification is much eſteemed by many, both as it increaſes the ſtrength without much expence, and agrees very well with the maxims above laid down. Its greateſt fault conſiſts in this, that the faces lie altogether expoſed to the enemy.

Vauban's new method places large baſtions before ſmall ones; the curtain being covered with a low tenaille and a double ravelin, *fig.* 8.

Fortification, according to Scheiter's method, ſuppoſes the external ſide A B, (*fig.* 9.) in large fortifications, 110 perches; in leſſer ones, 80; and in thoſe of a middle ſize, 90. The flanks N O, P Q, are perpendicular to the lines of defence A Q, B O; which in greater fortifications are 70, in leſſer 60, and in thoſe of middle ſize, 65 perches; theſe detach the baſtions from the curtain, and form a kind of inner receſs behind the curtain. The angle of the baſtion in a ſquare, is 60°; in a pentagon, 72°; in a hexagon, 78°; in a heptagon, 83°; and in works of more ſides, this angle is found by adding 2° for every ſide above the heptagon.

As to the outworks, they are much the ſame as in the preceding methods, only that the covert-way is double; as is the ravel which covers the curtain.

To lay down the plan of a regular fortification. 1. Meaſure exactly the circuit of the place to be fortified, at about twelve paces diſtance from the houſes; and dividing the whole circuit by 150 geometrical paces at leaſt, or 180 at moſt, the quotient will give the number of the baſtions, in ſuch a manner that their lines of defence ſhall not exceed the carriage of a muſket ball. 2. Inſcribe in a circle a polygon, with as many ſides as the place is to have baſtions; and from the center A (*fig.* 10.) through the angle B of the polygon, draw lines at pleaſure, which lines are called principals. Afterwards take B *a* = $\frac{1}{8}$ of the ſide of the polygon, and B F = $\frac{1}{3}$; then drawing the lines of defence F *g a*, F *g a*, from each point *a* raiſe perpendiculars; which meeting the lines of defence in the points *g*, *g*, will form the baſtions *a g* F *g a*, *a g* F, &c. 3. Having thus deſcribed the outward circuit of the rampart, draw lines *e*, *e*, *e*, parallel to the faces of the baſtions F *g*, F *g*, F *g*: theſe will determine the outward circuit of the moat, which ought to be rounded before the angles of the baſtions F F. 4. To finiſh the plan, draw within the place lines parallel to thoſe which form the outward circuit of the rampart, at the diſtance of $\frac{1}{3}$ of the flank for the parapet; at the diſtance of $\frac{1}{2}$ the demigorge B *a*, for the rampart; and at the diſtance of five feet from the parapet, for the banquet. In the ſame manner, on the outſide of the moat, muſt be drawn lines parallel to its outward circuit, at the diſtance of $\frac{1}{4}$ of the flank for the covered way; and at the diſtance of $\frac{2}{3}$ of the flank for the glacis.

To lay down the profile of theſe works.—Let A R R (*fig.* 11.) repreſent the level of the place; take A B, 5 paces, for the place of arms; the perpendicular O C, 16 feet, for the talus or ſlope; the thickneſs of the lower part of the rampart, B R, 12 paces; the upper part, C D, 6 $\frac{2}{3}$ paces; the banquet, *d* D, 6 feet; the thickneſs of the lower part of the parapet D V, 3 $\frac{1}{3}$ paces; the upper, at E, 2 $\frac{1}{3}$ paces; its inward height, E D, 6 feet; and its outward height, 5 feet; the talus of the rampart to the moat, G R, 7 feet; the talus of the ſcarp, *x y*, 2 paces; the depth of the moat, R *x*, 16 feet; the width of its channel, T, 15 feet; the talus of the counterſcarp, *a* K, 10 feet; and the banquet of the covered way, at L, 5 feet. Then follows the paliſade at N, and the glacis or eſplanade, M. In *fig.* 12. is repreſented a hexagon fortified with all the kinds of out-works, together with the manner of carrying on the trenches of approach. Here is alſo delineated a pentagonal citadel, with its out-works. The names of the different works and parts of this fortification, are theſe; *a*, *a*, *a*, &c. repreſent the declivity or ſlope, uſually called glacis; *b*, *b*, *b*, &c. the covert way; *c*, *c*, *c*, &c. the counterſcarp; *d*, a ſingle tenaille; *e*, a double tenaille; *f*, a horn-work; *g*, *g*, *g*, &c. places of arms; *h*, *h*, *h*, &c. the moat or ditch; *i*, *i*, *i*, &c. ravelins; *k*, *k*, *k*, &c. half moons; *l*, a crown-work; *m*, a bonnet or prieſt's cap; *n*, *n*, a counter-guard; *o*, *o*, *o*, &c. baſtions; *p*, *p*, *p*, baſtions with circular flanks; *q*, *q*, the curtain; *r*, *r*, *r*, &c. the ramparts; and *s*, *s*, *s*, &c. bridges over the moat. With reſpect to the approaches,

1, 1, 1, &c. repreſent the trenches; 2, 2, 2, &c. the lines of communication; 3, 3, batteries; 4, 4, 4, &c. forts for the defence of the trenches; 5, the deſcent into the covered way; and 6, a mine.

Irregular FORTIFICATIONS, are thoſe raiſed about irregular polygons; in which the engineer ought to follow, as much as poſſible, the proportions laid down for the regular ones. If baſtions are found too high to ſweep the circumjacent champaign, a ſecond baſtion muſt be added to the firſt, or even a third, if neceſſary; ſtill taking care that their faces be well defended. If, on the contrary, a baſtion is too low, a cavalier muſt be raiſed on it. It will ſometimes alſo happen, that the faces of baſtions would become exceſſive long, if they were to be extended till they meet; in which caſe, they are uſually cloſed with a re-entering angle, (*fig.* 13.) When one ſide of the polygon is long enough to admit of a baſtion in its middle, it is remedied by raiſing one; but if it will not admit of this, it may be remedied by forming a ſaliant angle in the middle; or by advancing the neighbouring baſtions nearer to each other, ſo that both may be entirely formed upon that ſide. When a long extended ſide of a place can not admit of baſtions, as being cut off by a river, or ſtands upon a deep aſcent, it may be fortified with redents or re-entering angles, not unlike the teeth of a ſaw. See *fig.* 14. But the defect of theſe redents is, that both the ſides of the tenaille, or front of a place, may be ruined from one battery; ſo that the beſiegers may than make an aſſault without fear of being enfiladed.

Marine FORTIFICATIONS. Though theſe have nothing peculiar in them, yet it may not be improper to give ſome directions with relation to batteries. 1. In raiſing batteries to hinder a deſcent, care ſhould be taken to diſpoſe them in ſuch places where the deſcent is moſt eaſy; and the guns ſhould be ſo levelled, as to ſcour the ſurface of the water, that they may fire effectually upon the boats as they approach. 2. It is likewiſe convenient to have batteries to play upon places where there is good anchorage; and theſe ſhould be ſomewhat more elevated than the former. 3. It is alſo neceſſary to erect batteries at the entrance of roads; and theſe ought to be ſo made, as to diſcover ſhips at a diſtance. 4. It is very neceſſary that theſe batteries ſhould be defended by ſome works, againſt attacks; and, if poſſible, ſhould be under the fire of the place; or, at leaſt, they ought not to be too far advanced.

FORTIN, FORTLET, or *Field* FORT, a ſconce or little fort, whoſe flanked angles are generally diſtant one from another a hundred and twenty fathoms. See FORT.

FORTISSIMO, in muſic, ſometimes denoted by FFF, or *f f f*, ſignifies to ſing or play very loud or ſtrong.

FORTUNE, *Fortuna*, a goddeſs worſhipped with great devotion by the ancient Greeks and Romans, who believed her to preſide over human affairs, and to diſtribute wealth and honour at her pleaſure.

FORUM, in Roman antiquity, a public ſtanding place within the city of Rome, where cauſes were judicially tried, and orations delivered to the people.

FOSS, or FOSSA, in anatomy, a kind of cavity in a bone, with a large aperture, but no exit or perforation.

Foſs is particularly uſed for the cavity, or indenture, in the back part of the neck.

FOSSA MAGNA, the interior cavity, or rima magna, of the pudendum muliebre. Bartholin calls it foſſa navicularis.

FOSS, in fortification, a hollow place, commonly full of water, lying between the ſcarp and counterſcarp, below the rampart; and turning round a fortified place or a poſt that is to be defended. See MOAT.

FOSS-WAY, one of the four principal highways of England, that anciently led through the kingdom; ſuppoſed to be made by the Romans, having a ditch upon one ſide thereof.

FOSIL, in natural hiſtory, denotes, in general, every thing dug out of the earth, whether they be natives thereof, as metals, ſtones, ſalts, earths, and other minerals; or extraneous, repoſited in the bowels of the earth by ſome extraordinary means, as earthquakes, the deluge, &c.

FOVEA CORDIS, in anatomy, the pit of the heart, or rather of the ſtomach.

FOUGADE, or FOUGASSE, in the art of war, a little mine, about eight or ten feet wide; and ten or twelve deep, dug under ſome work or poſt, which is in danger of falling into the enemy's hands; and charged with ſacks of powder, covered with ſtones, earth, and whatever elſe can make great deſtruction. It is ſet on fire like other mines, with a ſauciſſe.

FOUL, in the ſea-language, entangled or embarraſſed: foul anchor, i. e. an anchor which has either hooked its own or ſome other cable, wreck, rocks, &c. "a ſhip ran foul of us in the night," i. e. came cloſe to our ſhip, entangling herſelf amongſt the rigging.

FOUL-BOTTOM is when the bottom of a ſhip is covered with ooze, graſs, ſhells, or other excrement.

FOUL-HAWSE is when the ſhip being moored by two anchors, has turned round, and conſequently twiſted one cable about the other.

FOUL-WIND, a wind which blows contrary to the ſhip's courſe.

FOULNESS, in ſurgery, a term applied to wounds, where the fleſh is putrid, fungous, black, or livid.

FOUNDATION, in architecture, is that part of a building which is under ground. See BUILDING.

Foundation, called by Daviler *fondation*, is the coffer or bed dug below the level of the ground to raiſe a building upon, in which ſenſe the foundation either goes to the whole area of the building, as when there are to be vaults, cellars, &c. or it is drawn in trenches, as when only walls are to be raiſed. The foundation, fondement according to the ſame author, is properly ſo much of the maſonry as reaches as high as the ſurface of the ground, and ought always to be proportioned to the load or weight of the building that it is to bear. Sometimes the foundation is maſſive, and continued under the whole building, as in the antique arches and aqueducts, and ſome amphitheatres; but it is more uſually in ſpaces or intervals, either to avoid expence, as becauſe the vacuities are at too great a diſtance, in which latter caſe they make uſe of inſulated pillars bound together by arches.

Palladio allows a ſixth part of the height of the whole building for the hollowing or under-digging, unleſs there be cellars under-ground, in which caſe he would have it ſomewhat lower; and as to thickneſs, double the width of a wall is no bad rule. Palladio alſo lays down ſeveral rules to know if the earth be firm enough for the foundation, by obſervations from the digging of wells, and the like; but the beſt way to diſcover the nature of the ſoil is to try it with an iron-crow, or elſe with a borer, ſuch as is uſed by well-diggers.

Foundations are either natural or artificial. Natural as when we build upon a rock, or very ſolid earth, in which caſe we need not ſeek for any further ſtrengthening; for theſe, without digging or other artificial helps, are of themſelves fit to uphold the greateſt buildings. But if the ground be ſandy, or marſhy, or hath lately been dug, recourſe muſt be had to art. If the ground be ſandy or marſhy, you muſt dig till you find ſound ground, and the beſt is that which requires moſt labour in cutting, and when wet, does not diſſolve into dirt. If the earth to be built upon is very ſoft, as in mooriſh grounds, lay good pieces of oak, whoſe length muſt be about the breadth of the trench, or two feet longer than the breadth of the wall, acroſs the foundation, about two feet aſunder, and being well rammed down, lay long planks upon them, pinning or ſpiking down each plank to the pieces of oak on which it lies. But if the ground be very bad, let piles of oak, of a diameter about one twelfth part of their length, be drove down to reach the good ground, and placed as cloſe as one can ſtand by another; then ſpike down long planks upon them. And it muſt not be forgot to place the piles not only under the outer walls, but alſo under the inner walls that divide the building; for if theſe ſhould ſink it would make the outer wall crack, and ſo ruin the whole building. If the ground be faulty here and there let arches be turned over the faulty places, which will diſcharge them of the weight. As to the rules neceſſary to be obſerved in the ſubſtruction or artificial part of the foundation, they are theſe, 1. That the bottom of the trench

be made exactly level. 2. That the loweſt ledge or row be all of ſtone (the broader the better) laid cloſe together. 3. That the breadth of the ground-work be at leaſt double that of the wall to be raiſed on it. However, the breadth may be regulated according to the goodneſs of the ground, and the weight of the intended edifice. 4. That the foundation be made to diminiſh as it riſes, taking care, however, that it do ſo equally on both ſides. 5. That you ought never to build on the ruins of an old foundation, unleſs well aſſured of its depth and ſtrength to bear the ſuperſtructure. 6. And laſtly, The ſtones in a foundation ſhould be laid as they naturally lay in the quarry; a precept generally obſerved by all good architects, becauſe they find the ſtones are ſubject to cleave that way of the grain that lay horizontally in the quarry. In ſome places, buildings near the water are founded on ſacks of wool laid like matreſſes, which being well preſſed and greaſy, will never give way, nor rot in the water.

FOUNDATION *of Bridges* is laid after different manners. The firſt is by incloſing all round the ſpace of ground you would build upon, by dams made with piles ſet deep in the ground in double rows, well ſtrengthened and bound together with croſs pieces and cords, and filling the vacant ſpaces between them with chalk or other earthy matter. This being done, the water muſt be emptied out, and the foundation dug according to the quality of the ground, driving down piles, if it be neceſſary, upon which the walls of the foundation muſt be laid. But this method is only practicable in building on ſuch rivers, where the water is neither very rapid, nor very deep. The ſecond is done by laying the foundation on grate-work, rafts of ſtout oak well bound together, and made faſt at the ſurface of the water with cables or machines, and building upon them large quarters of ſtone, cramped together, and joined with good mortar, or cement, and afterwards letting them deſcend ſoftly by theſe cables and machines perpendicularly to the bottom of the water. This was the method practiſed in laying the foundation of Weſtminſter-Bridge, the grating being made of the bottom of a frame called by the French *caiſſon*, the ſides of which were ſo contrived that they might be taken off, after a pier was finiſhed. The third is by drawing off all, or the greateſt part of the water of the river into ſome other place; and this was done at London-Bridge, if we could believe Stow, who alledges, that during the time of building, the river was turned from Batterſea to Rotherhith: but this is not warranted.

FOUNDATION denotes alſo a donation or legacy either in money or lands, for the maintenance and ſupport of ſome community, hoſpital, ſchool, lecture, &c.

FOUNDAY, in metallurgy, a term uſed by the workers at the iron-mines in many counties of England, for the ſpace of ſix days, in which time they continue to make a determinate quantity of iron; ſo that they count their work by theſe foundays, or weeks.

FOUNDER, in a general ſenſe, the perſon who lays a foundation, or endows a church, ſchool, religious houſe, or other charitable inſtitution. The founder of a church may preſerve to himſelf the right of patronage, or preſentation to the living.

FOUNDER alſo implies an artiſt who caſts metals, in various forms, for different uſes, as guns, bells, ſtatues, printing characters, candleſticks, buckles, &c. whence they are denominated gun-founders, bell-founders, figure-founders, letter-founders, founders of ſmall works, &c. See FOUNDERY.

FOUNDER, in glaſs-making, a term appropriated to the crown and green glaſs, and is the perſon there, who in the ſame office in the white-glaſs making is called conciator.

FOUNDERING, in the menage, a diſorder in horſes, of which there are two kinds, viz. in the feet and in the cheſt.

Foundering in the feet, is an univerſal rheumatiſm, or defluxion of humours upon the ſinews of a horſe's feet, which cauſes ſo great a ſtiffneſs in the hoofs, that the horſe has no ſenſe or feeling of them.

This diſorder ariſes from hard riding; from great heats and colds; and is ſometimes occaſioned by watering a horſe when he is very hot, by which means, as the farriers term it, his greaſe is melted within him; alſo by wearing too ſtreight a ſhoe, or travelling upon hard ground.

The general methods of curing this diſtemper are, firſt to pare all the horſe's ſoles ſo thin, that you may ſee the quick: then bleed him well at every toe; ſtop the vein with tallow and roſin; and having tacked hollow ſhoes on his feet, ſtop them with bran, tar, and tallow, as boiling hot as may be; and this renew once in two days for a week together, after which, let him have good exerciſe, &c. or, after he is pared thin, and let blood at his toes, ſtop his feet with cow's dung, kitchen-fee, tar, and ſoot, boiled together, and poured boiling-hot into them.

Foundering in the cheſt may proceed from crudities in the ſtomach, or other infirmities, obſtructing the paſſages of the lungs; and may be diſcovered by the horſe's not being able to bow his joints; and being once laid, he cannot riſe again; his legs ſwell, &c.

As a particular remedy for cheſt-foundering, take five or ſix pennyworth of oil of petre, and mingle it with an equal quantity of ale, or beer: then rub this mixture with your hand on the part affected; and cauſe a red-hot fire-ſhovel to be held before it during the application.

FOUNDERING, among ſailors, ſinking in a ſtorm at ſea.

FOUNDERY, or FOUNDRY, the art of caſting all ſorts of metals, into different forms. It likewiſe ſignifies the work-houſe, or ſmelting-hut, wherein theſe operations are performed.

FOUNDERY, or CASTING, among ſculptors, &c. See the article CASTING.

FOUNDERY *of Bells*. The metal, it is to be obſerved, is different for bells, from what it is for ſtatues; there being no tin in the ſtatue-metal; but there is a fifth, and ſometimes more, in the bell-metal. See the article BELL.

The dimenſions of the core, and the wax, for bells, if a ring of bells eſpecially, are not left to chance, but muſt be meaſured by a ſcale, or diapaſon, which gives the height, aperture, and thickneſs neceſſary for the ſeveral tones required. See the article DIAPASON.

It is on the wax that the ſeveral mouldings and other ornaments are formed to be repreſented in relievo, on the outſide of the bell.

The buſineſs of bell-foundery is reducible to three particulars: 1. The proportion of a bell; 2. The forming of the mould; and, 3. The melting of the metal.

The proportions of the Engliſh bells differ much from thoſe of the Chineſe: in the former, the modern proportions are to make the diameter fifteen times the thickneſs of the brim, and twelve times the height.

There are two kinds of proportions, viz. the ſimple and the relative; the former are thoſe proportions only that are between the ſeveral parts of a bell, to render it ſonorous; the relative proportions eſtabliſh a requiſite harmony between ſeveral bells.

The particulars neceſſary for making the mould of a bell, are, 1. The earth: the moſt coheſive is the beſt: it muſt be well ground and ſifted, to prevent any chinks. 2. Brick-ſtone; which muſt be uſed for the mine, mould, or core, and for the furnace. 3. Horſe-dung, hair, and hemp, mixed with the earth, to render the cement more binding. 4. The wax for inſcriptions, coats of arms, &c. 5. The tallow equally mixed with the wax, in order to put a ſlight lay of it upon the outer mould, before any letters are applied to it. 6. The coals to dry the mould.

For making the mould, they have a ſcaffold conſiſting of four boards, ranged upon treſſels. Upon this, they carry the earth, groſsly diluted, to mix it with horſe-dung, beating the whole with a large ſpatula.

The compaſſes of conſtruction is the chief inſtrument for making the mould, which conſiſt of two different legs, joined by a third piece. And laſt of all, the founders ſhelves, on which are the engravings of the letters, cartridges, coats of arms, &c.

They firſt dig a hole, of a ſufficient depth to contain the mould of the bell, together with the caſe, or cannon,

under-ground; and about ſix inches lower than the terre-plain, where the work is performed. The hole muſt be wide enough for a free paſſage between the mould and walls of the hole; or between one mould and another, when ſeveral bells are to be caſt. At the center of the hole is a ſtake erected, that is ſtrongly faſtened in the ground. This ſupports an iron-peg, on which the pivot of the ſecond branch of the compaſſes turns. The ſtake is encompaſſed with a ſolid brick-work, perfectly round, about half a foot high, and of the propoſed bell's diameter. This they call a mill-ſtone. The parts of the mould are the core, the model of the bell, and the ſhell. When the outer ſurface of the core is formed, they begin to raiſe the core, which is made of bricks that are laid in courſes of equal height upon a lay of plain earth. At the laying each brick they bring near it the branch of the compaſſes, on which the curve of the core is ſhaped, ſo as that there may remain between it and the curve the diſtance of a line, to be afterwards filled up with layers of cement. The work is continued to the top, only leaving an opening for the coals to bake the core. This work is covered with a layer of cement, made of earth and horſe-dung, on which they move the compaſſes of conſtruction, to make it of an even ſmoothneſs every where.

The firſt layer being finiſhed, they put the fire to the core, by filling it half with coals, through an opening that is kept ſhut, during the baking, with a cake of earth, that has been ſeparately baked. The firſt fire conſumes the ſtake, and the fire is left in the core, half or ſometimes a whole day: the firſt layer being thoroughly dry, they cover it with a ſecond, third, and fourth; each being ſmoothed by the board of the compaſſes, and thoroughly dried before they proceed to another.

The core being completed, they take the compaſſes to pieces, with intent to cut off the thickneſs of the model, and the compaſſes are immediately put in their place, to begin a ſecond piece of the mould. It conſiſts of a mixture of earth and hair, applied with the hand on the core, in ſeveral cakes that cloſe together. This work is finiſhed by ſeveral layers of a thinner cement of the ſame matter, ſmoothed by the compaſſes, and thoroughly dried, before another is laid on. The firſt layer of the model is a mixture of wax and greaſe ſpread over the whole. After which are applied the inſcriptions, coats of arms, &c. beſmeared with a pencil dipped in a veſſel of wax in a chaffing-diſh: this is done for every letter. Before the ſhell is begun, the compaſſes are taken to pieces, to cut off all the wood that fills the place of the thickneſs to be given to the ſhell.

The firſt layer is the ſame earth with the reſt, ſifted very fine; whilſt it is tempering in water, it is mixed with cow's hair, to make it cohere. The whole being a thin cullis, is gently poured on the model that fills exactly all the ſinuoſities of the figures, &c. and this is repeated till the whole is two lines thick over the model. When this layer is thoroughly dried, they cover it with a ſecond of the ſame matter, but ſomething thicker: when this ſecond layer becomes of ſome conſiſtence, they apply the compaſſes again, and light a fire in the core, ſo as to melt off the wax of the inſcriptions, &c.

After this, they go on with other layers of the ſhell, by means of the compaſſes. Here they add to the cow's hair a quantity of hemp, ſpread upon the layers, and afterwards ſmoothed by the board of the compaſſes. The thickneſs of the ſhell comes to four or five inches lower than the mill-ſtone before obſerved, and ſurrounds it quite cloſe, which prevents the extravaſation of the metal. The wax ſhould be taken out before the melting of the metal.

The ear of the bell requires a ſeparate work, which is done during the drying of the ſeveral incruſtations of the cement. It has ſeven rings, the ſeventh is called the bridge, and unites the others, being a perpendicular ſupport to ſtrengthen the curves. It has an aperture at the top, to admit a large iron-peg, bent at the bottom; and this is introduced into two holes in the beam, faſtened with two ſtrong iron-keys. There are models made of the rings, with maſſes of beaten earth, that are dried in the fire, in order to have the hollow of them. Theſe rings are gently preſſed upon a layer of earth and cow's hair, one half of its depth; and then taken out, without breaking the mould. This operation is repeated twelve times for twelve half moulds, that two and two united may make the hollows of the ſix rings: the ſame they do for the hollow of the bridge, and brake them all, to unite them together.

Upon the open place left for the coals to be put in, are placed the rings that conſtitute the ear. They firſt put into this open place the iron-ring to ſupport the clapper of the bell; then they make a round cake of clay, to fill up the diameter of the thickneſs of the core. This cake, after baking, is clapped upon the opening, and ſodered with a thin mortar ſpread over it, which binds the cover cloſe to the core.

The hollow of the model is filled with an earth, ſufficiently moiſt, to fix on the place, which is ſtrewed, at ſeveral times, upon the cover of the core; and they beat it gently with a peſtle, to a proper height; and a workman ſmooths the earth at top with a wooden trowel dipped in water.

Upon this cover, to be taken off afterwards, they aſſemble the hollows of the rings. When every thing is in its proper place, they ſtrengthen the outſides of the hollows with mortar, in order to bind them with the bridge, and keep them ſteady at the bottom, by means of a cake of the ſame mortar, which fills up the whole aperture of the ſhell: this they let dry, that it may be removed without breaking. To make room for the metal they pull off the hollows of the rings, through which the metal is to paſs, before it enters into the vacuity of the mould. The ſhell being unloaded of its ear, they range under the mill-ſtone five or ſix pieces of wood, about two feet long, and thick enough to reach almoſt the lower part of the ſhell; between theſe and the mould they drive in wooden wedges with a mallet, to ſhake the ſhell of the model whereon it reſts, ſo as to be pulled up, and got out of the pit.

When this and the wax are removed, they break the model and the layer of earth, through which the metal muſt run, from the hollow of the rings, between the ſhell and the core. They ſmoke the inſide of the ſhell, by burning ſtraw under it, that helps to ſmooth the ſurface of the bell: then they put the ſhell in the place, ſo as to leave the ſame interval between that and the core; and before the hollows of the rings or the cap are put on again, they add two vents, that are united to the rings, and to each other, by a maſs of baked cement: after which they put on this maſs of the cap, the rings, and the vent, over the ſhell, and ſoder it with thin cement, which is dried gradually by covering it with burning coals. Then they fill up the pit with earth, beating it ſtrongly all the time, round the mould.

The furnace has a place for the fire, and another for the metal. The fire-place has a large chimney with a ſpacious aſh-hole. The furnace which contains the metal, is vaulted, whoſe bottom is made of earth, rammed down; the reſt is built with brick. It has four apertures; the firſt, through which the flame reverberates; the ſecond is cloſed with a ſtopple that is opened for the metal to run; the others are to ſeparate the droſs, or ſcoriæ, of the metal by wooden rakes: through theſe laſt apertures paſſes the thick ſmoke. The ground of the furnace is built ſloping for the metal to run down.

FOUNDERY *of great Guns and Mortar-Pieces.*—The method of caſting theſe pieces is little different from that of bells: they are run maſſy, without any core, being determined by the hollow of the ſhell; and they are afterwards bored with a ſteel trepan, that is worked either by horſes, or a water-mill.

For the metal, parts, proportions, &c. of theſe pieces. See CANNON.

Letter FOUNDERY, or *Caſting of Printing-Letters.* The firſt thing requiſite is to prepare good ſteel-punches, on the face of which is drawn the exact ſhape of the letter with pen and ink, if the letter be large, or with a ſmooth blunted point of a needle, if ſmall; and then, with proper gravers, the cutter digs deep between the ſtrokes, letting the marks ſtand on the punch; the work of hollowing being generally regulated by the depth of the counter-punch: then he files the outſide, till it is fit for the matrice.

They have a mould to juſtify the matrices by, which

conſiſts of an upper and under part, both which are alike, except the ſtool and ſpring behind, and a ſmall roundiſh wire in the upper part, for making the nick in the ſhank of the letter. Theſe two parts are exactly fitted into each other, being a male and female gage, to ſlide backwards and forwards. See the article GAGE.

Then they juſtify the mould, by caſting about twenty ſamples of letters, which are ſet in a compoſing-ſtick, with the nicks towards the right hand; and comparing theſe every way with the pattern-letters, ſet up in the ſame manner, they find the exact meaſure of the body to be caſt.

Next they prepare the matrix, which is of braſs or copper, an inch and a half long, and of a proportionable thickneſs to the ſize of the letter it is to contain. In this metal is ſunk the face of the letter, by ſtriking the letter-punch the depth of an *n*. After this, the ſides and face of the matrice are juſtified, and cleared, with files, of all bunchings that have been made by ſinking the punch.

Then it is brought to the furnace, which is built upright of brick with four ſquare ſides, and a ſtone at top, in which is a hole for the pan to ſtand in. They have ſeveral of theſe furnaces. See the article FURNACE.

Printing-letters are made of lead, hardened with iron or ſtub-nails. To make the iron run, they mingle an equal weight of antimony, beaten ſmall in an iron mortar, and ſtub-nails together. They charge a proper number of earthen pots, that bear the fire, with the two ingredients, as full as they can hold, and melt it in an open furnace, built for that purpoſe. See the article FLUX.

When it bubbles, the iron is then melted, but it evaporates very much. This melted compoſt is ladled into an iron-pot, wherein is melted lead, that is fixed on a furnace cloſe to the former, 3 lb. of melted iron to 25 lb. of lead; this they incorporate according to art.

The caſter taking the pan off the ſtone, and having kindled a good fire, he ſets the pan in again, and metal in it to melt. If it be a ſmall bodied letter, or a thin letter with great bodies, that he intends to caſt, his metal muſt be very hot, and ſometimes red hot, to make the letter come. Then taking a ladle, of which he has ſeveral ſorts, that will hold as much as will make the letter and break, he lays it at the hole where the flame burſts out; then he ties a thin leather, cut with its narrow end againſt the face, to the leather groove of the matrice, by whipping a brown thread twice about the leather groove, and faſtening the thread with a knot. Then he puts both pieces of the mould together, and the matrice into the matrice cheek; and places the foot of the matrice on the ſtool of the mould, and the broad end of the leather on the wood of the upper haft of the mould, but not tight up, leſt it hinder the foot of the matrice from ſinking cloſe down upon the ſtool, in a train of work. Afterwards laying a little roſin on the upper part of the mould, and having his caſting-ladle hot, he, with the boiling ſide, melts the roſin and preſſes the broad end of the leather hard down on the wood, and ſo faſtens it thereto. Now he comes to caſting, when placing the under half of the mould in his left hand, with the hook or jag forward, he holds the ends of its wood between the lower part of the ball of his thumb and his three hinder fingers; then he lays the upper half of the mould upon the under half, ſo as the male gages may fall into the female; and, at the ſame time, the foot of the matrice places itſelf upon the ſtool, and claſping his left hand thumb ſtrongly over the upper half, he nimbly catches hold of the bow or ſpring, with his right hand fingers at the top of it, and his thumb under it, and places the point of it againſt the middle of the notch in the backſide of the matrice, preſſing it forwards as well towards the mould, as downwards, by the ſhoulder of the notch, cloſe upon the ſtool, while at the ſame time with his hinder fingers, as aforeſaid, he draws the under half of the mould towards the ball of his thumb, and thruſts, by the ball of his thumb, the upper part towards his fingers, that both the regiſters of the mould may preſs againſt both ſides of the matrice, and his thumb and fingers preſs both ſides of the mould cloſe together.

Then he takes the handle of his ladle in his right hand, and with the ball of it gives two or three ſtrokes outwards upon the ſurface of the melted metal, to clear it of the ſcum; then he takes up the ladle full, and having the mould in the left hand, turns his left ſide a little from the furnace, and brings the geat of his ladle to the mouth of the mould; and turns the upper part of his right hand towards him, to pour the metal into it, while, at the ſame inſtant, he puts the mould in his left hand forwards, to receive the metal with a ſtrong ſhake, not only into the bodies of the mould, but, while the metal is yet hot, into the very face of the matrice, to receive its perfect form there as well as in the ſhank. Then he takes the upper half of the mould off, by placing his right thumb on the end of the wood next his left thumb, and his two middle fingers at the other end of the wood: he toſſes the letter, break and all, out upon a ſheet of waſte paper, laid on a bench, a little beyond his left hand; and then is ready to caſt another letter, as before, and likewiſe the whole number in that matrix.

Then boys, commonly employed for this purpoſe, ſeparate the breaks from the ſhanks, and rub them on a ſtone, and afterwards a man cuts them all of an even height, which finiſhes the fount for the uſe of the printer. See the next article.

A workman will ordinarily caſt 3000 of theſe letters in a day. The perfection of letters thus caſt, conſiſts in their being all ſeverally ſquare and ſtraight on every ſide; and all generally of the ſame height, and evenly lined, without ſtooping one way or other; neither too big in the foot, nor the head; well grooved, ſo as the two extremes of the foot contain half the body of the letter; and well ground, barbed, and ſcraped, with a ſenſible notch, &c. See the article PRINTING.

FOUNT, or FONT, among printers, a ſet or quantity of letters, and all the appendages belonging thereto, as numeral characters, quadrates, points, &c. caſt by a letter-founder, and ſorted. Founts are large or ſmall, according to the demand of the printer, who orders them by the hundred weight, or by ſheets. When a printer orders a fount of five hundred, he means that the fount, conſiſting of letters, points, ſpaces, quadrates, &c. ſhall weigh 500 lb. When he demands a fount of ten ſheets, it is underſtood, that with that fount he ſhall be able to compoſe ten ſheets, or twenty forms, without being obliged to diſtribute. The founder takes his meaſures accordingly; he reckons 120 lb. for a ſheet, including the quadrates, &c. or 60 lb. for a form, which is only half a ſheet; not that the ſheet always weighs 120 lb. or the form 60 lb. on the contrary, it varies according to the ſize of the form; beſides, it is always ſuppoſed that there are letters left in the caſes. As therefore every ſheet does not comprehend the ſame number of letters, nor the ſame ſort of letters, we muſt obſerve, that, as in every language ſome ſounds recur more frequently than others, ſome letters will be in much more uſe, and oftener repeated than others, and conſequently their cells or caſes ſhould be better ſtored than thoſe of the letters which do not recur ſo frequently: thus, a fount does not contain an equal number of *a* and *b*, or of *b* and *c*, &c. the letter-founders have therefore a liſt or tariff, or, as the French call it, a *police*, by which they regulate the proportions between the different ſorts of characters that compoſe a fount; and it is evident that this tariff will vary in different languages, but will remain the ſame for all ſorts of characters employed in the ſame language.

FOUNTAIN, *Fons*, a ſpring of living water that riſes out of the ground. See SPRING.

Fountains or ſources of rivers were held ſacred among the ancients, and even worſhipped as a kind of divinity: and it was a point of religion, not to muddy the waters in bathing.

Artificial FOUNTAIN, or *jet d'eau*, a contrivance, whereby water is violently ſpouted upwards.

Some fountains are founded on the elaſticity of the air, and others on the preſſure of the water.

The artificial fountain (plate LXVI. *fig.* 1.) which may be ſet up upon either of its ends, after it has played out all its water in a jet through the ſpouting-pipe E, plays again afreſh through the ſpout I, when you have turned it over like an hour-glaſs. The water contained in the cavity AFH runs down the curve pipe CDE, and ſpouts up through the jet E by the preſſure of the column of water CD. But, unleſs the pipe GF was

open

open at G; to let the air run up to F, and preſs at top of the ſurface of the water in the cavity A, the water could not run down and ſpout at E. There is ſuch another pipe as G F at K, belonging to the cavity B, through which the water of the jet received in the baſon ſupplies the cavity B, whilſt the fountain ſtands on the end B: but, when the fountain is inverted, it ſupplies B with air to let the water deſcend in the direction G H I, I becoming the ſpouting pipe.

Upon theſe principles depends alſo the alternate running and ſtopping of the fountain at command (*fig.* 2.) C A E is a receptacle of water cloſe from the air's entrance, except through the pipe G F, when the cock C, by which it was filled, is ſtopped. There is another pipe E D H B, which goes from the bottom of the water to the jet B in the baſon D B, but is ſtopped by the cock H. At the loweſt part of the baſon D B there is a ſmall hole at I to let the water of the baſon D B run into the baſon G H under it: there is alſo a ſmall triangular hole or notch in the bottom of the pipe F G at G. Turn the cock H, and the fountain will play ſome time; then ſtop, then play again alternately. The cauſe of playing and ſtopping is this; the water coming down the pipe E D H B would not come out at B, if the air S *s* above the water were not ſupplied, as it dilated: now it is ſupplied by the pipe G F, which takes it in at the notch G, and delivers it out at F; but after ſome time the water which has ſpouted out at B, falling down into the baſon D B, riſes high enough to come above the notch G, which ſtops the paſſage of the air, ſo that the air S *s* above the water in the veſſel C A E cannot ſufficiently preſs for want of a ſupply, and the fountain ceaſes playing. Now the water of D B runs down into the lower baſon H G, through the hole I, till it falls below the top of the notch G, and then the air runs up into the upper receptacle again, and ſupplying the air at S *s*, the fountain plays again. This is ſeen a little before-hand by a ſkin of water on the notch G, before the air finds paſſage, and then you command the fountain to play. The hole I muſt be leſs than that of the jet, otherwiſe the water would all run out into the lower baſon, without riſing high enough to ſtop the notch G.

In the next fountain A B (*fig.* 3.) the air is condenſed at the top of the water by means of a ſyringe, ſometimes by blowing in; and the air and water are retained by the cock C, which muſt be opened, before it can play; then the water, ſtrongly preſſed by the condenſed air at S S, goes through the pipe *o* and the adjutage *b* with great force, in jets of ſeveral figures according to the ſpouting-pipes put on at *b*.

In the fountain (*fig.* 4.) the air, being compreſſed by the concealed fall of waters, makes a jet, which ſeen for a while is looked upon as a perpetual motion by the ignorant.

The boxes C E and D Y X being cloſe, you only ſee the baſon A B W, with a hole at W, into which the water ſpouting out at B falls; but that water, going down the hole W, does not come up again at W, but runs down through the pipe W X into the box D Y X, from whence it drives out the air through the aſcending pipe Y Z into the cavity of the box C E, where, preſſing upon the water that is in it, it forces it out through the ſpouting-pipe O B, as long as there is any water in C E: ſo that this whole play is only whilſt the water contained in C E, having ſpouted out, falls down through the pipe W X into the cavity D Y X. The force of the jet is proportional to the height of the pipe W X, or of the boxes C E and D Y X above each other. The height of the water, meaſured from the baſon A B W to the ſurface of the water in the lower box D Y X, is always equal to the height meaſured from the top of the jet to the ſurface of the water in the middle cavity at C E. Now ſince the ſurface C E is always falling, and the water in D Y always riſing, the height of the jet muſt continually decreaſe, till it is ſhorter by the height of the depth of the cavity C E, which is emptying, added to the depth of the cavity D Y, which is always filling; and, when the jet is fallen ſo low, it immediately gives over. In the figure the air is repreſented by points.

To prepare this fountain, which is generally done privately firſt, pour in water at W, till the cavity D X Y be full; then turn the fountain over, and the water will run from the cavity D X Y into the cavity C E, which is full, when the water runs out at B held down. Set the fountain up again as if nothing had been done to it. When you would make it play, pour in about a pint of water into the baſon A B W, and when the pipe W X is filled, the fountain will play, and continue ſo to do, as long as there is water in C E. You may pour the water left in the baſon A B W into any veſſel, and invert the fountain, which, when ſet upright, will be ſet a playing by putting back the water poured out into A B W, and ſo toties quoties.

FOURCHEE, or FOURCHY, in heraldry, an appellation given to a croſs forked at the ends.

FOURCHER, or FOURCHING, in law, ſignifies the delaying or putting off an action, which might have been brought to a determination in a ſhorter time.

FOURTH, in muſic, one of the harmonic intervals. It conſiſts in the mixture of two ſounds, which are in the ratio of 4 to 3; that is, of ſounds produced by chords, whoſe lengths are to each other as 4 to 3.

FOWL, among zoologiſts, denotes the larger ſort of birds, whether domeſtic or wild: ſuch are geeſe, pheaſants, partridges, turkies, ducks, &c. See the articles GEESE, PHEASANT, &c.

Tame fowl make a neceſſary part of the ſtock of a country farm. See the article POULTRY.

FOX, *Vulpes*, in zoology, an animal of the dog-kind, which much reſembles the common dog in form, and is of the ſize of a ſpaniel: it is chiefly diſtinguiſhed by its long and ſtraight tail, with the tip white. See the articles CANIS and DOG.

The fox is a native of moſt northern countries. That of Siberia is about the ſize of a common kind; but its head is larger, and its tail not only bigger and more buſhy, but all of one colour.

FOX-GLOVE, *Digitalis*, in botany. See DIGITALIS.

FRACHES, in glaſs-making, flat iron pans, wherein the new-made veſſels are put, to be removed gradually from the fire. See the article GLASS.

FRACTION, in arithmetic, a broken number, a part, or diviſion of an unit, or integer.

The word is Latin, *fractio*, and derived from *frango*, to break.

Fractions are generally divided into *vulgar*, *decimal*, and *ſexageſimal*.

Vulgar FRACTIONS are thoſe which repreſent the parts of any thing propoſed.

A vulgar fraction is expreſſed by two numbers placed one above the other, having a line drawn between them. Thus $\frac{3}{4}$, $\frac{1}{6}$, $\frac{5}{4}$, &c. are vulgar fractions.

The number placed below the line is called the denominator, and denotes how many equal parts the thing is ſuppoſed to be divided into, being only the diviſor in diviſion. And the number placed above the line is called the numerator, and ſhews how many of theſe parts are contained in the fraction, it being the remainder after diviſion. Theſe admit of three diſtinctions, viz. *proper* or *ſimple*, *improper*, and *compound* fractions.

A proper, *pure*, or *ſimple* FRACTION is that which is leſs than an unit: that is, it repreſents the immediate part or parts of any thing leſs than the whole, and therefore its numerator is always leſs than the denominator. As $\frac{1}{3}$, $\frac{1}{4}$, $\frac{3}{5}$, $\frac{5}{6}$, &c.

An improper FRACTION is that which is greater than an unit; that is, it repreſents ſome number of parts greater than the whole thing, and its numerator is always greater than the denominator. As $\frac{5}{3}$, $\frac{9}{7}$, $\frac{41}{13}$, &c.

A compound FRACTION is a part of a part, conſiſting of ſeveral numerators and denominators united together with the word *of*. As $\frac{1}{3}$ of $\frac{3}{4}$ of $\frac{2}{5}$, &c. and is thus read one third of three fourths of two fifths of an unit.

That is, when an unit, or whole thing, is firſt divided into any number of equal parts, and each of theſe parts is ſubdivided into other parts, and ſo on: then theſe laſt parts are called compound fractions, or fractions of fractions.

All compound fractions are reduced to ſingle ones, by the following

Rule.—Multiply all the numerators into one another for a numerator, and all the denominators into one another for the denominator.

Thus

Fig. 1. Fountain.

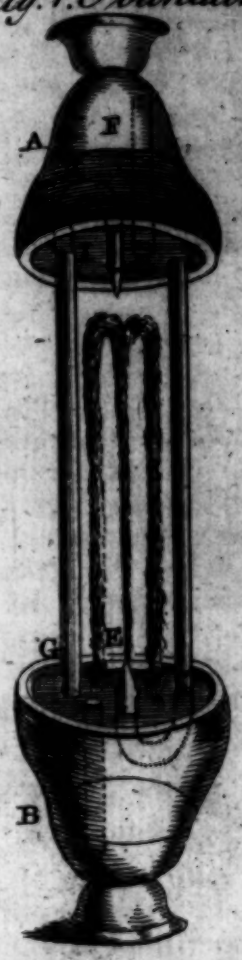


Fig. 2.

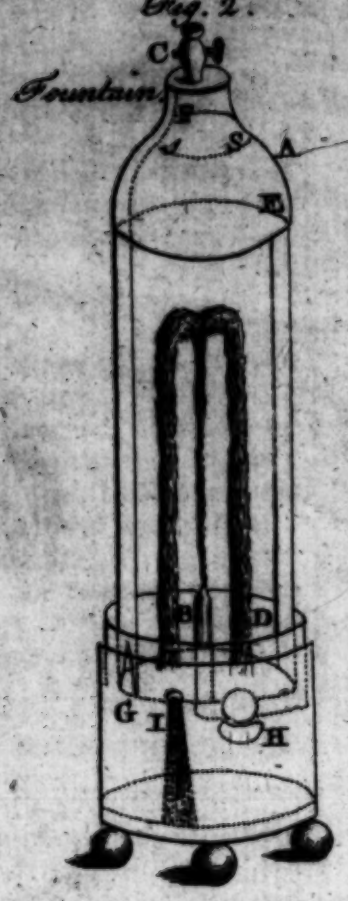
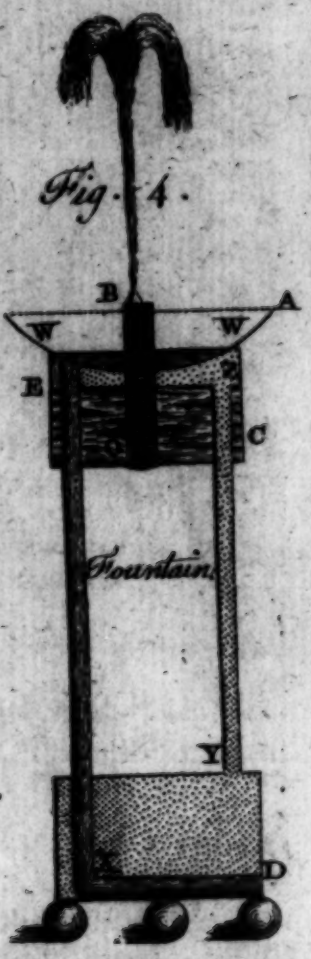


Fig. 3.

Fig. 4.



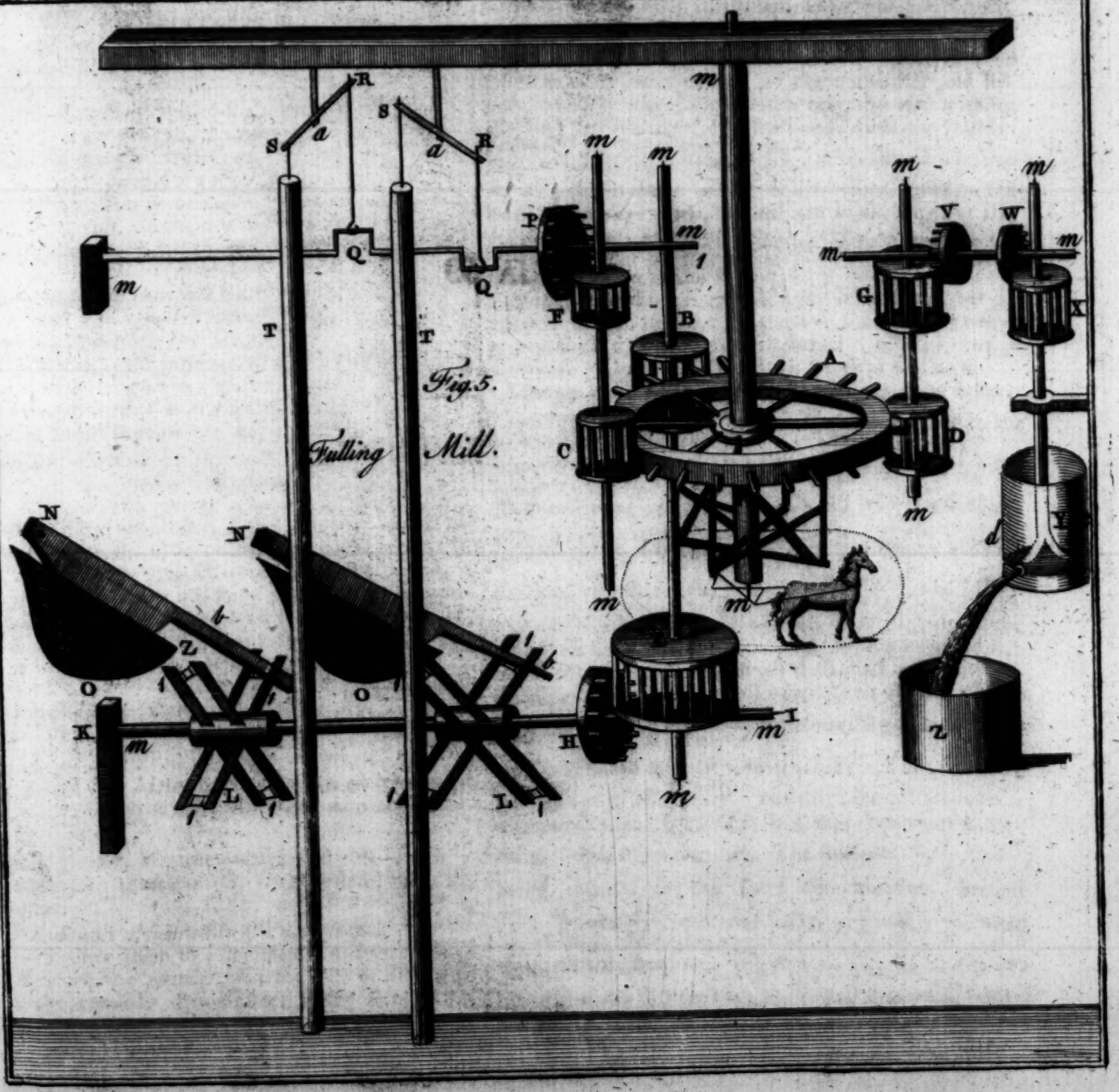


Fig. 5.

Fulling Mill.

5 JA 59

Thus the $\frac{1}{3}$ of $\frac{3}{4}$ of $\frac{2}{5}$ will become $\frac{6}{60}$, or $\frac{1}{10}$.

For $1\times3\times2=6$, the numerator, and $3\times4\times5=60$, the denominator.

To alter or change different FRACTIONS *into one denomination retaining the ſame value.*—In order to gain a clear underſtanding of this propoſition, it will be convenient to premiſe this lemma, viz. If a number multiplying two numbers produce other numbers, the numbers produced of them ſhall be in the ſame proportion that the numbers multiplied are.

That is, if both the numerator and denominator of any fraction be equally multiplied into another number, their products will retain the ſame value with that fraction.

As in theſe $\frac{2}{3}\times\frac{2}{2}=\frac{4}{6}$. Or $\frac{2}{3}\times\frac{3}{3}=\frac{6}{9}$. Or $\frac{2}{3}\times\frac{5}{5}=\frac{10}{15}$, &c.

That is, $\frac{2}{3}$ and $\frac{4}{6}$, or $\frac{2}{3}$ and $\frac{6}{9}$, or $\frac{2}{3}$ and $\frac{10}{15}$, are of the ſame value in reſpect to the whole or unit.

From hence it will be eaſy to conceive, how two or more fractions, that are of different denominations, may be altered or changed into others that ſhall have one common denominator, and ſtill retain the ſame value.

Example.—Let it be required to change $\frac{2}{3}$ and $\frac{3}{7}$ into two other fractions that ſhall have one common denominator, and yet retain the ſame value.

According to the foregoing lemma, if $\frac{2}{3}$ be equally multiplied by 7, it will become $\frac{14}{21}$, viz. $\frac{2}{3}\times\frac{7}{7}=\frac{14}{21}$. Again, if $\frac{3}{7}$ be multiplied equally with 3, it will become $\frac{9}{21}$, viz. $\frac{3}{7}\times\frac{3}{3}=\frac{9}{21}$. And by this means we have obtained two new fractions, $\frac{14}{21}$ and $\frac{9}{21}$, that are of one denomination, and the ſame value with the two firſt propoſed, viz. $\frac{14}{21}=\frac{2}{3}$, and $\frac{9}{21}=\frac{3}{7}$. And from hence ariſes the general rule for bringing all fractions into one denomination.

Rule.—Multiply all the denominators into each other for a new and common denominator; and each numerator into all the denominators except its own, for new numerators.

Example.—Let the propoſed fractions be $\frac{1}{3}$, $\frac{2}{5}$, $\frac{3}{4}$ and $\frac{6}{7}$.

Then $3\times5\times4\times7=420$, the new and common denominator: alſo $1\times5\times4\times7=140$, $2\times3\times4\times7=168$, $3\times3\times5\times7=315$, and $6\times3\times5\times4=360$, the new numerators. Hence 420 is the common denominator; and 140, 168, 315, 360, are the new numerators; and, conſequently, $\frac{140}{420}$, $\frac{168}{420}$, $\frac{315}{420}$, $\frac{360}{420}$, are the new fractions required.

To bring mixed numbers into FRACTIONS, *and the contrary.*—Mixed numbers are brought into improper fractions by the following

Rule.—Multiply the integers, or whole numbers, with the denominator of the given fraction, and to their product add the numerator of the fraction required.

Thus, $9\frac{4}{5}$ will become $\frac{49}{5}$; and $7\frac{6}{7}=\frac{54}{7}$.

To abbreviate or reduce FRACTIONS *into their loweſt or leaſt denomination.*

Rule.—Divide the greater number by the leſſer, and that diviſor by the remainder, if there be any, and ſo on continually, until there be no remainder left: then will the laſt diviſor be the greateſt common meaſure; and, if it happen to be 1, then are thoſe numbers prime numbers, and are already in their loweſt terms; but, if otherwiſe, divide the numbers by that laſt diviſor, and their quotients will be their leaſt terms required.

Example.—Let it be required to find the greateſt common meaſure of 72 and 108, viz. of $\frac{72}{108}$.

```
72) 108 (1
    72
    ---
36) 72 (2     Here, becauſe there is no remainder,
    72        36 is the greateſt common meaſure.
    ---
    (0)
```

Then $72\div36=2$, the numerator; and $108\div36=3$, the denominator: therefore $\frac{72}{108}$ is abbreviated to $\frac{2}{3}$, the loweſt terms.

Addition and ſubtraction of FRACTIONS.

Rule.—Reduce them to a common denominator, and add or ſubtract the numerators; the ſum or difference ſet over the common denominator is the ſum or remainder required.

Thus, $\frac{2}{3}+\frac{3}{4}=\frac{8+9}{12}=\frac{17}{12}=1\frac{5}{12}$; $\frac{3}{4}-\frac{2}{3}=\frac{9-8}{12}=\frac{1}{12}$; $\frac{4}{5}-\frac{3}{4}=\frac{16-15}{20}=\frac{1}{20}$.

Multiplication of FRACTIONS.

Rule.—Multiply their numerators one into another to obtain the numerator of the product; and their denominators multiplied into one another ſhall give the denominator of the product.

Thus, $\frac{2}{3}\times\frac{4}{5}=\frac{8}{15}$.

If a mixed quantity is to be multiplied, firſt reduce it to the form of a fraction, and if any integer is to be multiplied by a fraction, you may reduce it to the form of a fraction by placing an unit under it.

Examples. $5\frac{2}{3}\times\frac{3}{4}=\frac{17}{3}\times\frac{3}{4}=\frac{51}{12}$; $9\times\frac{2}{3}=\frac{9}{1}\times\frac{2}{3}=\frac{18}{3}=6$.

Diviſion of FRACTIONS.

Rule.—Multiply the numerator of the dividend by the denominator of the diviſor, and their product ſhall give the numerator of the quotient: then multiply the denominator of the dividend by the numerator of the diviſor, and their product ſhall give the denominator.

Thus, $\frac{4}{5})\frac{2}{3}(\frac{10}{12}$ $\frac{3}{4})\frac{5}{8}(\frac{32}{24}$.

The ſeveral rules of FRACTIONS *exemplified in algebraic quantities.*

Fractions in algebra are treated juſt in the ſame manner as in common arithmetic, only uſing algebraical inſtead of numeral operations; as will plainly appear from the following examples.

Examples of the reduction of FRACTIONS *from higher to lower terms.*

The fraction $\frac{4ab}{6bc}$, dividing both the numerator and denominator by the ſame quantity $2b$, will be reduced to the fraction $\frac{2a}{3c}$, a fraction of the ſame value with the former, but expreſſed in more ſimple terms: whence we may infer, that whenever a common letter or factor is to be found in every member both of the numerator and denominator, it may be cancelled every-where, without affecting the value of the fractions: thus the fraction $\frac{ac+bc}{cd+ce}$, expunging c, becomes $\frac{a+b}{d+e}$, a fraction of the ſame value. But if there be any one member, wherein the factor is not concerned, it muſt not be expunged at all: thus the fraction $\frac{ac+bc}{cd+e}$ cannot be reduced, becauſe the factor c is not to be found in e.

Note, That cancelling here is not ſubtracting, but dividing: thus to cancel the letter b in the quantity ab, ſo as to reduce it to a, is not to ſubtract b from ab, but to divide ab by b, in which caſe the quotient will be a.

Examples of FRACTIONS *reduced to the ſame denomination.*

1ſt. The fractions $\frac{a}{2}$, $\frac{b}{3}$, and $\frac{c}{4}$, when reduced to the ſame denomination, will ſtand thus; $\frac{12a}{24}$, $\frac{8b}{24}$, and $\frac{6c}{24}$. 2d. The fractions $\frac{a}{b}$ and $\frac{c}{d}$, ſo reduced, will ſtand thus; $\frac{ad}{bd}$ and $\frac{bc}{bd}$. 3. The fractions $\frac{p}{q}$, $\frac{r}{s}$, $\frac{t}{u}$, and $\frac{x}{y}$, after reduction, will ſtand thus; $\frac{psuy}{qsuy}$, $\frac{qruy}{qsuy}$, $\frac{qsty}{qsuy}$, and $\frac{qsux}{qsuy}$.

And here I cannot but obſerve, that the rule of this reduction demonſtrates itſelf: for in this example it is impoſſible not to ſee, that all theſe fractions, notwithſtanding this reduction, ſtill retain their former values: thus the firſt fraction $\frac{psuy}{qsuy}$, by cancelling common factors, is reduced to $\frac{p}{q}$, its former value; and the ſame may be obſerved of all the reſt: and this example amounts to a demonſtration, becauſe it is comprehended in general terms. But to go on: 4th. The fractions $\frac{1}{a}$, $\frac{1}{b}$, and $\frac{1}{c}$, being reduced to the ſame denomination, become $\frac{bc}{abc}$, $\frac{ac}{abc}$, and $\frac{ab}{abc}$. 5th. and laſtly, $\frac{1}{a+b}$ and $\frac{1}{a-b}$, when thus reduced, become $\frac{a-b}{aa-bb}$ and $\frac{a+b}{aa-bb}$: for 1, the numerator of the firſt fraction, multiplied into $a-b$, the denominator of the ſecond, makes $a-b$; and 1, the numerator

merator of the ſecond fraction, multiplied into $a+b$, the denominator of the firſt, makes $a+b$; and the product of the two denominators $a+b$ and $a-b$, multiplied together is $aa-bb$.

Addition of FRACTIONS.

1ſt. Theſe fractions $\frac{a}{2}$, $\frac{b}{2}$, and $\frac{c}{2}$, when added together, make $\frac{a+b-c}{2}$.

2d. The fraction $\frac{a+b}{2}$, added to the fraction $\frac{a-b}{2}$ makes $\frac{2a}{2}$ or a.

3d. The fraction $\frac{a}{b}$, added to the fraction $\frac{c}{d}$, makes $\frac{ad+bc}{bd}$.

4th. a added to $\frac{b}{c}$, that is, $\frac{a}{1}$, added to $\frac{b}{c}$, makes $\frac{ac+b}{c}$.

5th. $\frac{1}{a}$ added to $-\frac{1}{b}$, makes $\frac{b-a}{ab}$.

Subtraction of FRACTIONS.

When fractions are to be ſubtracted, change the ſign of the fraction to be ſubtracted, and then proceed exactly as in addition of fractions. Thus let it be required to ſubtract $\frac{a}{b}$ from $\frac{c}{d}$; by changing the ſign of $\frac{a}{b}$ the quantity to be ſubtracted, we ſhall have $\frac{c}{d}-\frac{a}{b}$ for the required difference, or $\frac{cb-da}{db}$. From $\frac{b}{c}$ ſubtract a, there will remain $\frac{b}{c}-\frac{a}{1}$ or $\frac{b-ca}{c}$. In the ſame manner, if from $\frac{d}{b}$ we take $\frac{a-b}{d}$, there will remain $\frac{d}{b}+\frac{b-a}{d}$ or $\frac{dd+bb-ba}{bd}$.

Multiplication of FRACTIONS.

The multiplication of fractions is performed, by multiplying the numerator and denominator of the multiplicand into the numerator and denominator of the multiplicator reſpectively.

Thus, $\frac{p}{q}\times\frac{r}{s}=\frac{pr}{qs}$, and $\frac{3p}{4q}\times\frac{5q}{6r}=\frac{15pq}{24qr}$ or $\frac{5q}{8r}$.

Diviſion of FRACTIONS.

Diviſion of fractions is performed by multiplying the numerator of the dividend into the denominator of the diviſor, for the numerator of the quotient, and the denominator of the dividend into the numerator of the diviſor for the denominator of the quotient. Or invert the numerator and denominator of the diviſor, and proceed as in multiplication of fractions, the product thence ariſing will be the quotient of the propoſed diviſion.

Let it be required to divide $\frac{p}{q}$ by $\frac{r}{s}$, the quotient by the firſt method becomes $\frac{ps}{rq}$, and by the ſecond, we are to multiply $\frac{p}{q}$ by $\frac{s}{r}$ (the diviſor inverted), which alſo gives $\frac{ps}{qr}$.

It being very uſeful to approximate, by means of a vulgar fraction, any decimal one propoſed, we ſhall here ſhew the method of inveſtigation. In order to this, let $\frac{a}{b}$ and $\frac{c}{d}$ be aſſumed to denote two vulgar fractions, in the loweſt numbers, equal nearly to the firſt figures of the given decimal; the one of them greater, and the other leſs, than the ſaid decimal. Moreover, ſuppoſing $\frac{c}{d}$ to be the neareſt value of the two, and the given quantity (or decimal) to be denoted by q; let there be aſſumed $\frac{a+cx}{b+dx}=q$. Whence x will be had $=\frac{bq-a}{c-dq}=\frac{a-bq}{dq-c}$. Let this value of x be found in the neareſt whole numbers; by means whereof the value of the fraction $\frac{a+cx}{b+dx}$ (which is a firſt approximation to the value p) will be given; and if with the fraction thus determined, and one of the two preceding ones ($\frac{a}{b}$ or $\frac{c}{d}$), the operation be repeated, a new value of x will be had from the very equation above exhibited; and from thence a ſecond approximation or value of the aſſumed fraction $\frac{a+cx}{b+dx}$. Whence the operation (if neceſſary) may be again repeated, till you arrive to any degree of exactneſs required.

Example 1. Let it be required to approximate, by means of a vulgar fraction, the quantity 3.141926, expreſſing the periphery of a circle, whoſe diameter is unity.

Here it is plain that $\frac{a}{b}$ will be $\frac{4}{1}$, and $\frac{c}{d}=\frac{3}{1}$: therefore, by writing 4, 1, 3, 1, and 3.14, &c. in the room of a, b, c, d, and g, reſpectively, the value of x $(=\frac{a-bg}{dg-c})$ is found $=\frac{4-3.13\,\&c.}{3.14,\&c.-3}=\frac{.85,\&c.}{.14,\&c.}=6$, nearly. Whence we have $\frac{a+cx}{b+dx}=\frac{4+3\times6}{1+3\times2}=\frac{22}{7}$, for a firſt approximation, being the ſame with that of Archimedes.

Again, by taking $\frac{a}{b}=\frac{3}{1}$, and $\frac{c}{d}=\frac{22}{7}$, and ſubſtituting as before, we get $x\,(=\frac{a-bg}{dg-c})=\frac{3-3.14159}{7\times3.14159-22}=16$ nearly. Whence we have $\frac{a+cx}{b+dx}=\frac{3+352}{1+112}=\frac{355}{113}$, for a ſecond approximation; agreeing with that of Metius: which converted to a decimal, errs only in the 7th place.

Example 2. Let it be required to approximate 3.43406.

Here $\frac{a}{b}=\frac{4}{1}$, and $\frac{c}{d}=\frac{3}{1}$, whence $x=1$; and ſo $\frac{a+cx}{b+dx}=\frac{7}{2}$, for a firſt approximation.

Secondly, $\frac{c}{d}=\frac{7}{2}$, and $\frac{a}{b}=\frac{3}{1}$, therefore $x=3$, and $\frac{a+cx}{b+dx}=\frac{24}{7}$, for a ſecond approximation.

Thirdly, $\frac{c}{d}=\frac{24}{7}$, and $\frac{a}{b}=\frac{7}{2}$; and ſo $x=3$, and $\frac{a+cx}{b+dx}=\frac{79}{23}$, a third approximation.

Fourthly, $\frac{c}{d}=\frac{79}{23}$, and $\frac{a}{b}=\frac{24}{7}$; whence $x=2$, and $\frac{a+cx}{b+dx}=\frac{182}{53}$; a fourth approximation. Proceeding in this manner, we may continually approach the value of the propoſed decimal fraction.

FRACTURE, in ſurgery, a rupture of a bone; or a ſolution of continuity in a bone, when it is cruſhed or broken by ſome external cauſe.

The word is Latin, *fractura*, and derived from *frango*, to break.

Surgeons generally divide fractures into three ſpecies, or thoſe of the ſimple, compound, and complicated kinds. A ſimple fracture is produced when only one bone is broken in one part, without any conſiderable injury done to the ſuperincumbent or adjacent parts. But where ſuch fracture happens in thoſe parts of the body where two large bones are contiguous to each other, in the cubit, for inſtance, when the radius is broken, whilſt the ulna remains entire, this ſpecies of fracture is by ſurgeons called incomplete, becauſe the ſituation of the parts is not much changed, and the length of the member remains the ſame. But when the ulna and radius, or the tibia and fibula in the leg, are both broken, this is called a complete or compound fracture; though we may alſo properly enough call it a compound fracture, where only one bone is broken in ſeveral parts. But where, beſides the fracture of one or more bones, there is a train of ſymptoms which requires a particular method of cure, ſuch as a wound or ulcer; then it is called a complicated fracture, becauſe in the cure of ſuch a diſorder, particular regard is to be had to the concomitant ſymptoms; but it is ſufficiently obvious, that a fracture cannot properly be ſaid to be complicated, unleſs the abovementioned ſymptoms are preſent in a very conſiderable degree; for a fracture cannot be produced without ſome degree of contuſion, and a ſlight inflammation is almoſt always ſubſequent to fractures. Hence a fracture is only ſaid to be complicated, when the concomitant ſymptoms are of ſuch importance as to require an apparatus and method of cure different from thoſe requiſite in a ſimple or compound fracture. Thus, for inſtance, when a conſiderable wound accompanies a fracture, ſuch a dreſſing cannot be uſed as in a ſimple fracture, where it is often left unchanged for ſeveral weeks; but ſuch an apparatus is required, as may, without endangering the ſeparation of the fractured and reduced bone, be frequently removed, in order to dreſs the wound.

Fractures are differently denominated according to their different directions. A tranſverſe fracture is produced, when a bone is divided by a ſection perpendicu-

la

lar to its length. An oblique fracture, on the contrary, is ſaid to be produced, when the diviſion of the bone is not perpendicular to its longitude, but declines more or leſs from a perpendicular direction. Hence the ſurface of the fracture is the greater, and the retention of the fractured portions, when reduced, the more difficult. A longitudinal fracture is, when the bone is ſplit in a longitudinal direction; for which reaſon it is rather a fiſſure than a fracture properly ſo called, becauſe the parts of the bone are not entirely ſeparated, but as it were fiſſured in a longitudinal direction.

In curing of fractures the principal concern ſhould be the agglutination of the bone: take care therefore, 1. That it is reduced to its proper ſituation; and this is done by extenſion and repoſition. 2. After reduction, apply a proper bandage, and preſcribe reſt to your patient. 3. Prevent, or remedy, the inconveniencies that may enſue; and the ſurgeon will be qualified for this, if he knows, 1. How the bones are ſituated, whether there are one or more in the limb; whether they are large or ſmall, robuſt or ſpongy, even or uneven; and whether one or more be fractured. 2. What muſcles are near, with their poſition and office. 3. Whether any of the larger nerves, veins, or arteries, are near: for a thorough knowledge of theſe things conduces very much to a ſucceſsful cure.

When the fractured bones continue in their natural poſition, a proper bandage will promote the agglutination of the fragments, without repoſition or extenſion; though, as often as they recede from each other, ſome degree of extenſion is abſolutely neceſſary, which muſt always be proportioned to the diſtortion of the fragments; for the wider the ſeparation and the ſhorter the limb, from a contraction of the muſcles, the greater extenſion is required. But this operation muſt be performed tenderly, leſt too great violence ſhould injure the patient.

In extending a fractured limb, care is to be taken, 1. That the patient is kept ſteady, to prevent his giving way to the extenſion. The poſture muſt be accommodated to the circumſtances; for ſometimes ſitting in a chair, or on the floor, ſometimes lying on a bed, or table, is more commodious. 2. The broken limb, both above and below the fracture, muſt be held by an aſſiſtant. 3. The aſſiſtant who holds the lower part muſt extend it with ſtrength ſufficient to replace the fragments. But, if the hands alone are not ſufficient, uſe a rope or napkin; and if one man is not enough, employ two or three. Obſerve always to proceed with tenderneſs, that you may not rack the patient with unneceſſary tortures.

There remains one very important obſervation relative to the extenſion of fractured bones, which is, that if the ſurgeon is called in after tumours, or violent inflammations come on, he ought to defer the extenſion, till they are removed; for, under theſe circumſtances, the parts affected cannot be handled, compreſſed, or extended, without much acute pains, convulſions, and the danger of a ſphacelus: but if the tumor or inflammation are ſlight, we may eaſily proceed to extenſion directly, in order to prevent their increaſe.

FRÆNUM, in anatomy, a term applied to ſome membranous ligaments of the body. As,

FRÆNUM LINGUÆ, the ligament under the tongue; which ſometimes ties it down too cloſe to the bottom of the mouth, and then requires to be inciſed or divided, in order to give this organ its proper and free motion. This diſorder generally ariſes in infants ſoon after their birth, ſo that they cannot move and exert their tongues in the action of ſucking: though it is ſometimes alſo obſerved in adults.

Each of the lips has alſo its peculiar frænum: the upper one under the noſe; the under one near the roots of the dentes inciſores: theſe are of the utmoſt ſervice to us in ſpeaking, and eating and drinking.

FRÆNUM PENIS, a ligament of the penis, that ties the prepuce to the lower part of the glans of the PENIS. See PENIS.

There is alſo a ſmall frænum of the clitoris, by which it is connected to the oſſa pubis. See the article CLITORIS.

FRAGARIA, the ſtrawberry, in botany, a genus of plants, the corolla of which conſiſts of five roundiſh patent petals, inſerted in the cup: there is no pericarpium; the common receptacle of the ſeed is of a roundiſh, oval figure, plane at the baſe, pulpoſe, large, ſoft, and deciduous; the ſeeds are numerous, ſmall, acuminated, ſcattered over the ſuperfices of the receptacle, and not deciduous.

FRAIL, a baſket made of ruſhes, or the like, in which are packed up figs, raiſins, &c. It ſignifies alſo a certain quantity of raiſins, about ſeventy-five pounds.

FRAISE, in fortification, a kind of defence, conſiſting of pointed ſtakes, ſix or ſeven feet long, driven parallel to the horizon into the retrenchments of a camp, a half-moon, or the like, to prevent any approach or ſcalade.

Fraiſes differ from paliſades chiefly in this, that the latter ſtand perpendicular to the horizon, and the former jet out parallel to the horizon, or nearly ſo, being uſually made a little ſloping, or with points hanging down. Fraiſes are chiefly uſed in retrenchments and other works thrown up of earth; ſometimes they are found under the parapet of a rampart, ſerving inſtead of the cordon of ſtone uſed in ſtone-works.

To FRAISE *a Battalion*, is to line the muſqueteers round with pikes, that, in caſe they ſhould be charged with a body of horſe, the pikes being preſented, may cover the muſqueteers from the ſhock of the horſe, and ſerve as a barricade.

FRAME, in joinery, a kind of caſe, wherein a thing is ſet or incloſed, or even ſupported, as a window-frame, a picture-frame, &c.

FRAME is alſo a machine uſed in divers arts; as,

FRAME, among printers, is the ſtand which ſupports the caſes. See the article CASE.

FRAME, among founders, a kind of ledge incloſing a board, which, being filled with wetted ſand, ſerves as a mould to caſt their works in. See FOUNDERY.

FRAME is more particularly uſed for a ſort of loom, whereon artificers ſtretch their linens, ſilks, ſtuffs, &c. to be embroidered, quilted, or the like.

FRAME, among painters, a kind of ſquare, conſiſting of four long ſlips of wood joined together, whoſe intermediate ſpace is divided by threads into ſeveral little ſquares like a net? and hence ſometimes called reticula. It ſerves to reduce figures from great to ſmall; or, on the contrary, to augment their ſize from ſmall to great.

FRAMING *of an Houſe*, among carpenters, denotes all the timber-work therein; namely, the carcaſe, flooring, partitioning, roofing, cieling, beams, aſhlering, &c. all together. See FLOORING, &c.

FRANCE, a large kingdom of Europe, ſituated between the fifth degree weſt, and ſeventh degree eaſt longitude, and between the forty-third and fifty-firſt degree north latitude, being bounded by the Engliſh Channel and the Auſtrian Netherlands, on the north; by Germany, Switzerland, Savoy, and Piedmont, in Italy, on the eaſt; by the Mediterranean ſea, and the Pyrenean mountains, which ſeparate it from Spain, on the ſouth; and by the Bay of Biſcay, on the weſt. This kingdom was formerly divided into twelve provinces, but at preſent it is divided into twenty-five general governments, over every one of which is an officer, called an intendant, appointed by the king, who has a power of controuling the governor, and all other officers of juſtice; and preſides over the receiver-general of his generality.

FRANCHISE, in a general ſenſe, a privilege or exemption from ordinary juriſdiction; as that for a corporation to hold pleas among themſelves to ſuch a value, or the like.

FRANCHISE is ſometimes uſed for an immunity from a tribute, in which ſenſe it is either perſonal or real; that is, belonging to a perſon immediately, or elſe by means of this or that place of which he is chief, or a member.

FRANCHISE is alſo uſed for an aſylum or ſanctuary, where people are ſecure of their perſons. See ASYLUM.

FRANCISCAN MONKS, FRIARS-MINOR, or GREY-FRIARS, religious of the order of St. Francis; founded by him in the year 1209. See the article FRIAR.

FRANK LANGUAGE, or LINGUA FRANCA, a kind

of jargon ſpoken in the Mediterranean, and particularly throughout the coaſts and parts of the Levant, compoſed of Italian, Spaniſh, French, vulgar Greek, and other languages.

FRANK-LAW, a word applied to the free and common law of the land, or the benefit a perſon has by it.

FRANK-PLEDGE, in our law, ſignifies a pledge or ſurety for the behaviour of freemen.

FRANKINCENSE, *Thus*, in the materia medica. See the article THUS.

FRANKS, FRANKIS, or FRANQUIS, an appellation given by the Turks, and other nations of Aſia, to all the inhabitants of the weſtern parts of Europe, to which they give the name of Frankiſtan.

FRAPPING, among ſailors, the act of croſſing and drawing together the ſeveral parts of a tackle, or other complication of ropes drawn tight to ſecure any body. The frapping always increaſes the tightneſs, or of courſe adds to the ſecurity acquired by the purchaſe.

FRAPPING *a Ship*, paſſing four, five, or ſix turns of a cable round the body or hull of a ſhip in the middle, to ſecure her in a great ſtorm, when it is apprehended ſhe has not ſufficient ſtrength to reſiſt the violent efforts of the waves: this expedient, however, is rarely put in practice, unleſs in very old ſhips, which the owners are willing to venture till the laſt.

FRATERNITY, in the Roman catholic countries, ſignifies a ſociety for the improvement of devotion.

FRATERNITY, in a civil ſenſe, a company or gild of certain artificers or traders. See the articles COMPANY and GILD.

FRATRICELLI, LITTLE BROTHERS, in church-hiſtory, a ſect of heretics who appeared in Italy about the year 1298, and afterwards ſpread all over Europe. They wore the habit of the Franciſcan order, and pretended that eccleſiaſtics ought to have no poſſeſſions of their own.

FRATRIAGE, *Fratriagium*, the partition among brothers or coheirs, coming to the ſame inheritance or ſucceſſion.

FRATRICIDE, the crime of murdering one's brobrother. See PARRICIDE.

FRAUD, in law, ſignifies deceit in grants or conveyances of lands, &c. or in bargains and ſales of goods, &c. to the damage of another perſon.

FRAXINUS, the aſh, in botany. See the article ASH.

FREAM, a name given by farmers to ploughed lands worn out of heart, and laid fallow till it recovers. See FALLOWING.

FRECKLES, *Lentigines*, in medicine, ſmall, yelloviſh, or duſky ſpots appearing on the ſkin, chiefly about the face, neck, and hands. It is moſtly a natural affection cauſed by the heat of the ſun, whereby ſome parts of the ſkin appear of a darker colour than uſual, called tan, ſunburn, and morphew, which differ only in degree, and uſually diſappear in winter.

Freckles are generally more numerous about the forehead and noſe than in any other parts of the face, and in ſize commonly equal the ſcale of a herring. Tan uſually ſpreads all over the face, the ſpots thereof being much larger than freckles: perſons of a delicate complexion, or ſuch whoſe hair is red, are moſt ſubject to freckles, eſpecially in thoſe parts which are expoſed to the air; and they are very hard to remove.

Mr. Homberg's medicine, which is compoſed of bullock's gall mixed with alum, and after the alum is precipitated, expoſed three or four months in the ſun in a cloſe phial, is the beſt remedy.

FREE, in a general ſenſe, is uſed in oppoſition to whatever is conſtrained or neceſſitated. When applied to things endowed with underſtanding, it more peculiarly relates to the liberty of the will.

FREE-BENCH, ſignifies that eſtate in copyhold which the wife, being eſpouſed a virgin, has after the deceaſe of her huſband for her dower, according to the cuſtom of the manor.

FREE-STATE, a republic governed by magiſtrates elected by the free ſuffrages of the inhabitants.

FREE-STONE, a whitiſh ſtone dug up in many parts of England, that works like alabaſter, but is more hard and durable; being of excellent uſe in building, &c. It is a kind of the grit ſtone, and is called free, from its being of ſuch a conſtitution as to cut freely in any direction: ſuch is the Portland-ſtone, and the free-ſtone of Kent.

FREE-THINKER. See the article DEIST.

FREE-WARREN, the power of granting or denying licenſe to any one to hunt in ſuch and ſuch ground.

FREE *the Boat*, or bale the boat, among ſailors, throw out the water.

FREEDOM, in general, the ſtate or quality of being free.

FREEDOM *of a Corporation*, the right of enjoying all the privileges and immunities belonging to it.

FREEDOM *of the Will*, that power or faculty of the mind whereby it is capable of acting, chuſing or rejecting whatever it judges proper. Of this every man muſt be ſenſible, who finds in himſelf a power to begin or forbear, continue or end ſeveral actions, barely by a thought or preference of the mind. The actual exerciſe of this power, is that which we call volition or willing; and the agent capable of acting in this manner, is denominated free, and the actions he performs, voluntary. Whereas, on the other hand, wherever any performance or forbearance are not equally in a man's power; wherever doing or not doing will not equally follow upon the preference of his mind, there he is not free, though perhaps the action may be voluntary. To illuſtrate this, ſuppoſe a man to be carried whilſt faſt aſleep into a room where is a perſon he longs to ſee, and be there locked faſt in, beyond his power to get out, he awakes, and is glad to ſee himſelf in ſo deſireable company, which he ſtays willingly in; that is, prefers his ſtaying to going away. In this caſe, his ſtay is voluntary; and yet, being locked faſt in, he is not at liberty to ſtay, he has not freedom to be gone. So that liberty does not conſiſt in the preference of the mind, but in the power of conforming to that preference.

FREEDOM *of Contrariety*, among moraliſts, that of chuſing either of two oppoſites, as virtue or vice, good or evil; concerning which the received doctrine is, that mankind have a freedom of contradiction, but not of contrariety; that is, they may abſtain from the purſuit of virtue and good, but are incapable of hating them, or of preferring their oppoſites. See the article CONTRADICTION.

FREEZE, or FRIEZE, in architecture. See the article FRIEZE.

FREEZE, or FRIEZE, in commerce, a coarſe kind of woollen ſtuff, or cloth, for winter wear; ſo called, as being freezed or napped on one ſide.

FREEZING, in philoſophy, the ſame with congelation. See CONGELATION and FROST.

Philoſophers are by no means agreed as to the cauſe of this phœnomenon. The Carteſians account for it by the receſs or going out of the ætherial matter from the pores of the water. The Corpuſcularians, on the other hand, attribute it to the ingreſs of frigorific particles, as they call them: Hobbes aſſerts, that theſe particles are nothing elſe but common air, which entangling itſelf with the particles of water, prevents their motion. Others will have a kind of nitrous ſalt to be the cauſe of congelation, by inſinuating itſelf between the particles of water, and fixing them together, like nails: and indeed it ſeems probable that cold and freezing do ariſe from ſome ſubſtance of a ſaline nature, floating in the air; ſince all ſalts, and particularly nitrous ones, when mixed with ice and ſnow, greatly increaſe their cold and even bulk.

By means of freezing, wine, vinegar, and malt-liquor may be reduced to a fourth part of their quantity, without any conſiderable loſs of their eſſential parts; ſince only the aqueous parts freeze, leaving the vinous part concentrated or brought into leſs compaſs, and capable of being tranſported with leſs expence, and keeping ſeveral years.

FREEZING MIXTURE. See the article ARTIFICIAL COLD.

FREEZING, in naval affairs, a ſort of ornament painting, conſiſting of trophies, flower-work, &c. a ſhip's quarter, ſtern, or fore part immediately below the upper-edge of her ſides, called the gunnel.

FREIGHT, or FRAIGHT, in navigation and commerce, the hire of a ſhip, or a part thereof, for the conveyance and carriage of goods from one part or place to another; or the ſum agreed on between the owner and the merchant, for the hire and uſe of a veſſel.

FREIGHT, is alſo uſed for the burden or lading of a ſhip, or the cargo of goods, &c. which ſhe has on board.

FREIGHT alſo ſignifies a duty of fifty ſols per tun, paid to the crown of France by the maſters of foreign veſſels going in or out of the ſeveral ports of that kingdom.

FRENUM, or FRÆNUM, in anatomy. See FRÆNUM.

FRENZY, or PHRENZY, in medicine. See the article PHRENZY.

FRESCO, a method of painting in relievo on walls, ſo as to endure the weather.

It is performed with water-colours on freſh plaiſter; or on a wall laid with mortar not yet dry. This ſort of painting has a great advantage by its incorporating with the mortar, and drying along with it, becomes very durable.

The compoſt ſhould be made of rubbiſh ſtones mixed with well-burnt flint, or lime, and water; but the ſaltneſs of the lime muſt be waſhed out, by pouring water frequently on it; but this ſhould not be done in moiſt weather.

To prevent the plaiſter from pealing, ſtrike into the joints of the wall ſtumps of horſe-nails ſix inches diſtant from each other. Firſt, plaiſter the walls pretty thick, then let it dry for ſome time, the deſign and colours being firſt ready prepared. This painting is chiefly performed on walls and vaults newly plaiſtered with lime and ſand; and the plaiſter is only to be put on in proportion as the painting proceeds.

Plaiſter the wall a ſecond time, about the thickneſs of half a crown, only ſo much as you intend to work upon; and, while it is wet, work the colours therein, which will incorporate with the plaiſter ſo as never to waſh out.

The painting muſt be worked with a free-hand, and your colours made high enough at firſt, as there can be no alteration made after the firſt painting.

In this work ſcarce any thing elſe is uſed but earths, which ſtill retain their colour, defending it from the burning and ſalt of the lime. The colours are white, made of lime ſlacked ſome time, and white marble duſt, red and yellow ochre, violet red, verditer, lapis lazuli, ſmalt, black Spaniſh brown, Spaniſh white, &c. all which are ground and worked up with water.

The bruſhes and pencils for this work muſt be long and ſoft, or elſe they will rake and raze the painting; the colours muſt be full and flowing from the bruſh, and the deſign or cartoon muſt be perfect in the paper-copy.

The ancients painted on ſtucco; and we may remark in Vitruvius what infinite care they took in making the incruſtations or plaiſtering of their buildings, to render them beautiful and laſting; though the modern painters find a plaiſter made of lime and ſand preferable thereto.

FRESHEN *the Hawſe*, among ſailors, when a ſhip rides at anchor, there is always ſome canvas, mat, leather, or ſuch like matter wound about the cable in the hawſe-hole, and where it may rub againſt the ſtem: the matter uſed on this occaſion is called ſervice, and, as by the pitching and labouring of the ſhip in a ſtorm when ſhe is anchored in an open road or bay, the ſervice muſt be in a ſhort time wore through, it is neceſſary to have it frequently renewed for the preſervation of the cables, on which all depends; and this act of renewing the ſervice is called freſhening the hawſe, which is a circumſtance a ſeaman can never be too careful in obſerving. See the article HAWSE.

FRESHES, among ſailors, the violence of an ebb-tide, encreaſed by heavy rains, flowing into the ſea, which it diſcolours to a conſiderable diſtance from the ſhore on ſuch occaſions, where the line on which the two colours meet, may be diſtinctly obſerved for a great length along the coaſt.

FRET, or FRETTE, in architecture, a kind of knot or ornament, conſiſting of two liſts or ſmall fillets variouſly interlaced or interwoven, and running at parallel diſtances equal to their breadth.

Every return and interſection of theſe frets muſt be at right angles, otherwiſe they loſe all the beauty, and become perfectly Gothic. Sometimes the fret conſiſts but of a ſingle fillet, which, if well diſpoſed, may be made to fill its ſpace exceedingly well. Frets were very much uſed by the ancients, eſpecially on even flat members, or parts of a building, as the faces of the corona, and eves of corniches; under the roofs, ſoffits, &c. and on the plinths of baſes. See the articles CORONA, EVE, &c.

FRET, in heraldry, a bearing compoſed of ſix bars, croſſed, and variouſly interlaced: ſome call it the true-lover's knot.

FRET, in muſic, ſignifies a kind of ſtop on ſome inſtruments, particularly baſs-viols and lutes. Frets conſiſt of ſtrings tied round the neck of the inſtrument, at certain diſtances, within which ſuch and ſuch notes are to be found.

FRET-WORK, that adorned with frets. It is ſometimes uſed to fill up and enrich flat empty ſpaces; but is moſtly practiſed in roofs, which are fretted over with plaiſter-work. The Italians alſo uſe fretworks in the mantling of chimneys with great figures, a cheap piece of magnificence, and as durable almoſt within doors, as harder matters in the weather.

FRETTY, in heraldry, an appellation given to bearings made up of ſix, eight, or more bars laid acroſs each other, in the manner of frets.

FRIABLE, among naturaliſts, an appellation given to bodies that are eaſily crumbled to pieces: ſuch are the free-ſtone, pumice-ſtone, &c.

FRIAR, or FRIER, from the French *frere*, a brother, a term common to monks of all orders, founded on this, that there is a kind of fraternity, or brotherhood, between the ſeveral religious perſons of the ſame convent or monaſtery.

Friars are generally diſtinguiſhed into theſe four principal branches, viz. 1. Minors, grey friars, or Franciſcans. 2. Auguſtines. 3. Dominicans, or black friars. 4. White friars, or Carmelites. From theſe four the reſt of the orders deſcend. See the articles FRANCISCANS, AUGUSTINES, &c.

FRIAR, in its more peculiar and proper ſenſe, is reſtrained to ſuch monks as are not prieſts, for thoſe in orders are generally dignified with the title of father. See MONK and FATHER.

FRIAR OBSERVANT is a branch of the Franciſcan friars; thus called, becauſe they are not combined together in any cloiſter, convent, or corporation, as the conventuals are; but have bound themſelves only to obſerve the rules of their order more ſtrictly than the conventuals do, from whom they ſeparated, out of a ſingularity of zeal, living in certain places of their own chuſing.

FRIAR'S COUL, in botany, a name given to ſeveral ſpecies of arum. See the article ARUM.

FRICTION, the act of rubbing the ſurface of one body againſt that of another.

The word is Latin, *frictio*, and derived from *frico*, to rub.

Among machines, ſome have a great deal more friction than others, and ſome very little. Thus a pendulum has little or no friction, but what ariſes from the reſiſtance of the air. But a carriage has a great deal of friction: for upon plain ground a loaded cart requires the ſtrength of ſeveral horſes to draw it along; and all or moſt of this force is owing to its friction. All compounded machines have great friction, and ſo much the more as they conſiſt of more parts that rub againſt one another. And there is a great variety in ſeveral ſorts of bodies, as to the quantity of friction they have, and even in the ſame bodies under different circumſtances: upon which account it will be impoſſible to give any ſtanding rules, by which its quantity can be exactly determined. All we can do is to lay down ſuch particular rules as have been deduced from experiments made upon particular bodies; which rules will require ſome variation under different circumſtances, according to the judgment and experience of the artiſt.

1. Wood and all metals, when oiled or greaſed, have nearly the ſame friction: and the ſmoother they are, the leſs friction they have: yet metals may be ſo far poliſhed as to increaſe friction by the coheſion of their parts.

Wood ſlides eaſier upon the ground in wet weather than in dry; and eaſier than iron in dry weather: but iron ſlides eaſier than wood in wet weather. Lead makes a great deal of reſiſtance. Iron or ſteel running in braſs, makes the leaſt friction of any. In wood acting againſt wood, greaſe makes the motion twice as eaſy, or rather $\frac{2}{3}$ eaſier. Wheel-naves greaſed or tarred, go four times eaſier than when wet.

Metals oiled makes the friction leſs than when poliſhed, and twice as little as when unpoliſhed.

In general, the ſofter or rougher the bodies, the greater is their friction.

2. As to particular caſes: a cubic piece of ſoft wood of eight pounds weight, moving upon a ſmooth plane of ſoft wood, at the rate of three feet per ſecond; its friction is about $\frac{2}{3}$ the weight of it: but if it be rough, the friction is little leſs than half the weight.

Upon the ſame ſuppoſition, other ſoft wood upon ſoft wood very ſmooth, the friction is about $\frac{1}{4}$ the weight.

Soft wood upon hard or hard upon ſoft, $\frac{1}{5}$ or $\frac{1}{6}$ the weight.

Hard wood upon hard wood, $\frac{1}{7}$ or $\frac{1}{8}$ the weight.

Poliſhed ſteel moving on ſteel or pewter, $\frac{1}{4}$ the weight: moving on copper or lead, $\frac{1}{5}$ the weight: on braſs $\frac{1}{3}$ the weight. Metals of the ſame ſort have more friction than different ſorts.

The friction, *cæteris paribus*, increaſes with the weight almoſt in the ſame proportion. The friction is alſo greater with a greater velocity, but not in proportion to it, except in very few caſes. A greater ſurface alſo cauſes ſomething more friction, with the ſame weight and velocity: yet friction may ſometimes be increaſed by having too little ſurface to move on; as upon clay, &c. where the body ſinks.

3. The friction ariſing from the bending of ropes about machines, differs according to their ſtiffneſs, the temper of the weather, degree of flexibility, &c. but, *cæteris paribus*, the force or difficulty of bending a rope is as the ſquare of the diameter of the rope, and its tenſion, directly; and the diameter of the cylinder or pulley it goes about, reciprocally.

A rope of one inch diameter, whoſe tenſion, or weight drawing it, is five pounds, going over a pulley three inches diameter, requires a force of one pound to bend it.

4. The reſiſtance of a plane moving through a fluid is as the ſquare of the velocity; and putting $v =$ velocity in feet, in a ſecond, it is equal to the weight of a column of the fluid, whoſe baſe is the plane, and height $\frac{v\,v}{64}$. And in a globe it is but half ſo much.

5. The friction of a fluid running through a tube is as the velocity and diameter of the tube.

But the friction is greater in reſpect to the quantity of the fluid, in ſmall tubes than in large ones; and that reciprocally as their diameters: but the abſolute quantity of the friction in tubes is but very ſmall, except the velocity be very great, and the tube very long.

But if a pipe be divided into ſeveral leſſer ones, whoſe number is n; the reſiſtance ariſing from the friction will be increaſed as $\sqrt{n}$. For the area of the ſection of any one pipe will be $\frac{1}{n}$, and the friction being as the circumference, will be as $\frac{1}{\sqrt{n}}$; and therefore the friction in all of them, will be $\frac{n}{\sqrt{n}}$, or as $\sqrt{n}$.

6. As to the mechanic powers. The ſingle lever makes no reſiſtance by friction: but if by the motion of the lever in lifting, the fulcrum, or place of ſupport, be changed further from the weight; the power will be decreaſed thereby.

7. In any wheel of any machine, running upon an axis; the friction on the axis is as the weight upon it, the diameter of the axis, and the angular velocity. This ſort of friction is but ſmall.

8. In the pulley, if p, q, be two weights, and q the greater; and $W = \frac{4pq}{p+q}$; then W is the weight upon the axis of the ſingle pulley: and it is not increaſed by the acceleration of the weight q, but remains always the ſame.

The friction of the pullies is very conſiderable, when the ſheaves rub againſt the blocks; and by the wearing of the holes and axels.

The friction on the axis of the pulley is as the weight W, its angular velocity, the diameter of the axis directly, and the diameter of the pulley inverſly. A power of one hundred pounds, with the addition of fifty pounds, will but draw up five hundred pounds with a tackle of five; and fifteen pounds over a ſingle pulley will draw up only fourteen pounds.

9. In the ſcrew, there is a great deal of friction: thoſe with ſharp threads have more friction than thoſe with ſquare threads: and endleſs ſcrews have more than either. Screws with a ſquare thread raiſe a weight with more eaſe than thoſe with a ſharp thread.

In the common ſcrew the friction is ſo great, that it will ſuſtain the weight in any poſition given, when the power is taken off; and therefore the friction is at leaſt equal to the power. From whence it will follow, that in the ſcrew

The power muſt be to the weight or reſiſtance, at leaſt as twice the perpendicular height of a thread, to the circumference deſcribed by one revolution of the power; if it be able to raiſe the weight, or only ſuſtain it. This friction of the ſcrew is of great uſe, as it ſerves to keep the weight in any given poſition.

10. In the wedge, the friction is at leaſt equal to the power, as it retains any poſition it is driven into; therefore in the wedge, the power muſt be to the weight at leaſt as twice the baſe to the height to overcome any reſiſtance.

11. To find the friction of any engine, begin at the power, and conſider the velocity and the weight at the firſt rubbing part; and eſtimate its quantity of friction by ſome of the foregoing articles; then proceed to the next rubbing part and do the ſame for it, and ſo on through the whole.

And note, that ſomething more is to be allowed for increaſe of friction, by every new addition to the power.

FRICTION, in medicine, the rubbing a diſeaſed part, either with or without unguents, oils, &c. Dr. Cheyne greatly recommends friction with a flesh-brush to perſons of weak nerves and ſedentary lives; by which means a full and free perſpiration would be promoted, and obſtructions removed, to the great relief of many valetudinarians.

FRIEZE, FREEZE, or FRIZE, in architecture, a large flat face, or member, ſeparating the architrave from the corniche, being that part of the entablature between the architrave and corniche.

This member was by the ancients called zoophorus, becauſe it was commonly enriched with the figures of animals. The frieze is ſuppoſed to be deſigned to repreſent the heads of the tranſverſe beams, which ſuſtain the roof or covering.

In the Tuſcan order it is quite plain, but is enriched with triglyphs in the Doric; it is ſometimes made arched or ſwelling in the Ionic: in the Corinthian and Compoſite it is frequently joined to the architrave by a little ſweep, and ſometimes to the corniche; and in theſe richer orders, it is commonly adorned with ſculpture, figures, compartments, hiſtories, foliages, feſtoons, &c.

As to the height of the frieze, it is in general much the ſame as that of the architrave. The height of the Tuſcan frieze, according to Vitruvius, who makes it flat and plain, is 30 minutes; but Palladio, who makes it convex and ſwelling, gives it only 26; Scamozzi makes it plain, but raiſes the height to 42 minutes. Vitruvius and Vignola, who make the Doric frieze flat, only covered with triglyphs, give it the height of 30 or 40 minutes: but Palladio and Scamozzi make it 45. The Ionic frieze, according to Vitruvius, who makes it flat, only carved with acanthus-leaves, &c. is 30 minutes in height; Vignola makes it 45, and ſa like

like Vitruvius: Palladio, who makes it convex and ſwelling, calls the height 27; and Scamozzi 28. The height of the Corinthian frieze, according to Vitruvius, who enriches it with acanthus-leaves, human figures, &c. is 37 minutes; but Vignola makes it 45; Palladio, 28; and Scamozzi 31 ½. Laſtly, the Compoſite frieze, which, in Vitruvius, is ſet with cartouſes, and carved between them, is, according to that writer, 52 ½ minutes high; but Vignola, who makes it like Vitruvius, gives it but 45 minutes; Palladio, who makes it ſwelling, has but 30; Scamozzi, 32.

From the variety of their ornaments, friezes obtain various denominations.

Convex or *Pulvinated* FRIEZES, ſuch whoſe profile is a curve, the beſt proportion of which is when drawn on the baſe of an equilateral triangle.

In ſome the ſwelling is only at top, as in a conſole; in others at bottom, as in a balluſter.

Flouriſhed FRIEZES, ſuch as are enriched with rinds of imaginary foliages, as the Corinthian frieze of the frontiſpiece of Nero: or with natural leaves, either in cluſters or garlands; or continued, as in the Ionic of the gallery of Apollo in the Louvre.

Hiſtorical FRIEZES, ſuch as are adorned with baſs relievos, repreſenting hiſtory, ſacrifices, &c. as the arch of Titus at Rome.

Marine FRIEZES, ſuch as repreſent ſea-horſes, tritons, and other attributes of the ſea, as ſhells, baths, grottos, &c.

Ruſtic FRIEZES, ſuch whoſe courſes are ruſticated or emboſſed, as in the Tuſcan frieze of Palladio.

Symbolical FRIEZES, thoſe adorned with the attributes of religion, as the Corinthian of the temple behind the Capitol at Rome; whereon are repreſented the inſtruments and apparatus of ſacrifice.

FRIGATE, in the marine, a light nimble ſhip, built for quick ſailing: frigates carry from twenty to thirty-eight cannon, and are eſteemed excellent cruiſers.

Formerly the name of frigate was only known in the Mediterranean; and given to a kind of long veſſel, which they made uſe of in thoſe ſeas; and went with ſails and oars. The Engliſh were the firſt who appeared on the ocean with thoſe ſhips; and fitted them for action as well as ſailing.

FRIGID, is applied to a jejune ſtile, that is unanimated by any ornaments, and conſequently without any force or vigour.

FRIGID ZONE, in geography. See the article ZONE.

FRIGORIFIC, in phyſiology, ſmall particles of matter, which, according to Gaſſendus and others, being actually and eſſentially cold, and penetrating other bodies, produce in them that quality which we call cold. See COLD.

FRIST, in the mercantile ſtyle, ſignifies ſelling goods upon credit, or truſt.

FRIT, in the glaſs manufacture, the matter or ingredients of which glaſs is to be made, when they have been calcined or baked in a furnace; or it is the calcined matter to be run into glaſs. See GLASS.

There are three kinds of frit; the firſt, that made for cryſtal; the ſecond, or ordinary frit, is that made for the common white or cryſtalline metal; and the third, that made for green glaſs.

The frit for cryſtal is made as follows: take two hundred pounds of tarſo, powdered fine, and ſifted; of the ſalt of polverine, one hundred and thirty pounds; mix them well together, and put them in the calcar, a ſort of oven, or reverberatory furnace, which ſhould firſt be well heated: here let them remain, baking, frying, and calcining, for five hours, during which the workman keeps mixing them with a rake, to make them incorporate.

The ſecond or ordinary frit is made of bare aſhes of polverine, without extracting the ſalt from them.

The third, for green graſs, is made of common aſhes, without any preparation.

It may be obſerved, that glaſs might be made by immediately melting the materials, without this calcining and making them into frit; but the operation would be much more tedious.

FRIZING *of Cloth*, a term in the woollen manufactury, applied to the forming of the nap of a cloth, or ſtuff, into a number of little hard burrs or prominences, covering almoſt the whole ground thereof.

Some cloths are only frized on the back-ſide, as black cloths; others on the right-ſide, as coloured and mixed cloths, rateens, baize, freezes, &c.

Frizing may be performed two ways; one with the hand, that is, by means of two workmen, who conduct a kind of plank that ſerves for a frizing inſtrument.

The other way is by a mill, worked either by water, or a horſe, or ſometimes by men. This latter is eſteemed the better way of frizing, by reaſon the motion being uniform and regular, the little knobs of the frizing are formed more equably and regularly. The ſtructure of this uſeful machine is as follows.

The three principal parts are the frizer or criſper, the frizing-table, and the drawer, or beam. The two firſt are two equal planks or boards, each about ten feet long, and fifteen inches broad, differing only in this, that the frizing-table is lined or covered with a kind of coarſe woollen ſtuff, of a rough ſturdy nap; and the frizer is incruſtated with a kind of cement compoſed of glue, gum arabic, and a yellow ſand, with a little aqua vitæ or urine. The beam, or drawer, thus called becauſe it draws the ſtuff from between the frizer and the frizing-table, is a wooden roller, beſet all over with little, fine, ſhort points, or ends of wire, like thoſe of cards uſed in carding of wool.

The diſpoſition and uſe of the machine is thus: the table ſtands immoveable, and bears or ſuſtains the cloth to be frized, which is laid with that ſide uppermoſt on which the nap is to be raiſed: over the table is placed the frizer, at ſuch a diſtance from it as to give room for the ſtuff to be paſſed between them, ſo that the frizer, having a very ſlow ſemicircular motion, meeting the long hairs or naps of the cloth, twiſts and rolls them into little knobs or burrs, while, at the ſame time, the drawer, which is continually turning, draws away the ſtuff from under the frizer, and winds it over its own points.

All that the workman has to do while the machine is a going, is to ſtretch the ſtuff on the table, as faſt as the drawer takes it off; and from time to time to take off the ſtuff from the points of the drawer.

The deſign of having the frizing-table lined with ſtuff of a ſhort, ſtiff, ſtubby nap, is that it may detain the cloth between the table and the frizer long enough for the grain to be formed, that the drawer may not take it away too readily, which muſt otherwiſe be the caſe, as it is not held by any thing at the other end. It were unneceſſary to ſay any thing particular of the manner of frizing ſtuffs with the hand, it being the aim of the workmen to imitate, as near as they can with their wooden inſtrument, the ſlow, equable, and circular motion of the machine: in needs only be added, that their frizer is but about two feet long and one broad; and that, to form the nap more eaſily, they moiſten the ſurface of the ſtuff lightly, with water mingled with whites of eggs or honey.

FROG, *Rana*, in zoology, a genus of amphibious animals, the body of which is broad and ſhort, without a tail, and furniſhed with four legs.

FROG, among farriers, the ſame with ſruſh. See FRUSH.

FRONDES, among botaniſts, denote leaves conſiſting of ſeveral other leaves, and forming the whole of the plant; as is the caſe of the fern-kind, in which, the fructification being on the back of the leaves, the ſingle leaf makes the whole plant, and is called frondis, not folium.

FRONT *of a Battalion*, among military men, is the firſt rank, or file-leaders. It is likewiſe called the face or head of a battalion.

FRONT *of a Place*, or the TENAILLE, in fortification, all that is contained between the flanked angles of the two neighbouring baſtions, viz. the two faces, two flanks, and the curtain.

FRONT, in architecture, the principal face or ſide of a building, or that which is preſented to the chief aſpect or view.

FRONT, in perſpective, a projection or repreſentation of the face or forepart of an object, or of that part directly oppoſite to the eye, which is more uſually called the orthography. See ORTHOGRAPHY.

FRONTAL,

FRONTAL, in architecture, a little fronton, or pediment, ſometimes placed over a little door, or window.

FRONTAL, or FRONTLET, or BROW-BAND, is alſo uſed in ſpeaking of the Jewiſh ceremonies.

This frontal conſiſts of four ſeveral pieces of vellum, on each whereof is written ſome text of Scripture: they are all laid on a piece of calf's leather, with thongs to tie it by.

The Jews apply the leather with the vellum on their foreheads in the ſynagogue, and tie it round the head with the thongs.

FRONTALE, in medicine, a name for any external medicine, or topic, applied to the forehead: more particularly it means a refrigrating and hypnotic remedy, prepared of cold cephalics, bruiſed and tied up in a linen bag, four or five fingers-breadth.

FRONTATED, a term uſed by botaniſts relating to the leaf of a flower, which grows broader and broader, perhaps terminating in a right line: and is uſed in oppoſition to cuſpidated, that is, when the leaves of the flower end in a point.

FRONTIER, the border, confine, or extremity of a kingdom or province, which the enemies find in front, when they would enter the ſame: thus we ſay, a frontier town, a frontier province, &c. Frontiers were anciently called marches.

FRONTIS Os, in anatomy, called alſo os coronale, the bone of the forehead.

This is a bone of the cranium, of an irregular form, double in infants, but in adults uſually ſingle: ſometimes however, it is divided in theſe into two parts down to the noſe. It is ſituated in the anterior part of the ſkull, and forms that part of the face which is called the forehead, from whence it has its name. Its figure is ſymmetrical, reſembling a large ſhell, almoſt round. See the article SKULL.

The os frontis is articulated, by ſuture, to ſeven other bones; the oſſa parietalia, os othmoides, os ſphenoides, oſſa lachrymalia, oſſa naſi, maxillaria, and the oſſa malarum. See the articles SUTURE, OSSA PARIETALIA, &c.

The os frontis contains the anterior lobes of the brain, and a portion of the longitudinal ſinus; and forms the forehead, the upper parts of the orbits, and a portion of the temples. See BRAIN.

In the internal ſurface of the os frontis there is a fovea, or furrow, and an eminence, to which the longitudinal ſinus of the dura mater adheres: on its external ſurface are ſituated the frontal and temporal muſcles, and the cartilaginous annule of the muſculus trochlearis of the eye. See MUSCULUS TROHCLEARIS, &c.

FRONTISPIECE, in architecture, the portrait or principal face of a building. See BUILDING.

FRONTISPIECE is alſo uſed to ſignify an ornament fronting the title page of a book, which, in ſome meaſure, ſhould expreſs the ſubject treated of.

FRONTON, in architecture, the ſame with pediment. See the article PEDIMENT.

FROST, in phyſiology, ſuch an exceſſively cold ſtate of the air, as converts watery fluids into ice. See the articles FREEZING and ICE.

FROTH, a white light ſubſtance, formed on the ſurface of fluids, by vehement agitation; conſiſting of little ſphericles, or globules.

FROTH-SPITTLE, or CUCKOO-SPITTLE, a name given to a white froth, or ſpume, very common in the ſpring, and firſt months of the ſummer, on the leaves of certain plants, particularly on thoſe of the common white field lychnis, or catch-fly, thence called by ſome ſpatling poppy.

All writers on vegetables have taken notice of this froth, though few have underſtood the cauſe or origin of it till of late; being formed by a little leaping animal, called by ſome the flea-graſhopper; by applying its anus cloſe the leaf, and diſcharging thereon a ſmall drop of a white viſcous fluid, which, containing ſome air in it, is ſoon elevated into a ſmall bubble: before this is well-formed, it depoſits ſuch another, and ſo on, till it is every way overwhelmed with a quantity of theſe bubbles, which form the white froth which we ſee.

FRUCTIFEROUS, ſignifies properly any thing that produces fruit; but, in a more large and figurative ſenſe, it is uſed by ſome, particularly lord Bacon, for ſuch experiments in natural philoſophy, as prove advantageous to the experimenter in point of gain or profit.

FRUCTIFICATION, among botaniſts, in a more lax ſenſe, includes the flower and fruit, with their ſeveral coverings. See the articles FLOWER and FRUIT.

Strictly ſpeaking, however, the term fructification ſignifies only the male and female organs of generation, called the ſtamina and piſtil.

FRUGIVOROUS BIRDS are ſuch as feed on fruits, either wholly or in part.

FRUIT, in general, includes whatever the earth produces for the nouriſhment and ſupport of a man, and other animals, as herbs, grain, hay, corn, &c. See the article HERBS, GRAIN, &c.

FRUIT more properly ſignifies the production of a tree, or plant, for the propagation or multiplication of its kind, in which ſenſe the word takes in all kinds of ſeeds, with their furniture. But botaniſts, uſually underſtand by it that part of a plant wherein the ſeeds are contained. See PLANT and SEED.

FRUIT alſo implies an aſſemblage of ſeeds in a head; as in a ranunculus, &c. and all kinds of ſeeds, or grains, whether incloſed in a cover, capſule, or pod; and whether bony, fleſhy, ſkinny, membranous, or the like.

The fruit in all plants, is the product, or reſult, of the flower; or that for the production and nutrition of which the flower was intended.

The ſtructure and parts of different fruit differ in ſome things, but in all the ſpecies, the eſſential parts of the fruit appear to be only continuations or expanſions of thoſe which are ſeen in the other parts of the tree; and the ſame fibres are continued to them from the root. An apple, cut in two tranſverſely, will be found principally compoſed of four parts. 1. A ſkin, or rind, which is only a continuation and expanſion of the outer bark of the tree. 2. A parenchyma, or pulp, which is an expanſion and intumeſcence of the blea, or inner bark of the tree. 3. The fibres, or ramifications of the woody part of the tree. 4. The core, which is the produce of the pith of the wood, indurated, or ſtrengthened by twigs of the woody fibres intermixed with it. This ſerves to furniſh a proper lodging for the ſeeds, and filtrates the juices of the parenchyma, or pulp, and conveys them to the ſeeds.

FRUITERY, a place for the keeping of fruit, a fruit-houſe, or fruit-loft.

A fruitery ſhould be inacceſſable to any thing of moiſture, and ſhould be as much as poſſible ſo even to froſt.

FRUMENTACEOUS, a term applied, by botaniſts, to all ſuch plant as have a conformity with wheat, in reſpect of their fruits, leaves, ears, or the like.

FRUSH, or FROG, among farriers, a ſort of tender horn which ariſes in the middle of a horſe's ſole; and, at ſome diſtance from the toe, divides into two branches, running towards the heel, in the form of a fork.

The fruſh is a part of a horſe's foot, the top of which only ſhould be pared, and that every time the foot is pared, otherwiſe it is apt to corrupt.

FRUSTUM, in mathematics, a part of ſome ſolid body ſeparated from the reſt.

FRUSTUM, of a pyramid, or cone, is a piece or part thereof cut off, generally by a line parallel to the baſe. The ſolidity of the fruſtum of a ſquare pyramid may be found by the following theorem.

To the rectangle of the ſides of the two baſes add the ſum of their ſquares; that ſum being multiplied into one third of the fruſtum's height, will give its ſolidity.

The ſolidity of the fruſtum of a cone may be found by the following theorem.

To three times the rectangle of the two diameters add the ſquare of their difference; that ſum multiplied by the height will give the ſolidity.

FRUTICOSE STALKS, among botaniſts, thoſe with a hard woody ſubſtance. See STALK.

FUCUS, is botany, a genus of ſubmarine plants belonging to the cryptogamia claſs of Linnæus.

The fucus conſiſts of a tough matter, formed into a kind of leaves, which are flat and variouſly divaricated; and

and which have ſome appearance of fructification, in punctated tubercles, covering oblong veſicles, ſuppoſed by Linnæus to be male flowers; and ſmooth, roundiſh veſicles, hollow and interwoven with filaments, which appear to him to be female flowers.

There are a great many ſpecies of fucus with broader or narrower leaves, and other peculiarities; one of which, the broad-leaved, ſerrated fucus, grows to the height of ſix, eight, or more inches.

FUGITIVE, a perſon obliged to fly his country, or remove from a place where he had ſome abode, or eſtabliſhment, on account of his crimes, debts, or other occaſions.

FUGUE, in muſic, is when different parts of a muſical compoſition follow each other, each repeating what the firſt had performed.

There are three kinds of fugues; the ſimple, double, and counter.

Single, or *Simple* FUGUE, is ſome point conſiſting of four, five, or more notes begun by one ſimple part, and ſeconded by a ſecond, third, fourth, fifth, &c. if the compoſition conſiſt of ſo many; repeating the ſame or ſuch like notes, that is, in the ſame proportion, ſo that the ſeveral parts follow, or come in one after another, in the ſame manner; the leading part ſtill flying before thoſe that follow.

FUGUE DOUBLE, or FUGA DOPPIA, is when two or more different points move together in a fugue, and are alternately mixed and interchanged by the ſeveral parts.

FULCRUM, in mechanics, the prop or ſupport by which a lever is ſuſtained. See the article LEVER.

FULICA, the coot, in ornithology, a genus of birds, of the order of the gallinæ, with a naked or bald forehead, and divided or cloven feet: add to this, that all the toes are longer than in whole footed birds, and have ſemicircular membranes affixed to their joints.

FULIGINOUS, whatever proceeds from a thick, ſooty ſmoke, ſuch as litharge and lamp-black.

FULL-MOON, *plenilunium*, that phaſis of the moon when, in her oppoſition to the ſun, the whole of her diſk is illuminated; in which time eclipſes of the moon can only happen. See the articles MOON and ECLIPSE.

FULLER, a workman employed in the woollen manufactories, to mill, or ſcour, cloths, ſerges, and other ſtuffs, in order to render them more thick, compact, and durable. See CLOTH.

FULLER'S EARTH, *cimolia purpuraſcens*, a kind of marle of a cloſe texture, and of a tolerably ſmooth and gloſſy ſurface, when it has been rubbed. It is extremely ſoft and unctuous to the touch, of a greyiſh brown-colour, with ſome admixture of the olive or greeniſh.

The fineſt fuller's earth in the world is dug in England, and all the nations round us would gladly purchaſe it at a great price, were the exportation of it allowed; but one of the great advantages of our woollen manufactory is the keeping it at home. Large quantities of it are dug near Wooburn in Bedfordſhire; there are alſo pits of it in Surry, and ſome other counties, and ſtrata in many places, where it would be very well worth the proprietors while to have it dug, though at preſent it is neglected.

It is of great uſe in ſcouring cloths, ſtuffs, &c. as it imbibes all the oil and greaſe uſed in dreſſing the wool.

FULLER'S WEED, in botany, a name ſometimes given to the dipſacus, or teaſel. See DIPSACUS.

FULLING, the art or act of ſcouring and preſſing cloths, ſtuffs, ſtockings, &c. to cleanſe, thicken, and render them more firm and ſtrong, which is done by means of a water-mill.

In the troughs of the mill are laid the cloths, ſtuffs, &c. intended to be fulled: then letting the current of water fall on the wheel, the mallets are ſucceſſively let fall upon them, when by their weight and velocity they ſtamp and preſs the ſtuffs very ſtrongly, which by this means become thickened and condenſed.

In this operation, fullers earth is uſed with ſome proportion of ſope; but ſope alone would do much better, was it not dearer than fuller's earth.

Fulling of ſtockings, caps, &c. is performed either with the hands or feet, or a kind of wooden machine, either armed with wooden teeth, or thoſe of horſes or bullocks. The ingredients generally uſed on this occaſion are fuller's earth, urine; white and green ſope; but water ſoftened with chalk is far preferable.

The following is M. Colmet's method of fulling with ſope, grounded on experiments made by order of the marquis de Louvois. Let a coloured cloth of about forty-five ells, be laid in the uſual manner in the trough of a fulling-mill, without firſt ſoaking it in water, as commonly practiſed in moſt places. To full this trough-full of cloth fifteen pounds of ſope are required, one half of which is to be melted into two pails of river or ſpring water, made as hot as the hand can bear. Let this ſolution be poured by little and little, upon the cloth, in proportion as it is laid in the trough: thus it is to be fulled for at leaſt two hours; after which, let it be taken out and ſtretched. This done, let the cloth be immediately returned into the ſame trough, without freſh ſope, and there fulled two hours more: then take it out, wring it well, and expreſs all the greaſe and filth. After the ſecond fulling, diſſolve the remainder of the ſope, as the former part, and throw it at four ſeveral times on the cloth, not forgetting to take it out every two hours, to undo the plaits and wrinkles it got in the trough. When it is ſufficiently fulled, and brought to the requiſite quality and thickneſs, it is ſcoured out for good in hot water, keeping it in the trough till it be thoroughly clean. As white cloths full more eaſily than coloured ones, a third part of the ſope may be ſaved.

FULLING-MILL, a machine for fulling cloth.

This machine will be better underſtood by the drawing on plate LXVI. *fig.* 5. than by the moſt accurate deſcription.

A, the great wheel moved by horſes. This turns the trundles B, C, D, and alſo thoſe marked E, F, G. Then E turns the cog-wheel H, with the axis I K, and the croſs-pieces L, L 1, 1, 1, &c. are pullies or rollers. M N, M N, are wooden beaters turning upon an axis paſſing through N, N. Whilſt the axis I K turns about, the end *l* ſlides along the pulley 1, and falling off, the part M ſtrikes againſt the cloth in the trough at O, O. The lantern F carries the cog-wheel P, and the cranks Q, Q, which work the pumps T, T, by help of the levers R S, R S, moveable about *a*. The trundle G carries the cog wheels V and W, and W carries the trundle X, with the piſton Y, which grinds the indigo in the veſſel C D, whence it flows into the veſſel Z. The *m*, *m*, &c. of all the axles run in pieces of timber going acroſs the mill, and faſtened to one another, and to the walls of the houſe.

FULMINATING, ſomething that thunders, or reſembles thunder. See the article THUNDER.

FULMINATION, in chemiſtry, is uſed in a ſynonymous ſenſe with detonation. See DETONATION.

FUMIGATION, in chemiſtry, a kind of calcination, when metals, or other hard bodies, are corroded, or ſoftened, by receiving certain fumes for that purpoſe.

FUMIGATION, in medicine, the application of fumes to particular parts of the body; as thoſe of factitious cinnabar to venereal ulcers.

FUMITORY, *Fumaria*, in botany, a plant with blueiſh green finely divided leaves; producing, towards the tops of the ſtalks, oppoſite to the leaves, ſpikes of irregular purpliſh flowers, followed each by a ſingle ſeed. It is an annual weed, growing in ſhady cultivated grounds, and flowers in May and June.

This herb is recommended as an aperient and reſolvent, in obſtructions of the viſcera, in ſcorbutic and cutaneous maladies. Hoffmann has a high opinion of it as a purifier of the blood, and gives it the preference to all the other herbs made uſe of in that intention. However, at preſent it is a ſtranger to practice; its ſenſible operation is by looſening the belly, and promoting urine.

FUNCTION, the act of fulfilling the duties of any employment.

Function is alſo applied to the actions of the body.

FUNCTION, in algebra, denotes any compound quantity; and when one of the component quantities is variable, it is ſaid to be a variable function. See the article QUANTITY.

FUND, in anatomy, ſignifies the bottom of any cavity

in the body; thus, the fund of the eye is that part poſſeſſed by the choroides and retina; the fund of the uterus, the fund of the bladder, &c. ſignify alſo the bottom of theſe parts. See the articles EYE and UTERUS.

FUND, in commerce, ſignifies the ſtocks of the great trading and monied companies. See the article STOCKS.

FUNDS is alſo a term adopted by thoſe who ſpeak of the public revenue of nations, to ſignify the ſeveral taxes that have been laid upon merchandizes either by way of duties of cuſtom, or exciſe, or in any other manner, to ſupply the exigencies of the ſtate, and to pay intereſt for what ſums it may have occaſion to borrow.

FUNERAL RITES, ceremonies accompanying the interment or burial of any perſon. See the article BURIAL.

FUNERAL COLUMN, a column crowned with an urn, wherein the aſhes of ſome deceaſed perſon are ſuppoſed to be encloſed; the ſuſt or ſhaft being beſet with tears or flames, the ſymbols of grief and immortality. See COLUMN.

FUNGUS, in ſurgery, a ſoft, fleſhy, ſpongy exceſcence, ariſing in the membranes, tendons, and other nervous parts, in conſequence of ulcers, wounds, contuſions, &c.

Mr. Sharp ſays, that in wounds made by a ſharp inſtrument, where there is no indiſpoſition of body, the cure is generally performed without any interruption but from the fungus; ſo that the buſineſs of ſurgery will conſiſt principally in a proper regard to that point, and the applications that will the leaſt interfere with the ordinary courſe of nature, which in theſe caſes will be ſuch as act the leaſt upon the ſurface of the wound; and, agreeable to this, we find that dry lint only is generally the beſt remedy through the whole courſe of dreſſing; at firſt it ſtops the blood with leſs injury than any ſtyptic powders or waters; and afterwards by abſorbing the matter, which in the beginning of ſuppuration is thin and acrimonious, it becomes, in effect, digeſtive: during incarnation, it is the ſofteſt medium that can be applied between the roller and tender granulations, and at the ſame time is an eaſy compreſs upon the ſprouting fungus.

If ulcers ſhould be of ſuch a nature as to produce a ſpongy lax fleſh ſprouting very high above the ſurface, it will be neceſſary to deſtroy it by ſome of the eſcharotics, or the knife: this fungus differs very much from that belonging to healing wounds, being more eminent and lax, and generally in one maſs; whereas the other is in little diſtinct protuberances. It approaches often towards a cancerous complexion; and when it riſes upon ſome glands, actually degenerates ſometimes into a cancer, as has happened in buboes of the groin. When theſe exceſcences have aroſe in venereal ulcers, eſcharotics are to be preferred; and pulvis angelicus, which is a compoſition of precipitate powder and burnt alum, as it eats deeper, is preferable to precipitate alone.

FUNGUS, in botany, an order of vegetables, extremely different from all others, and belonging to the cryptogamia claſs of Linnæus.

The fungi have, indeed, ſo little of the common and general appearance of vegetables, that many have denied them to be ſuch, and contended for their being only excrementitious matter, protruded from decaying vegetables of other kinds. But notwithſtanding the fungi have neither the colour or texture of other plants, nor leaves nor flowers like them; yet they muſt be allowed to belong to the vegetable kingdom, as having abſolute and perfect ſeeds, conſiſting uſually of ſingle antheræ, which produce plants like thoſe from which they are collected.

The fungi are extremely different in figure, and in their manner and place of growth; ſome growing on the ground, ſome on living trees, and many on decayed wood; and that horizontally or erect. Some are of only a few days duration, others remain for years, and ſome there are which grow under the ſurface of the earth in no particular direction.

FUNNEL *of a Chimney*, the ſhaft or ſmalleſt part of the waſte, where it is gathered into its leaſt dimenſions.

Palladio directs, that the funnels of chimneys be carried through the roof four or five feet at leaſt, that they may carry the ſmoke clear from the houſe into the air. See the article CHIMNEY.

He alſo adviſes, that chamber-chimneys be not made narrower than ten or eleven inches, nor broader than fifteen; for if too narrow, the ſmoke will not be able to make its way; and if too wide, the wind will drive it back into the room.

FUNNEL-FASHIONED, or FUNNEL-SHAPED-FLOWERS, in botany. See the article INFUNDIBULIFORM.

FUR, or FURR, in commerce. See FURR.

FURBISHER, a perſon who furbiſhes, poliſhes, or cleans arms, as guns, ſwords, piſtols, &c. which is chiefly performed with emery.

FURIES, *Eumenides*, *Diræ*, certain goddeſſes whoſe office it was to puniſh the guilty after death. Theſe were three in number; Alecto, Megæra, and Tiſiphone, who were deſcribed with ſnakes inſtead of hair, and eyes like lightning, carrying iron chains and whips in one hand, and in the other flaming torches; the latter to diſcover, and the former to puniſh the guilty; and they were ſuppoſed to be conſtantly hovering over ſuch perſons as had been guilty of any enormous crime.

Mythologiſts ſuppoſe, that Tiſiphone puniſhed the crimes which ſprang from hatred or anger; Megæra, thoſe from envy; and Alecto, thoſe from an inſatiable purſuit after riches and pleaſure. They were worſhipped at Caſina in Arcadia, and at Carmia in Peloponneſus. They had a temple at Athens, near the Areopagus, and their prieſts were choſen from amongſt the judges of that court. At Telphuſia a city in Arcadia, a black ewe was ſacrificed to them.

FURLING, in the ſea language, rolling a ſail up cloſe to the yard, ſtay, or maſt, and faſtening it by rolling a bandage or rope cloſe about it, and hence

FURLING-LINE is a line to faſten the ſail; thoſe which are made for yards are plaited and flat, and called gaſketts.

FURLONG, a long meaſure, equal to $\frac{1}{8}$ of a mile, or forty poles. See the articles MEASURE, MILE, and POLE.

It is alſo uſed in ſome law-books for the eighth part of an acre. See ACRE.

FURLOUGH, in the military language, a licence granted by an officer to a ſoldier, to be abſent for ſome time from his duty.

FURNACE, a veſſel or utenſil for maintaining a ſtrong fire, either of coal or wood.

FURNACE is alſo applied to that uſed in the melting of iron, which authors frequently confound with iron forges, though there is a conſiderable difference between them. See FORGE.

This furnace is a brick-ſtructure, much in the ſhape of an egg ſet on end, wherein the iron-ore, after it has been burnt in a kiln, is put, intermixed with cinders and charcoal, and the whole melted till it trickle down into the receiver underneath.

Swedenborg has laid down, from his own experience, certain rules for the conſtruction of metallurgic furnaces, by which they will always be made more advantageous to the proprietor, *cæteris paribus*, than any other kind. Theſe rules are, that the chimney be always placed as nearly as may be behind the center of the furnace; that the ſmaller the depth of the fire-place, provided it be ſufficient to hold the coals, the better; that all furnaces muſt be the better the wider they are forwards, and the higher they are, ſo as not to loſe the benefit of reverberation.

Bellows-FURNACE is one of the two kinds of furnaces uſed in coinage for the fuſion of metals, conſiſting of a flat hearth at bottom, into which the air may be admitted by a hole, as in the chemical furnace. On a level with the hearth is a ſecond aperture, which gives paſſage to the pipe of the bellows, from whence the furnace is denominated; about a foot over this is a moveable grate; and over this is the place where the crucible is ſet, which is ſquare, and made of the ſame earth with the crucible, of breadth ſufficient to bear a range of coals around the crucible. To melt metal in this furnace, they lay a little plate of forged iron over the grate, and on this they ſet the crucible, which is likewiſe covered with an iron or earthen lid; then they fill the furnace with charcoal, and when it is well lighted, and the crucible ſufficiently hot, they ſtop the vent-hole: laſtly, throwing on freſh coals, they ſtop the furnace with an iron lid; thus continuing

tinuing to work the bellows, and ſupply freſh fuel, till the metal is in fuſion.

Glaſs Painter's FURNACE is made of brick, nearly ſquare, and about 2 ½ feet each way. It is cut horizontally in the middle, by a grate, which ſuſtains the pan or ſhovel the glaſs is baked in. This furnace has two apertures, one below the grate, to put the fuel in at; the other above it, through which the workman ſpies how the action of the colours goes on.

Hatter's FURNACES are of three kinds: a little one under the mould, whereon they form their hats; a larger in the ſcouring-room, under a little copper, full of lees; and a very large one under the great copper, wherein they dye their hats.

Plumber's FURNACE is a receptacle for the melting of their metal for caſting ſheet lead, &c. It is made of caſt-iron, in the form of a common copper furnace; but by the plumbers called a pot, which is ſet up with brick in the ſame manner as that of copper.

Wind-FURNACE, the ſecond furnace uſed in the fuſion of metals for coinage. At bottom it has a hearth made hollow, in manner of a copel, with a vent-hole in the fore part thereof; over the vent-hole is a grate, ſealed in the maſſive of the furnace; over the grate is the place for the crucible, which is uſually of forged iron. The fire being lighted, the crucible is put in, with a cover over it, and a capital or cover of earth or iron, is laid likewiſe over the furnace; and at the top of this capital is a hole, five or ſix inches in diameter. This is called a wind-furnace, by reaſon the air entering thro' the vent-hole at bottom, which is always open, ſerves the ſame purpoſe as the bellows in the other furnaces. Gold is generally melted in the bellows-furnace, as requiring an intenſer heat before it fuſes; but ſilver and copper are commonly melted in the wind-furnace.

FURNITURE, in dialling, certain additional points and lines, ſuch as the ecliptic, circles of declination, azimuths, Italian hours, points of the compaſs, &c. drawn on dial-planes.

FUROR UTERINUS, a ſpecies of madneſs peculiar to women, proceeding from an ardent and inordinate deſire of coition, which deprives the patient of the uſe of reaſon, ſo that ſhe ſpeaks all manner of obſcene words, and abandoning all ſhame, invites the men to venereal embraces.

The immoderate deſire of copulation is produced by the plenty, acrimony, and heat of the uterine juices, exceeding the natural bounds, and creating an extraordinary turgency in the ſeminal veſſels, which, ſtimulating in a manner and inflaming the genital parts, excites a vehement and unruly appetite to venereal commerce.

FURR, in commerce, ſignifies the ſkin of ſeveral wild beaſts, dreſſed in alum with the hair on, and uſed as a part of dreſs by princes, magiſtrates, and others. The kinds moſt in uſe are thoſe of the ermine, ſable, caſtor, hare, rabbit, &c. See the articles ERMINE, SABLE, &c.

FURRS, in heraldry, a bearing which repreſents the ſkins of certain beaſts, uſed as well in the doublings of the mantles belonging to the coat-armour, as in the coat-armours themſelves. See the articles ERMINE, ERMINOIS, &c.

FURR, among carpenters, a piece nailed upon a raſter, to ſtrengthen it when decayed, or to make it ſtraight when it has ſunk in the middle.

FURRING, among carpenters, is the regular faſhioning out any part. When the main piece of the material is ſcanty, either by defects, wains, or want of thickneſs; then a piece of the ſame is put behind it to make good its thickneſs, which is called a furr.

FURUNCLE, or BOIL, in ſurgery, a ſmall reſiſting tumour, with inflammation, redneſs, and great pain, ariſing in the adipoſe membrane, under the ſkin.

As there is no part of the body free from being the ſubject of furuncles, ſo the whole is ſometimes ſo miſerably infeſted with them, that the patient can hardly tell how to ſtir himſelf, or on what part to lie. Not only adults, but alſo the younger, even new-born infants, are obnoxious to this dreadful diſorder, which occaſions in them moſt fatiguing clamour and reſtleſſneſs. Though there is little danger in this diſeaſe in adults; yet, in tender infants, it occaſions convulſions, and even death itſelf.

The principal cauſe of furuncles is a too glutinous and inſpiſſated ſtate of the blood; and, conſequently, the greater the inſpiſſation, the worſe and more numerous will be the furuncles.

With regard to the cure, it ſeems to conſiſt chiefly in reſtoring the ſtagnating blood to its former circulation and free motion.

When the furuncles are very numerous, or return again, it is proper to uſe internal purging medicines, and ſuch as attenuate and cleanſe the blood. In adults, bleeding is proper, both by the lancet and ſcarification with cupping; and, at the ſame time, a ſtrict regimen of diet ſhould be uſed, drinking frequently and plentifully of a decoction of the woods, and ſuch like attenuators of the blood. The patient ſhould alſo entirely abſtain from drinking fermented and ſpirituous liquors, particularly wine and its ſpirit; and from the too frequent uſe of tobacco. When the diſorder is recent, external medicines only will frequently ſuffice for the whole cure. For this purpoſe a mixture of honey, acidulated with ſpirit of vitriol till it has acquired a conſiderable ſharpneſs, is proper to anoint the furuncles. Of no leſs virtue is the frequent touching them with mere ſpirit of vitriol or ſulphur. Diſcutient plaſters are alſo found very ſerviceable, as thoſe of ſimple diachylon, de melito, de ſpermaceti, vel diaſaponis.

But if theſe medicines prove inſufficient to diſperſe the tumour, it is to be brought to ſuppuration, by applying a plaſter made of honey and flour, or of diachylon with the gums; and where theſe are inſufficient, to make uſe of the maturating cataplaſms recommended under the article PHLEGMON.

When the furuncle is known to be ripe, by its ſoftneſs and yellow head, recourſe is to be directly had to the ſcalpel; and having made an opening, the corrupted matter contained therein is to be diſcharged: after this, a plaſter of diachylon muſt be applied, and the ulcer daily cleanſed of its matter, till it is healed.

Puſtules and pimples ariſing in the face, are to be treated like furuncles; and, in both caſes, the drinking of whey, and the mineral waters, is accounted good for cleanſing the blood.

When ſucking infants are afflicted with furuncles, it is proper to give the mother, or nurſe, ſome purging medicine, and to order a ſtrict regimen and diet. At the ſame time the infant ſhould take ſome gentle laxative medicine, with abſorbent powders, to allay the acrimony of its juices. *Heiſter.*

FURZE, or FURZE-BUSH, in botany. See the article ULEX.

FUSAROLE, in architecture, a round member, carved in the manner of a collar or chaplet, with oval beads, and placed immediately under the echinus, in the Doric, Ionic, and Compoſite capitals.

FUSEE, in clock-work, is that conical part drawn by the ſpring, and about which the chain or ſtring is wound; for the uſe of which, ſee the articles CLOCK and WATCH.

FUSEE, or FIRELOCK. See MUSKETT.

FUSIBILITY, in natural philoſophy, that quality of bodies which renders them fuſible.

FUSIL, in heraldry, a bearing of a rhomboidal figure, longer than the lozenge, and having its upper and lower angles more acute and ſharp than the other two in the middle. It is called in Latin, *fuſus*, a ſpindle, from its ſhape.

FUSILIERS, or FUSILEERS, in the military art, are foot ſoldiers, armed with fuſees, or firelocks. See the article FIRELOCK.

FUSILY, or FUSILE, in heraldry, ſignifies a field, or ordinary, entirely covered over with, or divided into, fuſils. See FUSIL.

FUSION, the melting of metals, minerals, &c. by means of fire.

Different metals run in different manners from their ores: thus, lead, though extremely fuſible in the metal, runs with difficulty from the ore, ſo as to require a conſiderable violence of fire. This ſtubbornneſs not belonging to the metal, muſt be attributed to the ſtony, ſulphureous, or other mineral matter with which the ore is mixed; which matter ſeems to require a degree of heat capable

capable of vitrifying the lead, before the metal will run: but then the lead thus vitrified, recovers a metallic form again, by coming in contact with the coals. See the article LEAD.

Tin runs from its ore with greater eaſe than lead, and is therefore melted in much leſs furnaces: but copper requires an intenſe heat, or a blaſt furnace; and iron the greateſt heat that can be given in a furnace: and both iron and copper abſolutely require immediate contact with the fuel employed. Hence it appears that each metal muſt have its determinate degree of heat, to run it with advantage from the ore or ſtone.

In order, likewiſe, to obtain the metal from the ore to the beſt advantage, the ſcoria or ſlag muſt be neceſſarily made to run thin and fluid; otherwiſe it entangles or inviſcates the metal, and will not let it ſeparate fully. And hence we frequently obſerve in the aſſaying of copper ores, ſmall grains of metal interſperſed here and there, among the ſcoria, that require to be ſeparated by ſtamping and waſhing the whole maſs; which labour might have been prevented, by uſing a proper degree of heat capable of procuring a thin fuſion and a ſuitable flux, ſo as to have made all the metals fall to the bottom of the crucible; which it conſtantly does, when the operation is well performed. See FLUX.

It ſeems principally owing to a defect in the knowledge of fuſion, that ſo many recrements or ſlags of metals, anciently thrown as uſeleſs from the furnace, have been of late wrought to conſiderable profit by more ſkilful workmen: at leaſt it ſeems more rational to attribute the ſucceſs to this cauſe, than to a ſuppoſed growth of metals in ſuch ſlags; or to believe that lead has grown rich in ſilver by lying expoſed to the open air, while perhaps it is rather owing to the unſkilfulneſs of the former workmen, who were unable to ſeparate all the ſilver contained in the lead.

All moiſture, and too ſudden cooling, prove prejudicial to the more ignoble metals after fuſion, and ſometimes dangerous to the operator: for a little water falling upon melted iron or copper, makes them expand with prodigious violence, and diſcharge themſelves abroad with a force like that of a cannon; and even ſudden cooling will often occaſion the ſurface of the metal to crack, and ſuffer the more internal part, not yet ſet or fixed, to iſſue out to a conſiderable diſtance; whence either the loſs of the metal or miſchief may enſue.

To prevent theſe ill effects, after copellation it is uſual for the operator to throw a quantity of water, all at once, upon the lump of ſilver, as it lies in the teſt, at the moment when it begins to grow rigid; for the water, by its coldneſs, ſuddenly makes ſo thick a cover upon the ſurface of the ſilver, that the hotter parts in the inſide cannot break through the upper. *Shaw's Chem. Lect.*

FUST, the ſame with the ſhaft of a column. See the articles COLUMN and SHAFT.

FUSTIAN, in commerce, a kind of cotton ſtuff which ſeems as it were whaled on one ſide.

Right fuſtians ſhould be altogether made of cotton yarn, both woof and warp; but a great many are made of which the warp is flax, or even hemp.

There are fuſtians made of ſeveral kinds, wide, narrow, fine, coarſe; with ſhag or nap, and without it.

FUSTICK, or FUSTOCK, a yellow wood, that grows in all the Caribbee-iſlands, uſed in dying yellow.

FUTTOCKS, in ſhip-building, that part of a timber which reaches from the floor to the top-timber. See this diſtinctly explained in the article TIMBER.

FUTTOCK-*Shrowds*. See the article *Futtock*-SHROWDS.

FUTURE, in general, denotes whatever regards futurity, or the time to come. See the article TIME.

FUTURE TENSE, among grammarians. See the article TENSE.

FUZEE, or FUSEE, in military affairs. See the article FUSEE.

FUZEE, among farriers, two dangerous ſplents, joining from above downwards. They differ from ſcrew or thorough ſplents in this, that the latter are placed on two oppoſite ſides of the leg. See the article SPLENT.

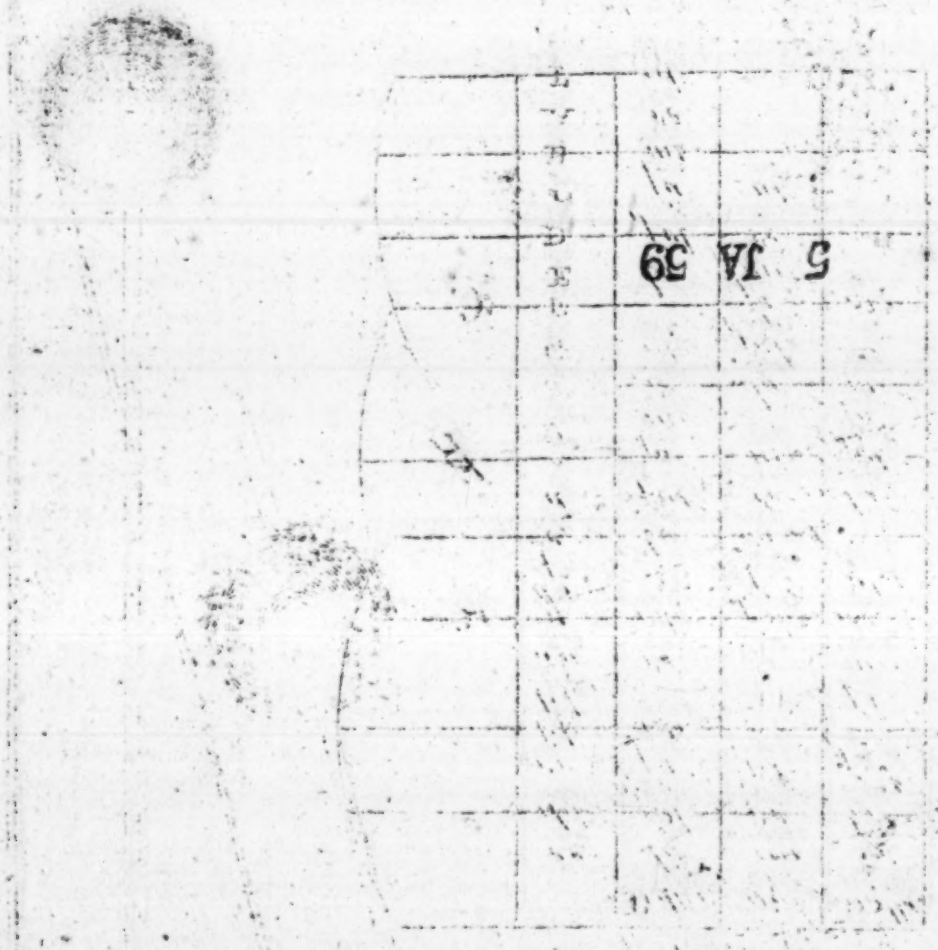

5 1A 39

Fig. 1.

Gage.

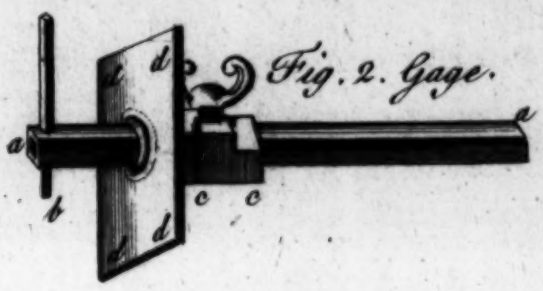
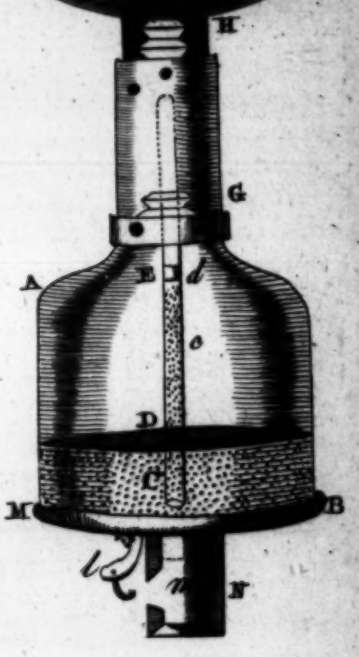
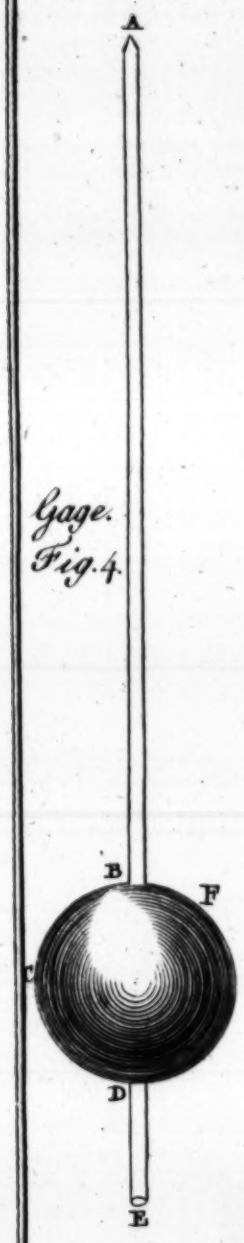


Fig. 2. Gage.

Gage.

Fig. 3.





Gage.
Fig. 4

Fig. 5. Gammut.

		B dur	nat	molle
	ee	la	mi	
	dd	sol	re	la
	cc	fa	ut	sol
	bb	mi		
	bb			fa
	aa	re	la	mi
𝄢	g	ut	sol	re
	f		fa	ut
	e	la	mi	
	d	sol	re	la
♯	c	fa	ut	sol
	b	mi		fa
	a	re	la	mi
	G	ut	sol	re
𝄡	F		fa	ut
	E	la	mi	
	D	sol	re	
	C	fa	ut	
	B	mi		
	A	re		
	F	ut		

Order of the GARTER.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

G.

GAG GAG

G in grammar, the ſeventh letter and fifth conſonant of our alphabet; but in the Greek, and all the oriental languages, it occupies the third place. It is one of the mutes, and cannot be ſounded without the aſſiſtance of ſome vowel.

In Engliſh it has a hard and ſoft ſound; hard, as in the words *game*, *gun*, &c. and ſoft, as in the words *geſture*, *giant*, &c. at the end of words, *gh* is pronounced like *ff*, as in the words *rough*, *tough*, &c. The letter *g* is alſo uſed in many words where the ſound is not perceived, as in *ſign*, *reign*, &c.

As a numeral, G was anciently uſed to denote 400; and with a daſh over it, thus $\overline{G}$, 40,000. In muſic it is the character or mark of the treble cleff; and from its being placed at the head, or marking the firſt ſound in Guido's ſcale, the whole ſcale took the name gamut. See the articles CLEF and GAMUT.

GABEL, a word met with in old records, ſignifying a tax, rent, cuſtom, or ſervice, paid to the king, or other lord.

GABEL, according to the French duties or cuſtoms, a tax upon ſalt, which makes the ſecond article in the king's revenue, and amounts to about one fourth part of the whole revenue of the kingdom.

GABIONS, in fortification, baſkets made of ozier-twigs, of a cylindrical form, ſix feet high, and four wide; which being filled with earth, ſerve as a ſhelter from the enemies fire.

They are commonly uſed on batteries, to ſcreen the engineers, &c. in order to which, one is placed on either ſide of each gun, room being only left for the muzzle to appear through. They alſo ſerve as a parapet on lines, lodgements, &c. when the ground is too hard to dig into.

There are a ſmaller ſort, uſed on parapets in trenches, &c. to cover the muſqueteers; which are placed ſo cloſe that the muzzle of a muſquet can hardly be put through.

GABLE, or GAVEL, among builders. See GAVEL.

GAD, among miners, a ſmall punch of iron, with a long wooden handle, uſed to break up the ore.

One of the miners holds this in his hand, directing the point to a proper place, while the other drives it into the vein, by ſtriking it with a ſledge hammer.

GAD-FLY, or BREEZE-FLY, names given to the black and yellow bodied œſtrus, a fly nearly as large as the common blue fleſh-fly. See OESTRUS.

GAFOLD-LAND, in old law-books, land liable to taxes, and let for rent.

GAGATES, JET, in natural hiſtory. See the article JET.

GAGE, in law-books, the ſame with ſurety or pledge. See the articles SURETY and PLEDGE.

GAGE, in joinery, an inſtrument marked G, in plate LXVII. *fig.* 1. in which the piece of wood *b* is moveable upon the ſtaff *c*, ſo as to be ſet nearer or farther from the tooth *a*, at pleaſure. Its uſe is to draw a line parallel to the ſtraight ſide of any board, for gaging tenons, and marking ſtuff for an equal thickneſs.

GAGE, among letter-founders, a piece of box, or other hard wood, variouſly notched; the uſe of which is to adjuſt the dimenſions, ſlopes, &c. of the different ſorts of letters. See *Letter* FOUNDERY.

Sliding-GAGE, a tool uſed by mathematical inſtrument makers, for meaſuring and ſetting off diſtances. It is alſo of uſe in letter-cutting, and making of moulds; ſee plate LXVII. *fig.* 2. where *aa* is the beam, *b* the tooth, *cc* the ſliding-ſocket, and *dddd* the ſhoulder of the ſocket.

GAGE, or *Weather*-GAGE, in navigation, a ſhip is ſaid to have gained the weather-gage of another when ſhe makes a greater progreſs to the windward, or when ſhe ſails to the windward of ſome other. See the article TACKING.

Sea-GAGE, an inſtrument invented by Dr. Hales and Dr. Deſaguliers, for finding the depth of the ſea, the deſcription of which is this. AB (plate LXVII. *fig.* 3.) is the gage-bottle, in which is cemented the gage-tube F*f* in the braſs cap at G. The upper-end of the tube F is hermetically ſealed, and the open lower-end *f* is immerſed in mercury, marked C, on which ſwims a ſmall thickneſs or ſurface of treacle. On the top of the bottle is ſcrewed a tube of braſs HG, pierced with ſeveral holes, to admit the water into the bottle AB. The body K is a weight hanging by its ſhank L, in a ſocket N, with a notch on one ſide at *m*, in which is fixed the catch *l* of the ſpring S, and paſſing through the hole L, in the ſhank of the weight K, prevents its falling out, when once hung on. On the top, in the upper part of the braſs-tube at H, is fixed a large empty ball, or full-blown bladder I, which muſt not be ſo large but that the weight K may be able to ſink the whole under water.

The inſtrument, thus conſtructed, is uſed in the following manner. The weight K being hung on, the gage is let fall into deep water, and ſinks to the bottom; the ſocket N is ſomewhat longer than the ſhank L, and therefore, after the weight K comes to the bottom, the gage will continue to deſcend, till the lower part of the ſocket ſtrikes againſt the weight; this gives liberty to the catch to fly out of the hole L, and let go the weight K; when this is done, the ball or bladder I, inſtantly buoys up the gage to the top of the water. While the gage is under water, the water having free acceſs to the treacle and mercury in the bottle, will by its preſſure force it up into the tube F*f*, and the height to which it has been forced by the greateſt preſſure, viz. that at the bottom, will be ſhewn by the mark in the tube which the treacle leaves behind it, and which is the only uſe of the treacle. This ſhews into what ſpace the whole air in the tube F*f* is compreſſed; and conſequently the height or depth of the water, which by its weight produced that compreſſion, which is the thing required.

If the gage-tube F*f*, be of glaſs, a ſcale might be drawn on it with the point of a diamond, ſhewing, by inſpection, what height the water ſtands above the bottom. But the length of 10 inches is not ſufficient for fathoming depths at ſea, ſince that, when all the air in ſuch a length of tube is compreſſed into half an inch, the depth of water is not more than 634 feet, which is not half a quarter of a mile.

If, to remedy this, we make uſe of a tube 50 inches long, which for ſtrength may be a muſquet-barrel, and ſuppoſe the air compreſſed into an hundredth part of half an inch; then by ſaying as 1 : 99 :: 400 : 39600 inches, or 3300 feet; even this is but little more than half a mile, or 2640 feet. But ſince it is reaſonable to ſuppoſe the cavities of the ſea bear ſome proportion to the mountainous parts of the land, ſome of which are more than three miles above the earth's ſurface; therefore, to explore ſuch great depths, the Dr. contrived a new form for his ſea-gage, or rather for the gage-tube in it, as follows: B C D F (*fig.* 4.) is a hollow metalline globe communicating on the top with a long tube A B, whoſe capacity is a ninth part of that globe. On the lower part at D, it has alſo a ſhort tube DE, to ſtand in the mercury and treacle. The air contained in the compound gage-tube is compreſſed by the water, as before; but the degree of compreſſion, or height to which the treacle has been forced, cannot here be ſeen thro' the tube; therefore, to anſwer that end, a ſlender rod of metal or wood, with a knob on the top of the tube A B, will receive the mark of the treacle, and ſhew it, when taken out.

If the tube A B be 50 inches long, and of ſuch a bore that every inch in length ſhould be a cubic inch of air, and the contents of the globe and tube together 500 cubic inches; then, when the air is compreſſed within an hundredth part of the whole, it is evident the treacle will not approach nearer than 5 inches of the top of the tube, which will agree to the depth of 3300 feet of water as above. Twice this depth will compreſs the air into half that ſpace nearly, viz. 2½ inches, which correſpond to 6600, which is a mile and a quarter. Again, half that ſpace, or 1¼ inch, will ſhew double the former depth, viz. 13200 feet, or 2½ miles, which is probably very nearly the greateſt depth of the ſea.

Bucket-Sea-GAGE, an inſtrument contrived by Dr. Hales, to find the different degrees of coldneſs and ſaltneſs of the ſea, at different depths; conſiſting of a common houſhold pail or bucket, with two heads to it. Theſe heads have each a round hole in the middle, near four inches diameter, and covered with valves opening upwards; and that they might both open and ſhut together, there is a ſmall iron-rod fixed to the upper part of the lower valve, and at the other end to the under part of the upper valve; ſo that as the bucket deſcends with its ſinking weight into the ſea, both the valves open by the force of the water, which by that means has a free paſſage through the bucket. But when the bucket is drawn up, then both the valves ſhut by the force of the water at the upper part of the bucket; ſo that the bucket is brought up full of the loweſt ſea-water to which it had deſcended.

When the bucket is drawn up, the mercurial thermometer, fixed in it, is examined; but great care muſt be taken to obſerve the degree at which the mercury ſtands, before the lower part of the thermometer is taken out of the water in the bucket, elſe it would be altered by the different temperature of the air.

In order to keep the bucket in a right poſition, there are four cords fixed to it, reaching about four feet below it, to which the ſinking weight is fixed.

Water-GAGE, or HYDROMETER. See the article HYDROMETER.

GAIANITES, *Gaianitæ*, in church hiſtory, a branch of Eutychians. See EUTYCHIANS.

GAIN, in commerce, is uſed in a ſynonymous ſenſe with profit. See PROFIT.

GAIN, in architecture, the levelling ſhoulder of a joiſt or other timber.

It is alſo uſed for the lapping of the end of the joints, &c. upon a trimmer or girder, and then the thickneſs of the ſhoulder is cut into the trimmer, alſo levelling upwards, that it may juſt receive the gain, and ſo the joiſt and trimmer lie even and level with the ſurface.

This way of working is uſed in floors and hearths.

GALANGALS, *Galanga*, in the materia medica, the name of two roots kept in the ſhops, a greater and a ſmaller; of which the ſmaller is by far the moſt eſteemed.

The leſſer galangal is a ſmall and ſhort root, of an irregular figure, and of the thickneſs of a man's little finger ſeldom met with more than an inch or two long. I ſhould be choſen full and plump, of a bright colour, ver firm and ſound, and of an acrid and inſupportably ho taſte.

The larger galangal is brought to us in pieces of tw inches or a little more in length, and of near an inch i thickneſs: its ſurface is leſs unequal and tuberoſe tha the ſmaller ſort, but is far from being ſmooth; on th outſide it is of a brown colour, with a very faint caſt red, and within it is of a paler colour, and has a muc leſs acrid and pungent taſte than the ſmaller kind. It to be choſen in the largeſt, ſoundeſt, and heavie pieces.

The roots of both the galangals, but particularly of th leſſer, abound with a volatile, oily, aromatic ſalt; th leſſer is eſteemed an excellent ſtomachic: it has the cred of being a great cephalic, cardiac, and uterine, but more particularly recommended in vertigos. Th greater galangal poſſeſſes the ſame virtues, but in a le degree.

GALANTHUS, the ſnow-drop, in botany, a genu of plants, the flower of which conſiſts of three oblon and obtuſe petals; the fruit is a globoſo-oval capſul obtuſely trigonal, and containing a great number roundiſh ſeeds.

The galanthus is the ſame with the narciſſo-leucoiu of authors, with a large ſnow-white flower.

GALAXY, in aſtronomy, the via lactea, or milk way in the heavens: a tract of a whitiſh colour, a conſiderable breadth, which runs thro' a great compa of the heavens, ſometimes in a double, but for the grea eſt part of its courſe in a ſingle ſtream; and is compoſe of a vaſt number of ſtars, too minute or too remote fro the earth, to be diſtinguiſhed by the naked eye; but a diſcovered in all parts of it, in great numbers, by t aſſiſtance of the teleſcope.

GALBANUM, in pharmacy, a gum iſſuing from t ſtem of an umbelliferous plant, growing in Perſia a many parts of Africa.

It is ſometimes met with in the ſhops in looſe gr nules, called drops or tears, and ſometimes in lar maſſes, formed of a number of theſe blended togethe but in theſe maſſes ſome accidental foulneſs is often mix with the gum. The ſingle drops uſually approach a roundiſh, oblong, pear-like form. Galbanum is ſo like wax, and, when freſh drawn, white; but it afte wards becomes yellowiſh or reddiſh: it is of a ſtro ſmell, of an acrid and bitteriſh taſte; it is inflammab in the manner of a reſin, and ſoluble in water like gum.

It attenuates and diſſolves tough phlegm, and is the fore of ſervice in aſthmas and inveterate coughs: it alſo of great ſervice in hyſteric complaints; it diſſipa flatulencies, promotes the menſes, and facilitates delive and the expulſion of the ſecundines. It is given in p and electuaries, and is uſed externally in form of a plaſt applied to the belly, againſt habitual hyſteric co plaints, and on many other occaſions.

GALENIC, or GALENICAL, in pharmacy, a ma ner of treating diſeaſes founded on the principles Galen.

The diſtinction of galenical and chemical was oc ſioned by a diviſion of the practitioners of medicine i two ſects, which happened on the introduction of c miſtry into medicine; then the chemiſts arrogating themſelves every kind of merit and ability, ſtirred up oppoſition to their pretenſions, founded on the invari adherence of the other party to the antient practice. A though this diviſion into the two ſects of galeniſts chemiſts has long ceaſed, yet the diſtinction of medici which reſulted from it, is ſtill retained.

Galenical medicines are thoſe which are formed b eaſier preparations of herbs, roots, &c. by infuſion, de tion, &c. and by combining and multiplying ingredi while thoſe of chemiſtry draw their more intimate remote virtues by means of fire and elaborate prep ons, as calcination, digeſtion, fermentation, &c.

GALENISTS, in church hiſtory, a branc anabaptiſts, who are ſaid to have adopted ſ

Arian opinions concerning the divinity of our Saviour.

GALILEANS, a ſect of Jews. Their founder was one Judas, a native of Galilee, from which place they derived their name. Their chief, eſteeming it an indignity for the Jews to pay tribute to ſtrangers, raiſed up his countrymen againſt the edict of the emperor Auguſtus, which had ordered a taxation or enrollment of all the ſubjects of the Roman empire.

They pretended that God alone ſhould be owned as maſter and lord; and in other reſpects were of the opinion of the Phariſees: but as they judged it unlawful to pray for infidel princes, they ſeparated themſelves from the reſt of the Jews, and performed their ſacrifices apart.

GALL, in the animal œconomy, the ſame with bile. See BILE and BILIOUS.

GALL-BLADDER, called veſicula, and cyſtis fellea, is uſually of the ſhape of a pear, and of the ſize of a ſmall hen's egg. It is ſituated in the concave ſide of the liver, and lies upon the colon, part of which it tinges with its own colour. It is compoſed of four membranes, or coats; the common coat; a veſicular one; a muſcular one, conſiſting of ſtraight, oblique, and tranſverſe fibres; and a nervous one, of a wrinkled or reticulated ſurface within, and furniſhed with an unctuous liquor.

The uſe of the gall-bladder is to collect the bile, firſt ſecreted in the liver, and mixing it with its own peculiar produce, to perfect it farther, to retain it together a certain time, and then to expel it.

GALL, in natural hiſtory, denotes any protuberance or tumour produced by the puncture of inſects on plants and trees of different kinds.

Theſe galls are of various forms and ſizes, and no leſs different with regard to their internal ſtructure. Some have only one cavity, and others a number of ſmall cells communicating with each other. Some of them are as hard as the wood of the tree they grow on, whilſt others are ſoft and ſpongy; the firſt being termed gall-nuts, and the latter berry-galls, or apple-galls.

The general hiſtory of galls is this: an inſect of the fly-kind is inſtructed by nature to take care for the ſafety of her young, by lodging her eggs in a woody ſubſtance, where they will be defended from all injuries: ſhe for this purpoſe wounds the branches of a tree; and the lacerated veſſels, diſcharging their contents, ſoon form tumours about the holes thus made. The hole in each of theſe tumours, through which the fly has made its way, may for the moſt part be found; and when it is not, the maggot-inhabitant or its remains are ſure to be found within, on breaking the gall. However, it is to be obſerved, that in thoſe galls which contain ſeveral cells, there may be inſects found in ſome of them, though there be a hole by which the inhabitant of another cell has eſcaped.

Oak-galls put, in a very ſmall quantity, into a ſolution of vitriol in water, though but a very weak one, give it a purple or violet colour; which, as it grows ſtronger, becomes black; and on this property depends the art of making our writing-ink, as alſo a great deal of thoſe of dying and dreſſing leather, and other manufactures.

In medicine, galls are found to be very aſtringent, and good, under proper management, in diarrhœas, dyſenteries, and hæmorrhages of all kinds; they have alſo a very eminent virtue as a febrifuge. Half a dram, or more, of the powder of Aleppo-galls may be given for a doſe, and will often cure an intermittent fever. They are alſo uſed externally by way of fomentation in procidentiæ of the anus: and a decoction of them has been injected in the fluor albus, with very great ſucceſs.

GALLEASSES, in the marine, the largeſt ſort of armed veſſels next to ſhips of war: they are a ſort of ſhip of one deck and three maſts; and are uſed by the Venetians only: they have thirty-two banks of oars, with ſix or ſeven ſlaves to an oar; three batteries of guns from thirty-ſix to twenty-four pounders; their complement of men conſiſts of a thouſand or twelve hundred. To ſee one of theſe galleaſſes at ſea, ſhe appears like a great floating iſland, able in appearance to encounter with twenty galleons (ſee the next article). The Turks have ſhips not unlike them, which they call mahones.

GALLEON was formerly a name given to ſhips of war which had three or four decks. That name is now no longer in uſe but with the Spaniards, which they give to their ſhips that are deſtined for Weſt-India voyages. Theſe ſhips, which are of a larger ſize, have always four decks. They give alſo the ſame name to greater or ſmaller veſſels, which go yearly to La Vera Cruz. The Portugueſe have ſhips which they call caragues, ſomewhat reſembling the galleon, which they ſend to India and the Brazils.

GALLERY *of a Ship*, a ſort of railed balcony, without the cabin, at the ſtern or quarter of a ſhip, for the convenience of the commander.

GALLERY, in architecture, a covered place in a houſe, much longer than broad, and uſually in the wings of a building; its uſe being chiefly to walk in.

GALLERY, in fortification, a covered walk acroſs the ditch of a town, made of ſtrong beams, covered over head with planks, and loaded with earth: ſometimes it is covered with raw hides to defend it from the artificial fires of the beſieged. Its ſides ſhould be muſket proof. It ought to be eight foot high, and ten or twelve wide, and the covering to riſe with a ridge, that what is thrown upon it by the beſiegers with a deſign to burn it, may roll off.

Galleries are chiefly uſed to ſecure and facilitate the miners approach to the face of the baſtion, over the moat, which is already ſuppoſed to be filled up with faggots and bavins, and the artillery of the oppoſite flank diſmounted.

GALLERY *of a Mine*, is a narrow paſſage, or branch of a mine, carried on underground to a work deſigned to be blown up.

Both the beſiegers, and the beſieged alſo, carry on galleries in ſearch of each other's mines, and theſe ſometimes meet and deſtroy each other.

GALLERY, in gardening, a kind of covered walk, in a garden, formed into porticoes or arches, with horn-beams, lime-trees, or the like.

Each pillar of the porticoes or arches ought to be four feet diſtant from the other, and the gallery twelve feet high, and ten feet wide, that there may be room for two or three perſons to walk in a-breaſt.

In forming theſe galleries, it is to be obſerved, that when the horn-beams are grown to the height of three feet, and the diſtance of the pillars well regulated; the next thing to be done is, to form the frontiſpiece: to perform which, the horn-beam muſt be run up a trellace made for that purpoſe, which forms the arch, and as it grows up, thoſe boughs which out-ſhoot the others, muſt be cut with the ſheers, and in time they will grow ſtrong, and may be kept in form by the ſheers.

GALLEY, a kind of low flat-built veſſel, with one deck, made either to ſail or row: they are from an hundred and twenty, to an hundred and thirty feet long, eighteen feet broad, and nine or ten feet deep. They have two maſts which can be ſtruck at pleaſure, two lateen ſails, and five pieces of cannon. The galleys have commonly twenty-five or thirty banks of oars on either ſide, to each of which are chained five or ſix ſlaves. There are no galleys now but in the Mediterranean; they commonly keep cloſe along ſhore; though they ſometimes venture out to ſea for a ſhort cruize.

GALLIAMBIC VERSE, *Galliambus*, in ancient poetry, a verſe conſiſting of ſix feet, viz. an anapeſt, or a ſpondee; an iambus, or an anapeſt, or a tribrach; an iambus; a dactyl; a dactyl; an anapeſt.

The word galliambus is a compound of iambus and gallus, a prieſt of Cybele. Theſe prieſts carried about the image of that goddeſs, in order to get alms, and as a part of their employment was ſinging verſes all over the country, they, by this means, rendered poetry very deſpicable.

GALLI, in antiquity, the prieſts of the goddeſs Cybele, who were eunuchs, and took their name from Gallus, a river in Phrygia.

GALLICAN, any thing belonging to France: thus the term Gallican church denotes the church of France, or the aſſembly of the clergy of that kingdom. See CHURCH.

GALLINÆ, in ornithology, an order of birds, the beak

beak of which is conic, and ſomewhat incurvated, and the upper chap imbricated.

Under this order are comprehended the oſtrich, peacock, pheaſant, woodcock, turkey, the common dunghill cock, partridge, &c.

GALLINACEOUS, an appellation given to the birds of the order of the gallinæ.

GALLING, or EXCORIATION, in medicine. See EXCORIATION.

GALLING *of a Horſe's Back*, a diſorder occaſioned by heat, and the chafing or pinching of the ſaddle.

In order to prevent it, ſome take a hind's ſkin well garniſhed with hair, and fit it neatly under the pannel of the ſaddle, ſo that the hairy ſide may be next the horſe.

When a horſe's back is galled upon a journey, take out a little of the ſtuffing of the pannel over the ſwelling, and ſew a piece of ſoft white leather on the inſide of the pannel; anoint the part with ſalt butter, and every evening wipe it clean, rubbing it till it grow ſoft, anointing it again with butter, or for want of that, with greaſe: waſh the ſwelling, or hurt, every evening with cold water and ſope, and ſtrew it with ſalt, which ſhould be left on till the horſe be ſaddled in the morning.

GALLIUM, ladies-bedſtraw, in botany, a genus of plants, the flower of which is a quadrifid ſingle petal, without any tube, and placed flatwiſe: the fruit conſiſts of two globoſe bodies, growing cloſe together, but not adhering, and containing each a ſingle kidney-ſhaped ſeed. It is ſaid to be an excellent aſtringent.

GALLON, a meaſure of capacity both for dry and liquid things, containing four quarts; but theſe quarts, and conſequently the gallon itſelf, are different, according to the quality of the thing meaſured: for inſtance, the wine gallon contains 231 cubic inches, and holds eight pounds averdupois, of pure water: the beer and ale gallon contain 282 ſolid inches, and holds ten pounds three ounces and a quarter averdupois, of water; and the gallon for corn, meal, &c. 272 $\frac{1}{4}$ cubic inches, and holds nine pounds thirteen ounces of pure water.

GALLOON, in commerce, a narrow thick kind of ferret, or lace, uſed to edge or border cloaths, ſometimes made of wool, and at others of gold or ſilver.

GALLOP, in the manege, a motion of a horſe that runs at full ſpeed, in which making a kind of leap forewards, he lifts both his fore-legs almoſt at the ſame time; when theſe are in the air, juſt upon the point of touching the ground, he lifts both his hind-legs almoſt at once.

GALLOWS *of a Plough*, a part of the plough-head, ſo called by farmers, from its reſemblance to the common gallows, as conſiſting of three pieces of timber, whereof one is placed tranſverſely over the heads of the other two. See PLOUGH.

GALLUS, the COCK, in ornithology, a well known domeſtic fowl, the head of which is ornamented with a longitudinal fleſhy creſt, or comb: the wattles are two, and placed longitudinally on the throat. This, in its natural ſtate, is a very robuſt and beautiful bird, variegated with a great number of elegant colours.

GALLY, in printing, a frame into which the compoſitor empties the lines out of his compoſing ſtick, and in which he ties up the page when it is completed.

The gally is formed of an oblong ſquare board, with a ledge on three ſides, and a groove to admit a falſe bottom, called a gally-ſlice.

GAMBOGE is a concreted vegetable juice, the produce of two trees, both called by the Indians caracapulli, and is partly of a gummy, and partly of a reſinous nature. It is brought to us either in form of orbicular maſſes, or of cylindrical rolls of various ſizes; and is of a denſe, compact, and firm texture, and of a beautiful yellow. It is chiefly brought to us from Cambaja, in the Eaſt-Indies, called alſo Cambodja, and Cambogia; and from thence it has obtained its names of cambadium, cambogium, and gambogium.

It is a very rough and ſtrong purge; it operates both by vomit and ſtool, and both ways with much violence, almoſt in the inſtant in which it is ſwallowed; but yet without griping. It requires caution and judgment in adminiſtring it; but thoſe who know how to give it properly, find it an excellent remedy in dropſies, cachexies, jaundice, aſthmas, catarrhs, and in the worſt cutaneous eruptions.

Its doſe is from two or three grains to ſix, eight, or ten; four grains generally operate briſkly without vomiting, and eight or ten grains uſually vomit briſkly, and afterwards purge downwards.

It is at preſent much more eſteemed by painters in water-colours, than by phyſicians.

GAME, *Ludus*, in general, ſignifies any diverſion, or ſport, that is performed with regularity, and reſtrained to certain rules. See the article GAMING.

GAMES, *Ludi*, in antiquity, were public diverſions exhibited on ſolemn occaſions. Such, among the Greeks, were the Olympic, Pythian, Iſthmian, Nemæan, &c. games; and, among the Romans, the Apollinarian, Circenſian, Capitoline, &c. games. See the articles OLYMPIC, PYTHIAN, &c.

GAMELIA, γαμηλια, in Grecian antiquity, a nuptial feaſt, or rather ſacrifice, held in the ancient Greek families on the day before marriage; thus called, from a cuſtom they had of ſhaving themſelves on this occaſion, and preſenting their hair to ſome deity to whom they had particular obligations.

GAMELION, a poem or compoſition in verſe on the ſubject of a marriage, commonly called epithalamium. See EPITHALAMIUM.

GAMING, the art or act of performing or practiſing a game, particularly a game of hazard, and this generally for ſtakes or a ſum of money.

Hazard, or chance, is a matter of mathematical conſideration, becauſe it admits of more and leſs. Gameſters either ſet out upon an equality of chance, or are ſuppoſed to do ſo. This equality may be altered, in the courſe of the game, by the greater good fortune or addreſs of one of the gameſters, whereby he comes to have a better chance, ſo that his ſhare in the ſtakes is proportionably better than at firſt. This more and leſs runs through all the ratios between equality and infinite difference, or from an infinitely little difference till it come to an infinite great one, whereby the game is determined. The whole game, therefore, with regard to the iſſue of it, is a chance of the proportion the two ſhares bear to each other.

The probability of an event is greater or leſs, according to the number of chances by which it may happen, compared with the number of all the chances by which it may either happen or fail.—Thus, ſuppoſe p the number of chances whereby an event may happen, and q the number of chances whereby it may fail: then if two gameſters, A and B, engage on theſe terms, that if any of the chances p happen, A ſhall win; but if thoſe of q happen, B ſhall win; and the ſtake be a, the expectancy of A will be defined by $\frac{p}{p+q} \times a$, and that of B by $\frac{q}{p+q} \times a$; conſequently if A or B ſell their expectances, they ſhould receive for them $\frac{p}{p+q} \times a$, and $\frac{q}{p+q} \times a$, reſpectively.

If there be two independent events, and p the number of chances, or, which is the ſame thing, the number of caſes wherein the firſt may happen, and q the number of thoſe wherein it may not happen, and r the number of caſes wherein the ſecond event may happen, and s the number of thoſe wherein it may not happen: multiply $p+q$ by $r+s$; the product, viz. $pr+qr+ps+qs$, will be the number of caſes wherein the contingency or non-contingency of the events may be varied.

Hence, if A lay with B, that both events ſhall happen, the ratio of the chances will be as pr to $qr+ps+qs$; if he lay that the firſt ſhall happen, but not the ſecond, the ratio of the chances will be as ps to $pr+qr+qs$; and if there were three or more events, the ratio of the chances would be found by multiplication alone.

If all the events have a given number of caſes wherein they may happen, and alſo a given number of caſes wherein they may not; and a be the number of caſes wherein any one may happen, and b the number of caſes wherein

it may not; and n be the number of all the events; raiſe $a+b$ to the power of n. If now A and B agree, that if one or more of the events happen, A ſhall win; if none, B: the ratio of the chances will be as $\overline{a+b}^n - b^n$ to b^n; for the only term where a is not found, is b^n.

If A and B play with a ſingle die, on this condition, that if A throw two or more aces at eight throws, he ſhall win; otherwiſe B ſhall win; what is the ratio of their chances?—Since there is but one caſe wherein an ace may turn up; and five where may it not; let $a=1$, and $b=5$. And again, ſince there are eight throws of the die, let $n=8$, and you will have $\overline{a\times b}^n - b^n - nab^{n-1}$, to $b^n + nab^{n-1}$. That is, the chance of A will be to that of B, as 663991 to 1015625, or nearly as 2 to 3.

A and B are engaged at ſingle quoits, and after playing ſome time, A wants 4 of being up, and B, 6; but B is ſo much the better gameſter, that his chance againſt A upon a ſingle throw, would be as 3 to 2; What is the ratio of their chances?—Since A wants 4, and B, 6, the game muſt neceſſarily end in 9 throws at moſt; therefore raiſe $a+b$ to the ninth power, and it will be $a^9 + 9a^8b + 36a^7b^2 + 84a^6b^3 + 126a^5b^4 + 126a^4b^5 + 84a^3b^6 + 36a^2b^7 + 9ab^8 + b^9$: and all the terms wherein a has 4 or more dimenſions, are for A; and all thoſe wherein it has 6 or more, for B: and the ratio of the chances will be as $a^9 + 9a^8b + 36a^7b^2 + 84a^6b^3 + 126a^5b^4 + 126a^4b^5$, to $84a^3b^6 + 36a^2b^7 + 9ab^8 + b^9$. Call a, 3, and b, 2; and you will have the ratio of the chances in numbers, 1759077 to 194048.

A and B are to play at ſingle quoits; and A is the beſt gameſter; ſo that he can give B, 2 in 3: What is the ratio of their chances, then, in a ſingle throw?—Suppoſe the chances ſought to be as z to 1; raiſe $z+1$ to its cube, and it will be z^3+3z^2+3z+1. Now ſince A could give B 2 in 3, it is plain that A might undertake to win three throws running; and conſequently the chances in this caſe will be as z^3 to $3zz+3z+1$; therefore $z^3 = 3zz+3z+1$. Or, $2z^3 = z^3+3zz+3z+1$. And hence $\sqrt[3]{2}\times z = z+1$; conſequently $z = \frac{1}{\sqrt[3]{2}-1}$.

The chances therefore are $\frac{1}{\sqrt[3]{2}-1}$ and 1 reſpectively.

To find in how many trials it is probable any event will happen; ſo that A and B may lay a wager upon even terms.—Let the number of caſes, wherein the thing may happen at the firſt trial be a, thoſe wherein it may not, b; and x the number of trials, wherein it is an even chance, whether the thing happen or not. By what is ſhewn above $\overline{a+b}^x - b^x = b^x$. Or $\overline{a+b}^x = 2b^x$. Therefore $x = \frac{\text{log. } 2.}{\text{log. } a+b - \text{log. } b.}$

Again, reſume the equation $\overline{a+b}^x = 2b^x$, and let $a:b::q:1$, and the equation will change into this $\overline{1+q}^x = 2$. Raiſe $1+q$ to the power of x, and it will be $1+\frac{x}{q}+\frac{x}{1}\times\frac{x-1}{2qq}+\frac{x}{1}\times\frac{x-1}{2}\times\frac{x-2}{3q^3}$, &c. $=2$. In this equation, therefore, if $q=1$, then $x=1$; if q be infinite, x will alſo be infinite. Suppoſing x infinite, the equation above will become $1+\frac{x}{q}+\frac{x^2}{2qq}+\frac{x^3}{6q^3}$, &c. $=2$.

Again, let $\frac{x}{q}=z$, and we ſhall have $1+z+\frac{zz}{2}+\frac{z^3}{6}$, &c. $=2$. But $1+z+\frac{zz}{2}+\frac{z^3}{6}$, &c. is a number whoſe hyperbolical logarithm is z; conſequently $z=$log. 2. But the hyperbolical of 2 is ,7 nearly; and therefore $z = \frac{7}{10}$ nearly.

Hence, where q is 1, there $x=q$; and where q is infinite, $x = \frac{7}{10}$ of q nearly. Thus are the limits of the ratio of x to q fixed; for that ratio begins with equality, and when raiſed to infinity, ends at length in the ratio of 7 to 10 nearly.

To find in how many throws A may undertake to throw two aces with two dice?—Since A has but one caſe or chance wherein he may throw two aces with two dice; and 35 wherein he may not; $q=35$; therefore multiply 35 by ,7; the product 24,5, ſhews that the number of throws required is between 24 and 25.

To find the number of chances for throwing any given number of points with a given number of dice?—Let $p+1$ be the given number of points; n the number of dice, and f the number of faces upon each die: let $p-f=q$, $q-f=r$, $r-f=s$, $s-f=t$, &c. The number of chances required will be,

$$+\frac{p}{1}\times\frac{p-1}{2}\times\frac{p-2}{3}, \text{ &c.}$$
$$-\frac{q}{1}\times\frac{q-1}{2}\times\frac{q-2}{3}, \text{ &c.}\times\frac{n}{1}$$
$$+\frac{r}{1}\times\frac{r-1}{2}\times\frac{r-2}{3}, \text{ &c.}\times\frac{n}{1}\times\frac{n-1}{2}$$
$$-\frac{s}{1}\times\frac{s-1}{2}\times\frac{s-2}{3}, \text{ &c.}\times\frac{n}{1}\times\frac{n-1}{2}\times\frac{n-2}{3}$$

Which ſeries is to be continued till ſome of the factors either become equal to nothing, or negative. And note, ſo many factors of the ſeveral products $\frac{p}{1}\times\frac{p-1}{2}\times\frac{p-2}{3}$, &c. $\frac{q}{1}\times\frac{q-1}{2}\times\frac{q-2}{3}$, &c. are to be taken as there are units in $n-1$.

Thus for example, let it be required to find how many chances there are for throwing 16 points with four common dice; then making $p+1=16$, we have $p=15$; from whence the number of chances required will be found to be

$$+\tfrac{15}{1}\times\tfrac{14}{2}\times\tfrac{13}{3} = +455$$
$$-\tfrac{9}{1}\times\tfrac{8}{2}\times\tfrac{7}{3}\times\tfrac{4}{4} = -336$$
$$\tfrac{1}{1}\times\tfrac{2}{2}\times\tfrac{1}{3}\times\tfrac{4}{4}\times\tfrac{3}{4} = +\ 6$$

But $455-336+6=125$, and therefore one hundred and twenty-five is the number of chances required.

To find at how many caſts A may undertake to throw 15 points with ſix dice?—Since A has 1666 chances for bringing up 15 points, and 44990 againſt it, divide 44990 by 1666, and the quotient 27 will be $=q$; therefore multiply 27 by ,7, the product 18,9 ſhews the number of throws required to be nearly 19.

To find the number of trials wherein it is probable any event may happen twice; ſo that A and B may lay a wager thereon with an equal chance.—Suppoſe the chances for happening in the firſt trial, to be a, and thoſe for failing b, and call the number of trials required, x; it appears from what is above ſhewn, that $\overline{a+b}^x = 2bx + 2xbx^{-1}a$, or $1+px = \overline{\frac{1+p}{2}}^x$ by writing p for $\frac{a}{b}$; conſequently log. $\overline{1+px} = x\times$ log. $\overline{1+p}$ − log. 2. Now, for px ſubſtitute $2+v$, then log. $\overline{v+3} = \frac{2+v}{p}\times$ log. $\overline{1+p}$ − log. 2. It appears, by page 679 of Mac Laurin's Fluxions, that the log. of $m+z$ is nearly equal to $\frac{2z}{2m+z}$ + log. m; therefore, by ſubſtituting 3 for m, and v for z, on the left hand ſide of the above equation, and 1 for m, p for z on the right, we ſhall have $\frac{2v}{6+v}$ + log. $3 = \frac{2+v}{p}\times\frac{2p}{2+p}$ − log. 2, or becauſe p is very ſmall $\frac{2v}{6+v}$ + log. $3 = 2+v$ − log. 2, or $\frac{2v}{6+v} = 2+v$ − log. 6; for log. of 6 put 1,7971, reduce the equation by compleating the ſquare, &c. and we get $v=-,3266$, $2+v=1,6784=px$. If $a=b$, then $px=3$. Now as twice the former value of px, viz. 3,3568 exceeds 3, the latter by ,3568, it follows, that the value of x is nearly equal to $\frac{b}{a}\times\overline{2-,3568}+2-,6632$, or $\frac{b}{a}$ 1,64 + 1,33.

If the wager be upon happening once, the number of trials will be between 1 p and 0,693 p
If upon twice, between 3 p and 1,678 p
If upon thrice, between 5 p and 2,675 p
If upon four times, between 7 p and 3,671 p
If upon five times, between 9 p and 4,673 p
If upon ſix times, between 11 p and 5,668 p.

To find at how many throws A may undertake to throw three aces twice with three dice? Since A has but one chance for throwing three aces and 215 againſt it; $p=215$. Therefore, multiply 215 by 1,678, the product 360,7 will ſhew the number of throws required to be between 360 and 361.

A and B depoſit each 12 pieces of money, and play with three dice, on theſe conditions, that every time 11 points are thrown, A ſhall give B one piece, and every

time 14 points are thrown, B ſhall give A a piece; and that he ſhall win the whole, that firſt gets all the money in his hands: we demand the ratio of the chance of A to that of B?—Let p be the number of pieces each ſeverally ſtakes, and a and b the number of chances whereby A and B may reſpectively gain each a piece; the ratio of their chances will be as a^p to b^p. In this caſe $p=12$, $a=27$, $b=15$; or if when $27:15::9:5$, you make $a=9$, $b=5$; and therefore the ratio of the expectancies will be as 9^{12} to 5^{12}, or as 244140625 to 282429536481.

Note. Great care muſt be taken to avoid the confounding of different problems together, from ſome appearance of affinity between them. The following one ſeems very like the former. C having 24 pieces, or counters, throws three dice, and every time 27 points turn up, gives one counter to A, and every time 14 turns up, gives one to B; and A and B engage on this footing, that he who firſt gets 12 counters, ſhall win the ſtake; we require the ratio of their expectancies?—This problem differs from the preceding one, in that the game muſt neceſſarily end in 23 throws; whereas, in the former, it might continue without limitation, by reaſon of the reciprocations of loſs and gain, which deſtroy one another. —Raiſe $a+b$ to the 23^d power, and the 12 former terms will be to the 12 latter, as the expectancy of A to that of B.

Three gameſters, A, B, and C, have each 12 balls, 4 of them white, and 8 black; and, being hoodwinked, play on this condition, that the firſt who chooſes a white ball ſhall win the ſtake; and that A ſhall have the firſt choice, then B, then C; and ſo round again: What then is the ratio of the chances of A, B, C? Let n be the number of balls, a the number of white ones, b of black ones, and 1 the ſtake. Here,

1°. A has the chances a for taking a white ball; and the chances b for a black one; conſequently his expectancy from the firſt choice is $\frac{a}{a+b}$, or $\frac{a}{n}$; therefore the expectation he has upon the ſtake 1, ariſing from the circumſtance he is in when he begins to draw, is $\frac{a}{n}\times 1$, or $\frac{a}{n}$; let it therefore be agreed among the adventurers, that A ſhall have no choice for a white counter, but that he ſhall be reputed to have had a black one, which ſhall actually be taken out of the heap, and that he ſhall have the ſum $\frac{a}{n}$ paid him out of the ſtake for an equivalent. Now $\frac{a}{n}$ being taken out of the ſtake, there will remain $1-\frac{a}{n}$ or $\frac{b}{n}$.

2°. B's probability of winning is $\frac{a}{n-1}$, whence his expectation will be $\frac{ab}{n.n-1}$. Suppoſe it therefore agreed that B ſhall have the ſum $\frac{n.n-1}{ab}$ paid him out of the ſtake, and that a black ball ſhall alſo be taken out of the heap. This being done, the remaining ſtake will be $\frac{b}{n}-\frac{ab}{n.n-1}$ or $\frac{nb-b-ab}{n.n-1}$, but $nb-ab=bb$; wherefore the remaining ſtake is $\frac{b.b-1}{n.n-1}$.

3°. After the ſame manner the expectation upon the third choice will be $\frac{b.a.b-1}{n.n-1.n-2}$, which we will likewiſe ſuppoſe to be paid him out of the ſtake, ſtill ſuppoſing a black counter taken out of the heap.

4°. A may have out of the remainder the ſum $\frac{b.a.b-1.b-2}{n.n-1.n-2.n-3}$; and ſo of the reſt till the whole ſtake be exhauſted. Wherefore having written the following ſeries; viz. $\frac{a}{n}+\frac{b}{n-1}P+\frac{b-1}{n-2}Q+\frac{b-2}{n-3}R+\frac{b-3}{n-4}S$, &c. wherein P, Q, R, S, &c. denote the preceding terms, take as many terms of this ſeries as there are units in $b+1$, (for the number of drawings cannot exceed $b+1$) then take for A the firſt, fourth, ſeventh, &c. terms; take for B the ſecond, fifth, eighth, &c. for C the third, ſixth, &c. and the ſum of thoſe terms will be the reſpective expectations of A, B, C, or becauſe the ſtake is fixed, theſe ſums will be proportional to the reſpective probabilities of winning.

Now to apply this to the preſent caſe, make $n=12$, $a=4$, $b=8$, and the general ſeries will become $\frac{4}{12}+\frac{8}{11}P+\frac{7}{10}Q+\frac{6}{9}R+\frac{5}{8}S+\frac{4}{7}T+\frac{3}{6}U+\frac{2}{5}X+\frac{1}{4}Y$; or multiplying the whole by 495, to take away the fractions, the ſeries will be $165+120+84+56+35+20+10+4+1$.

Therefore, aſſigning to A $165+56+10=231$, to B $120+35+4=159$, to C $84+20+1=105$; the probabilities of winning will be proportional to the numbers 231, 159, 105, or 77, 53, 35.

A wagers with B, that in taking out ſeven counters, blindfold, from a heap containing 12 counters, four of them white, and eight black, three of them ſhall be white ones: What is the ratio of their expectancies?—1°. Seek how many different ſevens can be taken out of 12; they will be found by the method of combinations to be 792.

$$\frac{12}{1}\times\frac{11}{2}\times\frac{10}{3}\times\frac{9}{4}\times\frac{8}{5}\times\frac{7}{6}\times\frac{6}{7}=792.$$

2°. Set aſide three white ones, and find the different combinations of 4 in 8 black ones, they will be found to be 70.

$$\frac{8}{1}\times\frac{7}{2}\times\frac{6}{3}\times\frac{5}{4}=70.$$

And ſince there are four ways in which 3 white may be taken out of 4; multiply 70 by 4, and it gives 280 for the different ways whereby three whites may come out with four blacks.

3°. By the common laws of gaming, he is reputed a winner who does more than is required, unleſs the contrary be expreſsly agreed on; and therefore, if A takes out four white counters with three black ones, he wins. Set aſide four whites, and then find the combinations of three of the eight blacks with four whites, there will appear to be 56.

$$\frac{8}{1}\times\frac{7}{2}\times\frac{6}{3}=56.$$

4°. A therefore has $280+56=336$ chances whereby he may win, which taken from 792, the whole number of chances leaves 456 for thoſe whereby he may loſe. The ratio of the chances of A, therefore, to that of B, is as 336 to 456, or as 14 to 19.

If any number of gameſters, A, B, C, D, E, &c. equally ſkilful, depoſit each one piece of money, and engage on theſe conditions, that two of them, A and B, beginning the game, whichever of them ſhall be overcome, ſhall give place to the third C, who is to play with the conqueror; and the conqueror here to be taken up by the fourth man D; and thus on, till ſome one, having conquered them all round, draws the ſtake: What is the ratio of their expectancies?—This problem, M. Bernouilli ſolves analytically. Here, calling the number of gameſters $n+1$, he finds that the probabilities of any two immediately following each other in the courſe of playing, are in the ratio of $1+2^n$ to 2^n; and therefore the expectancies of the ſeveral gameſters A, B, C, D, E, &c. are in a geometrical progreſſion $1+2^n:2n::a:c::c:d::d:e$, &c.

Hence it is eaſy to determine the ſtate of the probabilities of any two gameſters, either before the game, or in the courſe thereof. If, e. gr. there be three gameſters, A, B, C; then $n=2$, and $1+n^2=5$, $n^2=4$: hence 5, 5 and 4, are as their reſpective chances for winning, before A has overcome B, or B, C; and therefore their expectancies as $\frac{5}{14}$, $\frac{5}{14}$, $\frac{4}{14}$: for all of them taken together muſt make 1, or abſolute certainty. After A has overcome B, the probabilities for A, B, and C, will be $\frac{1}{7}$, $\frac{2}{7}$, $\frac{4}{7}$, as in the anſwer above. If there be four gameſters, A, B, C, D, their probabilities from the beginning will be as 81, 81, 72, 64; for here $n=3$, and $1+2^n=9$, $2^n=8$, then $9:8:8:\frac{64}{9}$; conſequently 9, 9, 8, $\frac{64}{9}$, are the reſpective chances for A, B, C, and D, before they begin to play; multiply each number by 9 to avoid fractions, and we have 81, 81, 72, 64, the numbers above given. After A has beat B and C, the probabilities of C, B, D, A, will in whole numbers be as 16, 18, 28, 27.

Three gameſters, A, B, and C, whoſe dexterities are equal, depoſit each one piece, and engage upon theſe terms: that two of them ſhall begin to play, and that the vanquiſhed party ſhall give place to the third, who is to take up the conqueror, and the ſame condition to go round; each perſon, when vanquiſhed, forfeiting a certain ſum to the main ſtake, which ſhall be all ſwept by the perſon who firſt beats the other two ſucceſſively. How much

much, now, is the chance of A, better or worſe than that of C.

1°. If the forfeiture be to the ſum each perſon firſt depoſited, as 7 to 6, the gameſters are upon equal footing. 2°. If the forfeiture be in a leſs ratio to the depoſit, A and B are on a better footing than C; if in a greater ratio, the advantage is on the ſide of C. 3°. After A has overcome B once, the probabilities are as $\frac{12}{7}$, $\frac{6}{7}$, $\frac{3}{7}$; or as 4, 2, 1; viz. that of A the greateſt, and of B the leaſt.

M. Bernouilli gives an analytical ſolution of the ſame problem, only made more general; as not being confined to three gameſters, but extending to any number, at pleaſure.

A and B, two gameſters of equal dexterity, play with a given number of balls; after ſome time, A wants 1 of being up, and B, 3: What is the ratio of their chances? —A's expectancy is worth $\frac{7}{8}$ of the ſtake, and B's only $\frac{1}{8}$; ſo that their chances are as 7 to 1.

Two gameſters, A and B, of equal dexterity, are engaged in play, on this condition, that as often as A exceeds B, he ſhall give him one piece of money, and that B ſhall do the like, as oft as A exceeds him; and that they ſhall not leave off till one has won all the other's money: each now having four pieces, two by-ſtanders, R and S, lay a wager on the number of turns in which the game ſhall be finiſhed; viz. R lays that it ſhall be over in ten turns: What is the value of the expectancy of S? Anſwer $\frac{560}{1024}$, or $\frac{33}{64}$ of the wager; or it is to that of R, as 560 to 464.

If each player had five pieces, and the wager were, that the game ſhall end in ten turns, and the dexterity of A were double that of B, the expectancy of S would be $\frac{1800}{3561}$.

If each gameſter had four pieces, and the ratio of the dexterity were required to make it an even wager, that the game ends in four turns, it will be found that the one muſt be to the other as 5,274 to 1.

If each gameſter have four pieces, and the ratio of their dexterities be required to make it an even lay, that the game ſhall be ended in ſix turns, the anſwer will be found to be as 2,576 to 1.

GAMMUT, GAM, GAMMA, or GAMMAUT, in muſic, a ſcale whereon we learn to ſound the muſical notes, *ut*, *re*, *mi*, *fa*, *ſol*, *la*, in their ſeveral orders and diſpoſitions. See NOTE and SCALE.

The invention of this ſcale is owing to Guido Aretine; tho' it is not ſo properly an invention as an improvement on the diagram, or ſcale of the Grecians. See the article DIAGRAM.

The gammut is alſo called the harmonical hand, by reaſon that Guido made firſt uſe of the figure of the hand to demonſtrate the progreſſion of his ſounds.

Guido, finding the diagram of the ancients of too ſmall an extent, added five more chords or notes to it; one below the proſlambanomenos of the ancients, and four above the note hyperbolæon. The firſt he called hypoproſlambanomenos, and denoted it by the letter G, or the Greek Γ, gamma; which note being at the head of the ſcale, occaſioned the whole ſcale to be called by the name of gamm, or gammut. This ſcale is divided into three ſeries or columns, the firſt called durum, the ſecond natural, and the third molle, as repreſented by the ſcheme in plate LXVII. *fig.* 5.

The uſe of this ſcale is to make the paſſages and tranſitions from B molle to B durum, by means of tones and ſemitones. The ſeries of B natural ſtanding between the other two, communicates with both, ſo that to name the chord of the ſcale by theſe ſyllables, if we would have the ſemitones in their natural places, viz. *b*, *c*, and *e*, *f*; then we apply *ut* to *g*; and after *la* we go into the ſeries of B natural, at *fa*; and after the *la* of this, we return to the former at *mi*; and ſo on. And we may begin at *ut* in *c*, and paſs into the firſt ſeries at *mi*, and then back to the other at *fa*, by which means the one tranſition is a ſemitone, viz. *la*, *fa*, and the other a tone, *la*, *mi*. To follow the order of B molle, we may begin with *ut* in *c* or *f*, and make each ſemitone after the ſame manner.

Hence came the barbarous names of gammut, are, B *mi*, &c. But what perplexed work is here with ſo many different ſyllables applied to each chord, and all to mark the places of the ſemitones, which the ſimple letters *a*, *b*, *c*, &c. do as well, and with more eaſe.

Several alterations have been made in the gammut. M. le Murs particularly added a ſeventh ſyllable, viz. *ſi*; and the Engliſh uſually throw out that and *ut*, and make the other ſerve for all, as will be ſhewn under the article SOLFAING.

GAMMUT, or GAMM, is alſo the firſt or graveſt note in the modern ſcale of muſic, the reaſon of which is ſhewn under the preceding article.

GANDER, in ornithology, the male of the gooſe kind; one of which, it is ſaid, will ſerve five geeſe. See GOOSE.

GANGLIO, or GANGLION, in ſurgery, a hard tubercle, generally moveable, in the external or internal part of the carpus, upon the tendons or ligaments in that part, uſually without any pain to the patient. Tho' ganglions ſo nearly reſemble an encyſted tumour, that Celſus makes them one and the ſame; yet their difference may appear, if it were only from their different ſeats; ganglions being confined to the tendons and ligaments of the hands and feet, whereas encyſted tumours are not reſtrained to any part of the body. See the article ENCYSTED.

With regard to the cauſe of ganglions, they ſeem generally to proceed from an inſpiſſation of the viſcid juices, which are let out, and lodged betwixt the fibres and membranes, when the tendons and ligaments of thoſe parts have been injured by a fall, blow, ſtrain, contuſion, or the like, in which caſe they gradually increaſe more or leſs, as long as the fibres yield; the juices find vent ſo as to advance to the ſize of a filbert, walnut, or even a pigeon's egg: ſome are oblong, round, or oval, with an equal or uneven ſurface: ſome of them which are recent, may be eaſily diſperſed; and others, which have been of long ſtanding, hardly yield to any remedies but the knife.

The inſpiſſated matter of a recent ganglion may often be happily diſperſed by barely rubbing the tumour well every morning with the faſting ſaliva, and binding a plate of lead on it afterwards for ſeveral weeks ſucceſſively. Many attribute a greater diſcutient virtue to the lead, when it has firſt had ſome mercury rubbed on it. Foreſtus, and others, adviſe the uſe of a plaſter of ammoniac and mercury, and often to rub them with oil of ſoap. Others write, that a cure may be readily performed, if the patient lays his hand upon a table, and ſtrikes on the tumour with his fiſt: but care ſhould be taken not to injure the bones, tendons, or other parts of the hand in ſtriking the tumour; and the ſame care muſt be taken if there is a neceſſity of having recourſe to cauſtics or inciſion, in order to remove them.

GANGRENE, a very great and dangerous degree of inflammation, wherein the parts affected begin to corrupt, and put on a ſtate of putrefaction. A gangrene is diſtinguiſhed from a ſphacelus, inaſmuch as this latter is not an incipient but an abſolute and perfect corruption, or death of the parts, already made. See the article SPHACELUS.

A gangrene may be diſcovered generally from the following ſigns; namely, the inflammation, with its ſymptoms, which have all along been very violent, do generally undergo a ſudden change, as if they were going off. The parts which were before ſwelled and tenſe, do now grow ſoft and flaccid, and upon preſſing with the finger on the ſkin and fat, its impreſſion remains behind, as in an œdema; at length the cuticula ſeparates from the cutis, often riſing up in bliſters, like thoſe on burns, filled with a reddiſh, yellowiſh, and black humour; and the ſenſe of the limb is in ſome degree diminiſhed. See the article OEDEMA.

The cauſes of a gangrene, as well as a ſphacelus, are either external or internal. Among the internal cauſes are reckoned an eryſipelas, and all other inflammations which riſe ſpontaneouſly, and can by no means be diſperſed, nor brought to ſuppuration. Inflammations of this kind uſually proceed from the blood's being too acrimonious, or corrupted by the bile, or in a ſcorbutus; or when the circulation of blood is too quick, or too ſlow, by reaſon of old age, or any other weakneſs; or, laſtly, when the patient uſes a perverſe courſe of life with reſpect

ſpect to diet, and paſſions of the mind, eſpecially anger, grief, and fear, during the time of the inflammation. By external cauſes are intended injuries of the air, cold water, and the application of topical remedies externally to the inflamed parts; which are either cooling, aſtringent, fat, oily, or the like; together with all great external hurts or accidents, which frequently happen to the body through falls, blows, &c. as in wounds, fractures, luxations, &c.

A gangrene is for the generality never without danger, becauſe it eaſily changes into a ſphacelus, or intire mortification, which never admits of cure but by taking off the dead parts. But a gangrene which is ſlight, incipient, and not ſpread far, but only affects the ſkin and fat, is not very difficult to cure; eſpecially when it happens in a young and ſtout patient, in a mild and temperate ſeaſon, and does little or no injury to the muſcles and nerves: but the larger, more violent, and confirmed is the gangrene, and the faſter it ſpreads, the more difficult it is generally to effect a cure, eſpecially in an old or weak patient; or in an ill habit of body, from a dropſy, phthiſis, or ſcorbutus: the weather alſo being too hot, or very cold, or the parts affected being near the thorax, or abdomen, may make the caſe more dangerous. Nor can this caſe be neglected without the utmoſt danger of life, or its ſuddenly turning into a ſphacelus.

Therefore the gangrene muſt be treated ſo, that it may not terminate in a ſphacelus. For which end, firſt of all, in plethoric and ſtrong habits, the patient muſt be bled largely, and the operation repeated at diſcretion; but in weak habits, it ſhould be omitted. The remainder of the treatment, according to Heiſter, will conſiſt chiefly in obſerving the following directions. 1. To be careful in the beginning to prevent all violent external cauſes of inflammations, too ſtrict a bandage in wounds and fractures, all foreign bodies which are ſtuck in the part, as thorns, ſplinters, &c. improper medicines externally applied, as ointments, oils, and plaſters, with cooling and aſtringent things; all which ſhould be removed as ſoon as poſſible. 2. The next obſervation reſpects chiefly the keeping up the patient's ſtrength, eſpecially in weak and old people. This may be beſt effected by ordering a diet which not only affords good juices, but is alſo well accommodated to the age, conſtitution, and other circumſtances of the patient. In weak and old people, the moſt ſuitable diet will be ſoops, ſtrengthening broths, &c. With reſpect to medicines, the moſt proper are the corroborants, uſually termed cordials, as the ſpirits, eſſences, powders, and electuaries of that tribe; eſpecially made up or mixed with confected alkermes. It will be proper alſo, in this caſe, frequently to apply a ſponge to the noſe or carpal arteries, which has been dipped in hungary water; alſo to bind it to the temples. For patients who are of a more warm, ſanguine, and bilious habit, ſoops and ptiſans mixed with acid juice of citrons or lemons, will be very proper ſtrengtheners; at the ſame time, not neglecting other medicines, which are proper to be uſed in fevers; but the Peruvian bark is by many celebrated in this diſorder beyond any other internal medicine. 3. The chief and laſt obſervation concerning the treatment of a gangrene, is chiefly to diſcharge the ſtagnating and corrupted blood from the parts affected as ſoon as poſſible, to prevent the neighbouring parts from being affected thereby.

The principal means to effect this are, 1. To make uſe of proper internal, ſtrengthening medicines. 2. To make ſcarifications on the part affected, by numerous inciſions lengthways, and of a ſufficient depth, in order to diſcharge the ſtagnating and corrupted blood, and to make way for the ingreſs of the virtues of the diſcutient medicines which are applied externally. Laſtly, 3. Diſcutient, ſtimulating, and balſamic fomentations and cataplaſms which reſiſt putrefaction, are to be carefully applied to the diſordered part.

The fomentation is to be applied hot, ſeveral times in a day, to the parts affected, by means of linnen or woollen cloths; and to give a laſting warmth, we may apply a hot tile wrapped up in a thick cloth, or a hot bag of ſand.

GANNET, in ornithology, a bird of the larus or gull-kind, frequent on the weſtern coaſts of England. It is equal in ſize to the common duck. The upper part of the body is of a deep ruſty ferrugineous colour, much like that of the common buzzard; and the breaſt and belly are alſo brown, but paler. It is an extremely ſingular ſpecies, its whole aſpect, in ſome degree, approaching to that of ſome of the larger birds of prey.

GANTLET, or GAUNTLET, a large kind of glove, made of iron, and the fingers covered with ſmall plates. It was formerly worn by cavaliers, when armed at all points.

GAOL, a priſon, or place of legal confinement.

GAOL-DELIVERY, is where a commiſſion or patent is granted by the king in the nature of a letter, to certain perſons, who are thereby appointed his juſtices, or to two or three of them, authorizing them to deliver his gaol, at ſuch a place, of the priſoners contained therein; and for that end it commands them to meet at ſuch place, at the time they themſelves ſhall appoint, when the ſheriff of the county is commanded to bring all the priſoners in the gaol before them, &c. 4 *Inſt.* 168.

GARBLER *of Spices*, an ancient officer in the city of London, who is authorized to go into ſhops, ware-houſes, &c. there to view and ſearch drugs, ſpices, &c. and ſee that they be garbled or cleanſed from the droſs and duſt wherewith they are mixed.

GARDANT, or GUARDANT, in heraldry, denotes any beaſt full faced, and looking right forward.

GARDEN, a plot of ground, cultivated and properly ornamented with a variety of plants, flowers, fruit, &c.

Gardens are uſually diſtinguiſhed into flower-garden, fruit-garden, and kitchen-garden; the firſt of which, being deſigned for pleaſure and ornament, is to be placed in the moſt conſpicuous part, that is, next to the back front of the houſe; and the two latter being deſigned for uſe, ſhould be placed leſs in ſight. But though the fruit and kitchen-gardens are here mentioned as two diſtinct gardens, yet they are now uſually in one; and that with good reaſon, ſince they both require to be placed out of the view of the houſe. See KITCHEN-GARDEN.

In the choice of a place proper for a garden, the moſt eſſential points to be conſidered are the ſituation, the ſoil, the expoſure, water, and proſpect.

1. As to the ſituation, it ought to be ſuch a one as is wholeſome, and in a place neither too high nor too low; for if a garden be too high, it will be expoſed to the winds, which are very prejudicial to trees; and if it be too low, the dampneſs, the vermin, and the venomous creatures that breed in ponds and marſhy places, add much to their inſalubrity. The moſt happy ſituation is on the ſide of a hill, eſpecially if the ſlope be eaſy, and in a manner imperceptible; if a good deal of level ground be near the houſe; and if it abounds with ſprings of water; for, being ſheltered from the fury of the winds, and the violent heat of the ſun, a temperate air will be there enjoyed; and the water that deſcends from the top of the hill, either from ſprings or rain, will not only ſupply fountains, canals, and caſcades for ornament, but when it has performed its office, will water the adjacent valleys, and, if it be not ſuffered to ſtagnate, will render them fertile and wholeſome. Indeed if the declivity of the hill be too ſteep, and the water be too abundant, a garden on the ſide of it may frequently ſuffer, by having trees torn up by torrents and floods; and by the tumbling down of the earth above, the walls may be demoliſhed, and the walks ſpoiled. It cannot, however, be denied, that the ſituation on a plain, or flat, has ſeveral advantages which the higher ſituation has not: for floods and rain commit no damage; there is a continued proſpect of champaigns, interſected by rivers, ponds, and brooks, meadows and hills covered with woods or buildings; beſides, the level ſurface is leſs tireſome to walk on, and leſs chargeable, than that on the ſide of a hill, ſince terrace walks and ſteps are not there neceſſary: but the greateſt diſadvantage of flat gardens, is the want of thoſe extenſive proſpects which riſing grounds afford.

2. A good earth, or ſoil, is next to be conſidered; for it is ſcarce poſſible to make a fine garden in a bad ſoil: there are indeed ways to meliorate ground, but they are very expenſive; and ſometimes when the expence has been beſtowed of laying good earth three feet deep over the whole ſurface, a whole garden has been ruined

when the roots of the trees have come to reach the natural bottom.

To judge of the quality of the ſoil, obſerve whether there be any heath, thiſtles, or ſuch like weeds growing ſpontaneouſly in it; for they are certain ſigns that the ground is poor. Or if there be large trees growing thereabouts, obſerve whether they grow crooked, ill ſhaped, and grubby; and whether they are of a faded green, and full of moſs, or infeſted with vermin; if this be the caſe, the place is to be rejected: but, on the contrary, if it be covered with good graſs fit for paſture, you may then be encouraged to try the depth of the ſoil. To know this, dig holes in ſeveral places, ſix feet wide, and four feet deep; and if you find three feet of good earth, it will do very well; but leſs than two, will not be ſufficient. The quality of good ground is neither to be ſtony, nor too hard to work; neither too dry, too moiſt, nor too ſandy and light; nor too ſtrong and clayey, which is the worſt of all for gardens.

3. The next requiſite is water, the want of which is one of the greateſt inconveniencies that can attend a garden, and will bring a certain mortality upon whatever is planted in it, eſpecially in the greater droughts that often happen in a hot and dry ſituation in ſummer; beſides, its uſefulneſs in fine gardens for making fountains, canals, caſcades, &c. which are the greateſt ornaments of a garden.

4. The laſt thing to be conſidered, is the proſpect of a fine country; and though this is not ſo abſolutely neceſſary as water, yet it is one of the moſt agreeable beauties of a fine garden: beſides, if a garden be planted in a low place that has no kind of proſpect, it will not only be diſagreeable, but unwholeſome.

In the laying out and planting of gardens, the beauties of nature ſhould always be ſtudied; for the nearer a garden approaches to nature, the longer it will pleaſe. The area of a handſome garden may take up thirty or forty acres, but not more; and the following rules ſhould be obſerved in the diſpoſition of it. There ought always to be a deſcent at leaſt three ſteps from the houſe to the garden; this will render the houſe more dry and wholeſome, and the proſpect on entering the garden more extenſive. The firſt thing that ſhould preſent itſelf to view, ſhould be an open lawn of graſs, which ought to be conſiderably broader than the front of the building; and if the depth be one half more than the width, it will have a better effect: if on the ſides of the lawn there are trees planted irregularly, by way of open groves, the regularity of the lawn will be broken, and the whole rendered more like nature. For the convenience of walking in damp weather, this lawn ſhould be ſurrounded with a gravel walk, on the outſide of which ſhould be borders three or four feet wide, for flowers: and from the back of theſe, the proſpect will be agreeably terminated by a ſlope of ever-green ſhrubs, which, however, ſhould never be ſuffered to exclude agreeable proſpects, or the view of handſome buildings. Theſe walks may lead thro' the different plantations, gently winding about in an eaſy natural manner, which will be more agreeable than either thoſe long ſtraight walks, too frequently ſeen in gardens, or thoſe ſerpentine windings, that are twiſted about into ſo many ſhort turns, as to render it difficult to walk in them: and as no garden can be pleaſing where there is a want of ſhade and ſhelter, theſe walks ſhould lead as ſoon as poſſible into plantations, where perſons may walk in private, and be ſheltered from the wind. Where the borders of the gardens are fenced with walls or pales, they ſhould be concealed with plantations of flowering-ſhrubs intermixed with laurels, and other ever-greens, which will have a good effect, and at the ſame time conceal the fences, which are diſagreeable, when left naked and expoſed to the ſight. Groves are the moſt agreeable parts of a garden, ſo that there cannot be too many of them; only that they muſt not be too near the houſe, nor be ſuffered to block up agreeable proſpects. To accompany parterres, groves opened in compartments, quincunxes, and arbour-work with fountains, &c. are very agreeable. Some groves of ever-greens ſhould be planted in proper places, and ſome ſquares of trees of this kind may alſo be planted among the other wood. See QUINCUNX, &c.

Narrow rivulets, if they have a conſtant ſtream, and are judiciouſly led about a garden, have a better effect than many of the large ſtagnating ponds or canals ſo frequently made in large gardens. When wilderneſſes are intended, they ſhould not be cut into ſtars and other ridiculous figures, nor formed into mazes or labyrinths, which in a great deſign appear trifling. Buildings, ſtatues, and vaſes, appear very beautiful; but they ſhould never be placed too near each other: magnificent fountains are alſo very ornamental; but they ought never to be introduced, except there be water to keep them conſtantly running. The ſame may alſo be obſerved of caſcades and other falls of water. See the articles CASCADES, FOUNTAINS, &c.

In ſhort, the ſeveral parts of a garden ſhould be diverſified; but in places where the eye takes in the whole at once, the two ſides ſhould be always the ſame. In the buſineſs of deſigns, the aim ſhould be always at what is natural, great, and noble. The general diſpoſition of a garden, and of its parts, ought to be accommodated to the different ſituations of the ground, to humour its inequalities, to proportion the number and ſorts of trees and ſhrubs to each part, and to ſhut out from the view of the garden no objects that may become ornamental. And before a garden is planned out, it ought ever to be conſidered, what it will be when the trees have had twenty years growth. *Miller's Gard. Dict.*

GARDENING, a branch of agriculture, containing the cultivation of gardens. See the preceding article.

The art of gardening affords a variety of delights. It teaches how to diſpoſe fruit trees, flowers, and herbs to the beſt advantage, whether for profit or pleaſure; and ſhews how to prepare the ſoil for ſowing the different kinds of ſeeds, as well as how to treat the plants when grown up. It is a pleaſure to behold a perſon employed, amongſt the plants of a ſpacious garden, in reforming, by proper methods, a growth of natural wildings; to ſee him cultivate mutual alliances between his plants, by grafting or inoculation, whereby the bad are meliorated, and the good rendered ſtill more perfect. By this means, a plant taken from the wilds of a foreſt, ſoftens its ſavage nature, and will ſometimes diveſt itſelf of its thorns, when it happens to be aſſociated with a domeſtic one. As to the ſeveral parts and operation of gardening, the reader will find them deſcribed under the articles of SOWING, PLANTING, TRANSPLANTING, GRAFTING, INOCULATION, PRUNING, NURSERY, HOT-BED, GREEN-HOUSE, WALK, TERRACE, ALLEY, AVENUE, ARBOUR, GROVE, ESPALIERS, STANDARDS, &c.

GARGARISM, in medicine, is ſometimes taken, in a large ſenſe, for every collution of the mouth; but, ſtrictly ſpeaking, it ſignifies a liquid medicine, appropriated to affections of the mouth, gums, fauces, larynx, and ſometimes of the head, received into the mouth, and there uſed by way of collution, without deglutition.

GARLAND, among ſailors, a ſort of net uſed by the different meſſes of a ſhip of war to hang their proviſions in, in the apartment where they eat and ſleep.

GARNET, among ſailors, a ſort of tackle or complication of pullies, fixed to the main-ſtay of a merchant-ſhip to hoiſt the cargo in and out at the time of lading and delivering her.

Alſo a rope fixed to the lower corners or clues of the main-ſail and fore-ſail to draw them up to the yard occaſionally, and hence called clue-garnet. See the article CLUE-GARNET.

GARNET, *Granatus*, in natural hiſtory, a very beautiful gem, of a red colour, with an admixture of bluiſh.

When pure and free from blemiſhes, it is little inferior, in appearance, to the oriental ruby, tho' only of a middle degree of hardneſs between the ſapphire and common cryſtal. It is found of various ſizes, from that of a pin's head to an inch in diameter.

Among our lapidaries and jewellers, genuine garnets are known by different names, according to their different degrees of colour. 1. The garnet, ſimply ſo called, is the fineſt and moſt valuable kind, being of a very deep blood-red, with a faint admixture of blue. 2. The rock-ruby, a name very improperly given to the garnet, when it is of a very ſtrong but not deep red, and has a fairer caſt of the blue: this is a very beautiful gem. 3. The

ſorane of ſerain garnet, that of a yet brighter red, approaching to the colour of native cinnabar, with a faint blue tinge. 4. The almandine, a garnet only a little paler than that called the rock-ruby.

Garnets are very properly diſtinguiſhed into the oriental and occidental kinds, as being found in Europe as well as the Eaſt-Indies. The oriental ones are principally brought from Calicut, Cananor, and Cambay; and the European ones are common in Italy, Hungary, and Bohemia.

Some authors have ſuppoſed the deeper-coloured garnet to be the ſame with the carbuncle of the antients, from which it really differs; ſince, on receiving the ſun's beams, it never gives ſo true a fire-colour as the carbuncle. See CARBUNCLE.

GARRISON, in the art of war, a body of forces, diſpoſed in a fortreſs, to defend it againſt the enemy, or to keep the inhabitants in ſubjection; or even to be ſubſiſted during the winter ſeaſon; hence, garriſon and winter-quarters are ſometimes uſed indifferently, for the ſame thing; and ſometimes they denote different things. In the latter caſe, a garriſon is a place wherein forces are maintained to ſecure it; and where they keep regular guard, as a frontier town, a citadel, caſtle, tower, &c. The garriſon ſhould always be ſtronger than the townſmen.

Winter-quarters ſignify a place where a number of forces are laid up in the winter ſeaſon, without keeping the regular guard. See WINTER-QUARTERS.

GARRISON-TOWN, a ſtrong place in which troops are quartered, and do duty, for the ſecurity thereof, keeping ſtrong guards at each port, and a main guard in the market-place.

Order of the GARTER, a military order of knighthood, the moſt noble and antient of any lay-order in the world, inſtituted by king Edward III. This order conſiſts of twenty ſix knights-companions, generally princes and peers, whereof the king of England is the ſovereign or chief. They are a college or corporation, having a great and little ſeal.

Their officers are a prelate, chancellor, regiſter, king at arms, and uſher of the black rod. They have alſo a dean with twelve canons, and petty canons, vergers, and twenty-ſix penſioners, or poor knights. The prelate is the head. This office is veſted in the biſhop of Wincheſter, and has ever been ſo. Next to the prelate is the chancellor, which office is veſted in the biſhop of Saliſbury, who keeps the ſeals, &c. The next is the regiſter, who by his oath is to enter upon the regiſtry the ſcrutinies, elections, penalties, and other acts of the order, with all fidelity. The fourth officer is garter, and king at arms, being two diſtinct offices united in one perſon. Garter carries the rod and ſcepter at the feaſt of St. George, the protector of this order, when the ſovereign is preſent. He notifies the elections of new knights, attends the ſolemnity of their inſtallations, carries the garter to the foreign princes, &c. He is the principal officer within the college of arms, and chief of the heralds. See KING *at Arms*.

All theſe officers, except the prelate, have fees and penſions. The college of the order is ſeated in the caſtle of Windſor, with the chapel of St. George, and the chapter-houſe, erected by the founder for that purpoſe. The habit and enſign of the order are a garter, mantle, cap, george, and collar. The four firſt were aſſigned the knights companions by the founder; and the george and collar by Henry VIII. The garter (ſee plate LXVII. *fig.* 6.) challenges preheminence over all the other parts of the dreſs, by reaſon that from it the noble order is denominated; that it is the firſt part of the habit preſented to foreign princes, and abſent knights, who, and all other knights elect, are therewith firſt adorned; and it is of ſo great honour and grandeur, that by the bare inveſtiture with this noble enſign, the knights are eſteemed companions of the greateſt military order in the world. It is worn on the left leg between the knee and calf, and is enamelled with this motto, HONI SOIT QVI MAL Y PENSE; i. e. "Shame to him that thinks evil hereof." The meaning of which is, that king Edward having laid claim to the kingdom of France, retorted ſhame and defiance upon him that ſhould dare to think amiſs of the juſt enterprize he had undertaken, for recovering his lawful right to that crown; and that the bravery of thoſe knights whom he had elected into this order, was ſuch as would enable him to maintain the quarrel againſt thoſe that thought ill of it.

The mantle (*fig.* 7.) is the chief of thoſe veſtments made uſe of upon all ſolemn occaſions. The colour of the mantle is by the ſtatutes appointed to be blue. The length of the train of the mantle only diſtinguiſhes the ſovereign from the knights companions. To the collar of the mantle is fixed a pair of long ſtrings, anciently wove with blue ſilk only, but now twiſted round, and made of Venice gold and ſilk, of the colour of the robe, with knobs, or buttons, and taſſels at the end. The left ſhoulder of the mantle has from the inſtitution been adorned with a large garter, with the device HONI SOIT, &c. Within this is the croſs of the order, which was ordained to be worn at all times by king Charles I. At length the ſtar was introduced, being a ſort of croſs irradiated with beams of ſilver. *Fig.* 8.

The collar (*fig.* 9.) is appointed to be compoſed of pieces of gold in faſhion of garters, the ground enamelled blue, and the motto gold. See COLLAR.

The manner of electing a knight companion into this moſt noble order, and the ceremonies of inveſtiture, are as follow. When the ſovereign deſigns to elect a companion of the garter, the chancellor belonging to this order draws up the letters, which paſſing both under the ſovereign's ſign manual and ſignet of the order, are ſent to the perſon by garter principal king at arms, and are in this manner, or to the ſame effect. "We, with the companions of our moſt noble order of the garter, aſſembled in chapter, holden this preſent day at our caſtle at Windſor, conſidering the virtuous fidelity you have ſhewn, and the honourable exploits you have done in our ſervice, by vindicating and maintaining our right, &c. have elected and choſen you one of the companions of our order. Therefore, we require you to make your ſpeedy repair unto us, to receive the enſigns thereof, and be ready for your inſtallation upon the—day of this preſent month, &c."

The garter, which is of blue velvet bordered with fine gold wire, having commonly the letters of the motto of the ſame, is, at the time of election, buckled upon the left leg, by two of the ſenior companions, who receive it from the ſovereign, to whom it was preſented upon a velvet cuſhion by garter king at arms, with the uſual reverence, whilſt the chancellor reads the following admonition, enjoined by the ſtatutes. "To the honour of God omnipotent, and in memorial of the bleſſed martyr St. George, tye about thy leg, for thy renown, this noble garter; wear it as the ſymbol of the moſt illuſtrious order, never to be forgotten, or laid aſide; that thereby thou mayeſt be admoniſhed to be courageous, and having undertaken a juſt war in which thou ſhalt be engaged, thou mayeſt ſtand firm, valiantly fight, and ſucceſſively conquer."

The princely garter being thus buckled on, and the words of its ſignification pronounced, the knight elect is brought before the ſovereign, who puts about his neck, kneeling, a ſky coloured ribbon, (*fig.* 10.) whereunto is appendant, wrought in gold within the garter, the image of St. George on horſeback, with his ſword drawn, encountering with the dragon. In the mean time, the chancellor reads the following admonition: "Wear this ribbon about thy neck, adorned with the image of the bleſſed martyr and ſoldier of Chriſt, St. George, by whoſe imitation provoked, thou mayeſt ſo overpaſs both proſperous and adverſe adventures, that having ſtoutly vanquiſhed thy enemies both of body and ſoul, thou mayeſt not only receive the praiſe of this tranſient combat, but be crowned with the palm of eternal victory."

Then the knight elected kiſſes the ſovereign's hand, thanks his majeſty for the great honour done him, riſes up, and ſalutes all the companions ſeverally, who return their congratulations. *Fig.* 7. exhibits a view of a knight of the garter in the habit of this order.

Since the inſtitution of this order, there have been eight

eight emperors, and twenty-eight kings, beſides numerous ſovereign princes enrolled as companions thereof. Its origin is ſomewhat differently related: the common account is, that it was erected in honour of a garter of the counteſs of Saliſbury, which ſhe dropped dancing with king Edward, and which that prince picked up; but our beſt antiquaries think it was inſtituted on account of the victory over the French at Creſſy, where the king ordered his garter to be diſplayed as a ſignal of the battle.

GAS, among chemiſts, a term made uſe of by Helmont, to ſignify, in general, ſpirit incapable of coagulation, ſuch as proceeds from fermented wine.

GASKET, among ſailors, a ſort of platted cord faſtened to the ſail-yards of a ſhip to furl, or tie up the ſail to the yard: it is uſed by wrapping it round the yard and ſail, the latter of which is rolled up cloſe to the former for that purpoſe.

GASTRO-EPIPLOIC Vein, a vein that opens into the vena portæ. See Vein.

GASTRIC, in general, ſomething belonging to the ſtomach. See Stomach.

Gastric Juice, *gaſtricus ſuccus*, among phyſicians, a thin, pellucid, ſpumous, and ſaltiſh liquor, which continually diſtills from the glands of the ſtomach for the dilution of the food. See Food.

Gastric Veſſels, in anatomy, the arteries and veins of the ſtomach. See the articles Artery and Vein.

GASTROCNEMIUS, in anatomy, the name of two thick, pretty broad, and oblong muſcles, which form a great part of what is called the calf of the leg. They are ſituated laterally with reſpect to each other under the poples.

Gastrocnemius is alſo the name of one of the extenſor-muſcles of the foot.

GASTRORAPHY, γαστροραφια, in ſurgery, the operation of ſowing up wounds of the abdomen.

GASTROTOMY, γαστροτομια, in ſurgery, the cutting open the abdomen and uterus, as in the Cæſarian ſection. See the article Cæsarian.

GATE, in architecture, a large door, leading, or giving entrance into a city, town, caſtle, palace, or other conſiderable building: or a place giving paſſage to perſons, horſes, coaches, or waggons, &c. As to their proportion, the principal gates for entrance through which coaches and waggons are to paſs, ought never to be leſs than ſeven feet in breadth, nor more than twelve, which laſt dimenſion is fit only for large buildings. The height of a gate is to be 1 ½ of the breadth, and ſomewhat more; but as for common gates in inns, under which waggons go loaded with hay, ſtraw, &c. the height of them may be twice their breadth.

Paled Gates, ſuch as are ſet up in fences for ſhutting up the paſſages into fields, and other incloſures.

Theſe are of two ſorts, either of ſawed or cleft timber.

GATE, in the manege, the going or pace of a horſe.

GAVELET, in law, an antient and ſpecial ceſſavit uſed in Kent, where the cuſtom of gavel-kind continues, by which the tenant, if he withdraws his rent and ſervices due to the lord, forfeits his lands and tenements.

Gavelet, in London, is a writ uſed in the huſtings, given to lords of rents in the city of London.

GAVELKIND, a tenure or cuſtom belonging to lands in the county of Kent, by which the lands of the father are, at his death, equally divided among all his ſons; or the land of a deceaſed brother, in caſe he leaves no iſſue, among all the brethren. This is by ſome called ancient ſocage-tenure; the cuſtom came from our Saxon anceſtors, among whom the inheritance of lands did not deſcend to the eldeſt, but to all the ſons alike; and the reaſon why it was retained in Kent is, becauſe the Kentiſh men were not conquered by the Normans in the time of William I.

The particular cuſtoms attending this tenure are, that the heir, at the age of fifteen, may give or ſell his lands in gavelkind; and though the father is attainted of treaſon and felony, and ſuffers death, the ſon ſhall inherit. A wife ſhall be endowed of a moiety of the gavelkind-lands, of which her huſband died ſeiſed, during her widow-hood. Likewiſe a huſband may be tenant by curteſy of half his wife's lands, without having any iſſue by her; but if he marries again, not having iſſue, he forfeits his tenancy.

GAVELMAN, a tenant liable to pay tribute.

GAVELMED, the duty of mowing graſs, required by the lord of his cuſtomary tenants.

GAUGE, or Gage. See Gage.

Gauge Line, on the gauging-rod. See the article Gauging.

Gauge-Point, of a ſolid meaſure, the diameter of a circle, whoſe area is equal to the ſolid content of the ſame meaſure. Thus, the ſolidity of a wine-gallon being 231 cubic inches, if you conceive a circle to contain ſo many inches, the diameter of it will be 17.15; and that will be the gauge-point of wine-meaſure. And an ale gallon, containing 282 cubic inches, by the ſame rule, the gauge-point for ale-meaſure will be found to be 19.15. After the ſame manner, may the gauge-point of any foreign meaſure be obtained; and from hence may be drawn this conſequence, that when the diameter of a cylinder, in inches, is equal to the gauge-point of any meaſure, given likewiſe in inches, every inch in length thereof will contain an integer of the ſame meaſure, *e. gr.* in a cylinder whoſe diameter is 17.15 inches, every inch in height contains one entire gallon in wine meaſure; and in another, whoſe diameter is 18.95 inches, every inch in length contains one ale-gallon.

GAUGER, a king's officer who is appointed to examine all tuns, pipes, hogſheads, and barrels of wine, beer, ale, oil, honey, &c. and give them a mark of allowance, before they are ſold in any place within the extent of his office.

GAUGING, the art of meaſuring the contents of all kinds of veſſels, thereby to determine the quantity of liquids, &c. they contain.

Gauging is a branch of ſtereometry. The principal veſſels that come under its operation are pipes, barrels, rundlets, and other caſks; alſo coolers, fats, backs, ſtills, &c.

The ſolid content of cubical, parallelopipedal, and priſmatical veſſels is found in cubic inches, &c. by multiplying the area of the baſe by the perpendicular altitude. And the area of cylindrical veſſels is found by multiplying the area of the circular baſe by the perpendicular altitude.

Before the content of a caſk can be known, its form or ſhape muſt be conſidered; for though the diameters and length of one caſk may be equal to thoſe of another, yet one of them may contain ſeveral gallons more than the other; and therefore the content of all caſks cannot be found by the ſame rule. Moſt writers, therefore, in treating of this ſubject, have taken it for granted, that every common caſk is in one of the following ſolids, viz.

1. The middle fruſtum of a ſpheroid (plate LXVIII. *fig.* 1.

2. The middle fruſtum of a parabolical ſpindle (*fig.* 2.

3. The middle fruſtum of two parabolical conoids abutting upon one common baſe (*fig.* 3.

4. The middle fruſtum of two cones abutting upon one common baſe (*fig.* 4.

Accordingly they have laid down rules for finding the contents of theſe ſolids, and by thoſe rules they ſuppoſe the content of any caſk may be found.

See the method of finding the area of theſe figures under their proper articles.

From what has been ſaid, it follows that, if we are not exact in aſſigning the caſk its true form, it is impoſſible we ſhould ever be exact in aſcertaining its contents. Now it is evident to thoſe converſant in theſe affairs, that there never was any caſk in the ſhape of any one of thoſe ſolids whoſe names they bear, unleſs it can be ſuppoſed that it was effected by chance, the cooper never intending them for ſuch: and though it ſhould be admitted that a caſk may approach nearly to the form of ſuch a ſolid, yet what officer had any rule to direct in aſcertaining its true form, or to which of the varieties it belonged? Whence it follows, that the beſt method of gauging all kinds of caſks is to reduce them to cylinders; that is, to find a mean diameter between the head and the bung, whence its content will always be found exceedingly near the truth. The following example will explain this method.

Suppoſe

Suppoſe the area caſk ABCD, (*fig.*5.) whoſe length AB = 32, 5 inches, the bung diameter CD = 31, and that of the head IK = 24, was required.—Lay your gauging-rod upon the bung C, ſo that it may be parallel to AB; then will HL = AB, the length, and, if twice HI be taken from CD, the remainder will be = IK, the head diameter. Make EC = HE, and meaſure EF, whoſe double being taken from CD, there will remain FG, the mean diameter, which ſuppoſe = 28.85. Then this caſk will be gauged by the following

Rule.—To the ſquare of the bung diameter, add the ſquare of the head, and four times the ſquare of the mean diameter; multiply this ſum by the length of the caſk, and divide by 2154,3 for ale, and by 1764,71 for wine, which will give the content reſpectively.

GAUGING-*Rule* is an inſtrument commonly made of box, and ſometimes ivory, exactly a foot long, one inch and two tenths broad, and $\frac{1}{4}$ of an inch thick.

Deſcription of the GAUGING *Rule.*—This inſtrument conſiſts of four parts, viz. a rule and three ſmall ſcales or ſliding-piece fitted nicely with grooves to ſlide in it.

The firſt marked BN, to ſlide by the line A, the ſecond marked CD, to ſlide between the lines D and E, (*fig.* 7.) and the third marked N, (*fig.* 8.) ſlides in the edge of the rule between the two lines marked ſeg. L *y*, ſeg. S *t*. When the ſliders B and C are drawn out to their due extent, the whole rule will be three feet in length.

Of the firſt face of the rule *fig.* 6. — On the firſt face of the ſliding-rule here deſcribed, are placed four lines of numbers; the firſt line of numbers conſiſts of two radius's, and is numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; and then again, 2, 3, 4, 5, 6, 7, 8, 9, 10. (*fig.* 6.) On this line are placed ſeveral braſs center pins. The firſt in the firſt radius at 2150,42, and the third likewiſe at the ſame number taken in the ſecond radius, having MB ſet to them, ſignifying that the aforeſaid number repreſents the cubic inches in a malt buſhel; the ſecond and fourth center pins are ſet at the number 282, on each radius; they have the letter A ſet to them, ſignifying that the aforeſaid number repreſents the cubic inches in an ale gallon, and the W on the line B, ſtands at 231, being the cubic inches in a wine gallon, you may ſee it is placed both in the firſt and ſecond radius, the C in the ſame line being placed at 3.14, which is the circumference of a circle whoſe diameter is unity.

The fourth line on the firſt face is a broken line of numbers of two radius's, numbered 2, 1, 9, 8, 7, 6, 5, 4, 3, 2, 1, 9, 8, 7, 6, 5, 4, 3. The number 1 is ſet againſt M. B. of the firſt radius of the line A; this line hath M. D. ſet to it, ſignifying malt-depth. Note, the little long black dots over the center pins are put directly over the proper numbers. This line of numbers hath A placed at the end thereof, and is called A for diſtinction's ſake.

2. The ſecond and third line of numbers which are on the ſliding piece BN, (and which may be called but one line) are exactly the ſame with the firſt line of numbers; the little black dot that is near the diviſion 7, on the firſt radius, having S *i* ſet after it, is put directly over .707, which is the ſide of a ſquare inſcribed in a circle whoſe diameter is unity. The black dot near unto the figure 9, after which is written S *e*, is ſet directly over .886, which is the ſide of a ſquare equal to the area of a circle whoſe diameter is unity.

Of the ſecond face of the rule, *fig.* 7. — 3. The ſecond face of the rule has one ſingle line of numbers marked D, and numbered 1, 2, 3, &c. to 10. The line C (on the ſlider) is a double line of numbers of the ſame length with the ſingle one D, and by this on the ſlider is the ſingle line of numbers of D again repeated, which anſwers to the ſquare and cube roots of the lines C and E; the WG on the line D being placed at 17,14 is the gauge point for wine, and AG placed at 18,9 is the gauge point for ale gallons; the MS which ſtand at 46,37 is the gauge point for a malt buſhel in ſquare meaſure: and MR being placed at 52,32 is the gauge point for a malt buſhel in round or circular meaſure; the TP which ſtands at 6,32 is the gauge-point for a pound of tallow neat; the line marked E on the ſecond face of the rule, is a triple line of numbers, and is numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, 1, which 1 ſtands for 10, the next line being numbered 1, 2, 3, &c. to 10, which 10 ſtands for 100, the third line being numbered 1, 2, 3, &c. to 1000, having E after it, and therefore is called the line E for diſtinction's ſake. Its uſe is to find the cube root of any number, and to calculate diagonal lines for any meaſure or caſk whatſoever.

4. The two lines of numbers which are on the ſliding-piece marked C, are exactly the ſame as on the ſliding-piece on the other ſide the rule.

Of the third face (or edge) of the rule.—On one edge of the rule (*fig.* 8.) are placed two lines of ſegments of a ſpheroidal caſk, each numbered 1, 2, 4, &c. to 100; the firſt is for finding the ullage of a caſk taken as the middle fruſtum of a ſpheroid, lying with its axis perpendicular to the horizon; this line is marked thus ſeg. L *y*, the other line of ſegments marked ſeg. S *t*, is for finding the ullage of a caſk ſtanding.

Between theſe two ſegments ſlides a line of numbers with a double radius, marked at the end with N; and at each end of the ſlider there is a braſs ſtud for conveniency of moving them to and fro with your thumb.

Of the fourth face (or edge) of the rule.—5. On the oppoſite face of the rule (*fig.*9.) is placed a line of inches to 12 decimally divided; next to this lieth a line numbered with 1, 2, 3, &c. to 7, and at the end marked with ſpheroid, by help of which is found a mean diameter for a caſk, in form of the middle fruſtum of a ſpheroid; next under this is a line for finding the mean diameter of a caſk in form of the middle fruſtum of a parabolic ſpindle, called by gaugers, the ſecond variety of caſks; it is numbered 1, 2, 3, 4, 5, 6, and at its end is writ ſecond variety; next under this lieth a line for finding the mean diameter of a cask of the third variety, that is, a cask formed by fruſtums of two parabolic conoids abutting upon a common baſe, it is numbered 1, 2, 3, 4, 5, and at the end thereof is writ third variety.

Of the three ſliding-pieces, *fig.* 10. and 11.—6. The above are all the lines on the four ſides of the rule; but on the back-ſide of the two ſliding-peices is a line of inches from 13 to 36, when the two ſliding pieces are put end-ways together; and againſt that the correſponding gallons or hundred parts, that any ſmall tub, or ſuch like open veſſel (from 13 to 36 inches diameter) will contain at one inch deep; theſe are commonly called (by the gaugers) the ale area's; and by drawing out of the firſt ſlider, any open veſſel's diameter under 36 inches may be taken, and its area in ale gallons is ſhewn by inſpection; if the tub be more than 24 and leſs than 36 inches diameter, then pin the firſt ſlider faſt, and draw out the other ſlider, and you have the diameter in inches and decimal parts of an inch of that tub, with the ale area anſwering to that diameter by inſpection.

7. The inſide of the little ſlider marked N, O, (*fig.*12.) on the rule, is for reducing casks in the form of the fruſtum of a cone to a cylinder; as ſuppoſe the difference between the head and bung of a cask to be 5.3, ſeek this in the line of inches, and againſt it you will find 3.4, which add to the head diameter, and the ſum will be the mean diameter, that is, the diameter of a cylinder, (having the ſame length with the cask propoſed) equal to the ſaid cask.

Conſtruction of the lines on the ſliding-rule.—All the lines of numbers above deſcribed are made by one general rule, which is this; get a plate of braſs, or copper, &c. of what length you deſign your line to be; and thereon draw three parallel lines, for the better diſtinguiſhing the diviſions of the lines of numbers, and make a mark for the beginning of it; cloſe by theſe parallel lines draw ten other parallel lines, and divide this into ten equal parts; one of which ſubdivide into 100 equal parts, which makes it a diagonal ſcale of 1000 equal parts; being thus prepared, look into the table of logarithms for the number 200, and againſt it you will find the logarithm 2,301030, rejecting the characteriſtic 2, and alſo the three laſt figures on the right hand 030, becauſe the length of the radius is divided but into 1000 equal parts; take 301 from your diagonal ſcale in your compaſſes, and lay off that diſtance from the beginning of the line of numbers, and there place the figure 2 for the firſt prime. Again, to find the diviſion for the ſecond prime, look into the table of logarithms for the number 300, and you will find its logarithm to be 2,477121; reject

Fig. 1. Gauging

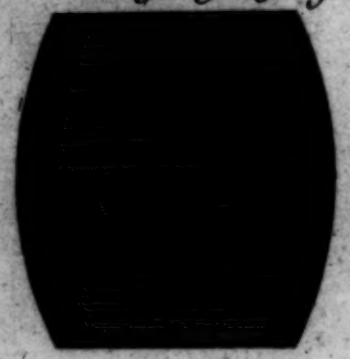


Fig. 2. Gauging.

Fig. 3. Gauging.

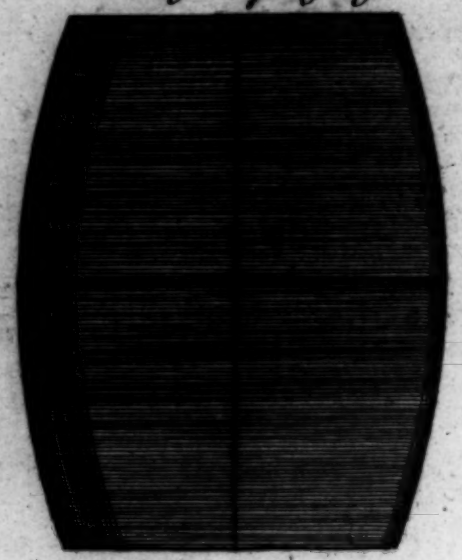
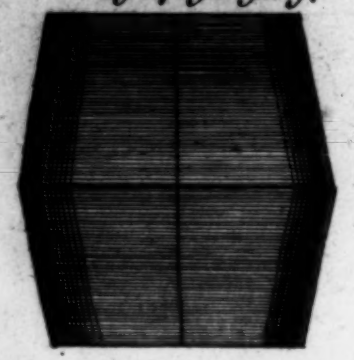


Fig. 4. Gauging.



EVERARD'S SLIDING RULE

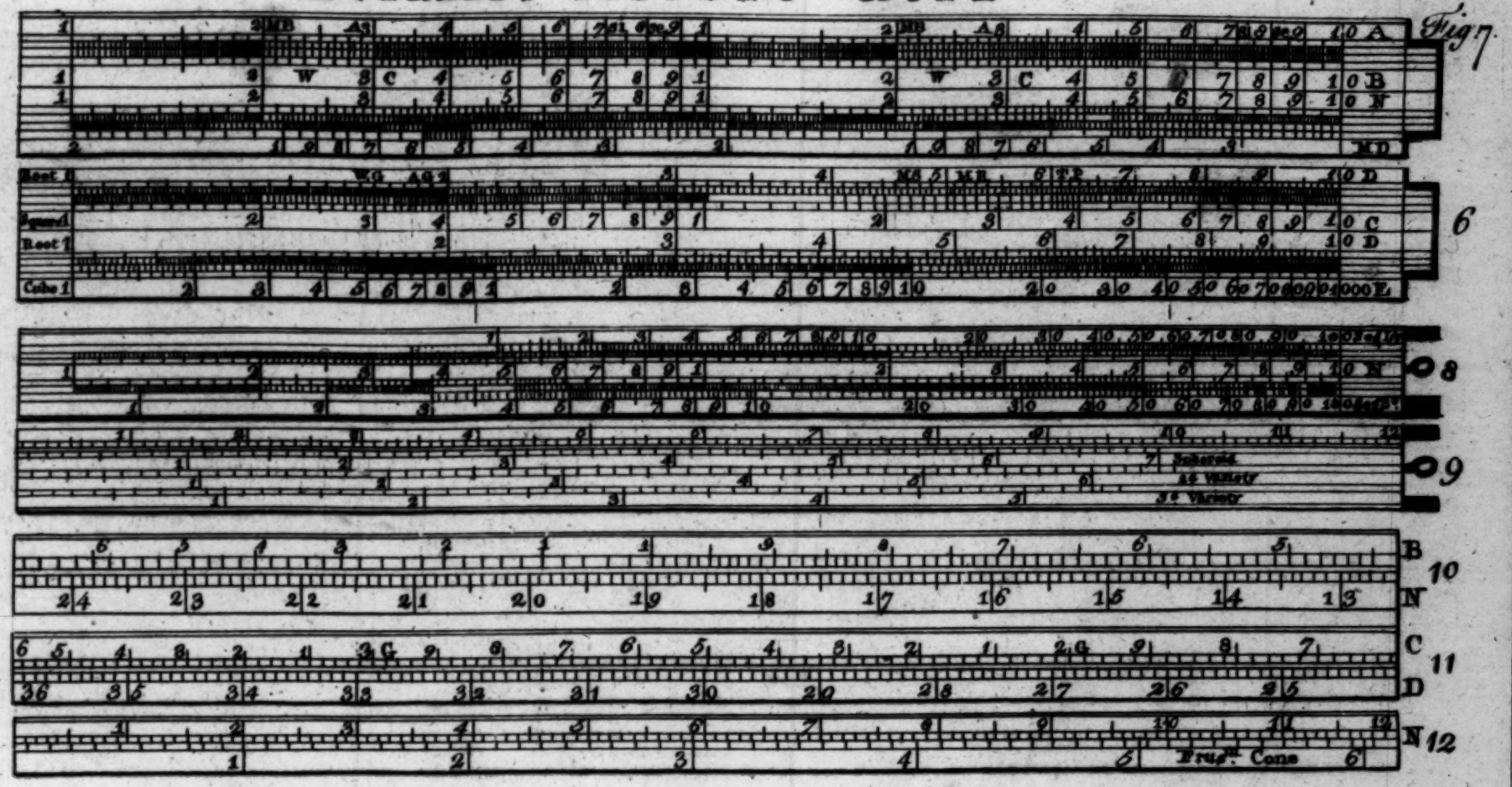
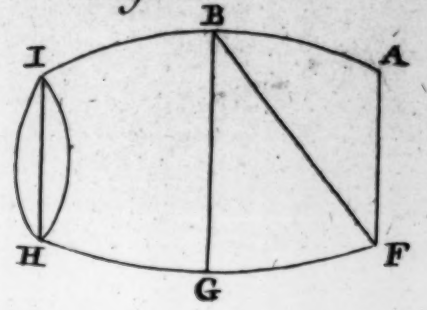


Fig. 5. Gauging

Fig. 13.



5 JA 59

reject the characteriſtic 2, and alſo the three laſt figures to the right hand, and take in your compaſſes from your diagonal ſcale, as before, the number 477, and lay off that diſtance from 1, at the beginning of the line of numbers, to 3 for the ſecond prime: and ſo by proceeding thus you will compleat all the prime numbers of one radius of your line of numbers.

The line called the malt depth, marked M D, is only the aforementioned line of numbers turned the contrary way, and is ſo ordered, that the number 1 on M D may exactly ſtand even with, or againſt M B on the line A, and then all the other diviſions will fall in their true places. By this means any number on A or B, multiplied by any number directly under it on the line M D, will always be equal to 2150.42, the number of inches in a malt buſhel.

The lines of ſegments marked ſeg. L *y*, and ſeg. S *t*, may be put on the ſliding-rule in the following manner: Let a cask be fixed upon, whoſe form agrees the neareſt to the moſt common ones in practice, and ſuppoſe both its bung, diameter, and length, divided into 100 equal parts, and planes drawn through each of them, viz. the firſt hundred (ſerving for the ſegment marked ſeg. S *t*) all parallel to the heads, and the ſecond hundred (ſerving for the ſegment marked ſeg. L *y*) all parallel to that plane which paſſes thro' the length of the cask. Now if the meaſure in gallons of each of theſe ſlices to be found, and the laſt always added to the ſum of the preceding ones, ſucceſſively, we ſhall have two tables of meaſures, one for the ſegment ſtanding, and the other for the ſegment lying. Theſe lines of ſegments may be otherwiſe put on as thus: take a cask, in form of the middle fruſtum of a ſpheroid, whoſe head diameter is 24,37, bung diameter 30,0, and length 44,85. This cask filled with water will contain juſt 100 gallons.

Now to find againſt what number on the line of numbers of the ſliding-place any diviſion of the line of ſegments, for a cask lying, muſt ſtand, proceed thus: let juſt one gallon be drawn off, then take the wet inches of the bung diameter, which reſerve; ſet the bung diameter to 100 on the intended line of ſegments, and againſt the reſerved wet inches place 99 on the line of ſegments. This being done, draw off again juſt one gallon, and take the wet inches of the bung diameter, againſt which, the ſlider ſtill remaining fixed as before, ſet 98; proceed in this manner, ſtill drawing off one gallon each time, and careſully taking the wet inches of the bung diameter, until you have compleated the line of ſegments for a cask lying.

The other ſegment line on the ſame face of the rule may be made in the ſame manner as this, by ſetting the aforeſaid veſſel upright, and making uſe of the length inſtead of the bung diameter. The conſtruction of the lines on the other edge of the rule for the four varieties of casks, are thus: 1. If there be a cask, in form of the middle fruſtum of a ſpheroid, half the difference of the ſquares of the bung and head diameters, added to the ſum and half ſum of the ſaid ſquares, divided by 3, will be the ſquare of the mean diameter, the ſquare root of which will be the mean diameter. 2. Three tenths of the difference of the ſquares of the bung and head diameters, added to the ſum and half ſum of the ſaid ſquares, and the whole divided by 3, will be the ſquare of the mean diameter of a cask of the ſecond variety. 3. To the ſum and half ſum of the ſquares of the bung and head diameters, add one tenth of the difference of the ſaid ſquares, which ſum, divided by 3, gives the ſquare of the mean diameter of a cask of the third variety. 4. And laſtly, from the ſum and half ſum of the ſquares of the bung and head diameters, ſubtract half the ſquare of the difference of the diameters, and the remainder divided by 3, will be the ſquare of the mean diameter of a cask of the fourth variety, or two equal fruſtums of a cone abutting upon a common baſe.

The inſide of the two ſliders are divided into inches, and every inch into ten equal parts; the other line, which lieth by the ſide of the line of inches, is the area in ale gallons and decimal parts of a gallon, which are made thus, viz. ſet unity on C to A G, the ale gauge point upon D, and againſt any diameter on D, is the area in ale-

gallons, and decimal parts of a gallon, upon C.

So as the rule now ſtands, it is a table for all diameters whatſoever.

Note, The gallons are put in large figures, and the tenths of a gallon in ſmaller figures; every tenth of a gallon is divided into five by a ſmall diviſion, every one of which ſignifies two hundred parts of a gallon. By which I ſee, as the rule now ſtands, that a tub of 19 inches diameter will hold one gallon and ſomething more, upon one inch of depth; and 24 inches diameter gives for the area 1 gallon and 6 tenths, 30 inches diameter gives 2 gallons and a half for the area, or content, at one inch deep.

Conſtruction of the Four-foot GAUGING-ROD.—This rod is uſually made of box-wood, and conſiſts of four rules, each a foot long, and about half an inch ſquare, joined together by three braſs joints, by which means the rod is rendered four feet long, when the four rules are quite opened, and but one foot in length when they are folded together.

On the firſt face of this rod is placed a line of inches (and ſometimes with it a line of ale areas) decimally divided, whoſe uſe is to take dimenſions neceſſary for gauging veſſels either for ale, wine, malt, &c.

Two diagonal lines are placed near the line of inches, one for ale, the other for wine.

The diagonal line of a cask is found by putting the rod in at the bung to the interſection of the head of the veſſel, with the ſtaves oppoſite to the bung hole; ſo B F, (plate LXVIII. *fig.* 13.) is the diagonal line.

By the bung, head, and length of a cask, we can find its diagonal line, as has been already ſhewn; whence, by having the contents of two ſimilar casks, and the diagonal of one of them given, we can find the diagonal line of the other; for as the content of any cask in ale or wine gallons, is to the cube of its diagonal, ſo is the content of any other cask (ſimilar to the former) to the cube of its diagonal, whoſe cube root is the diagonal required.

Lines adapted to the London casks are placed on the other faces of this four-foot gauging-rod, viz. 1. A line for a butt ſtanding. 2. For a butt lying; each of which contains 108 gallons, beer-meaſure. 3. A line for a hogſhead containing 54 gallons. 4. A line for the barrel of 36 gallons. 5. A line for a kilderkin of 18 gallons. 6. A line for a firkin of nine gallons. Then to gauge any of theſe casks, there is no more to do than to put in your rod perpendicular at the bung, &c. and if the cask is not full it gives you the quantity of liquor in the cask.

For the ſame purpoſe there are alſo lines put on four-foot gauging-rods for wine meaſure; as 1. A ton of 252 gallons. 2. A butt of 126 gallons. 3. A puncheon of 84 gallons. 4. A hogſhead of 63 gallons. 5. A tierce of 42 gallons. 6. A barrel of 31 ½ gallons. 7. A rundlet of 18 gallons. And laſtly, an anchor of 10 gallons. By theſe lines all brandies and oils are gauged.

Theſe lines for London casks are made, by ſetting the veſſel level, and pouring in one gallon of water, and then put the rod downright into the bung-hole (if it is a lying cask) or at the head (if a ſtanding cask) and where the ſurface of the water cuts the rod, make the diviſion for one gallon; then, pour in another gallon, and where the ſurface of the water cuts the rod, make diviſions for two gallons; proceed thus by pouring in one gallon ſucceſſively after another, and make diviſions at every place on the face of the rod, to which the water riſes, till the cask be full, and then you have the ſcale for that cask properly divided. Proceed in the ſame manner for every one of the London casks abovementioned, and all the lines will be finiſhed when figured.

Note, The diviſions for quarts, marked by dots on the rod, are made by pouring in a quart of water ſucceſſively, and that you may not be at a loſs to know what cask is in hand, the rod will ſhew you, for by meaſuring the depth of the bung, &c. if it cut 36, it is a barrel; if 18, it is a kilderkin, &c. and by the line for that cask you muſt take its ullage; that is, the quantity of liquor either drawn out, or remaining in the cask. For the uſes of the line of number, &c. ſee GUNTER's *Line*.

GAUNTLET, or GANTLET. See the article GANTLET.

GAVOTTA, or GAVOTTE, is a kind of dance, the air of which has two brisk and lively strains in common time, each of which strains are played twice over; the first has usually four or eight bars, and the second contains eight, twelve, or more.

Tempi di GAVOTTA is when only the time or movement of a gavotte is imitated, without any regard to the measure, or number of bars or strains.

GAURS, in matters of religion, an ancient sect of the magicians in Persia. They have a suburb at Ispahan, which is called Gaurabad, or the town of the Gaurs, where they are employed only in the meanest and vilest drudgery: but they chiefly abound in Kerman, the barrenest province in all Persia, where the Mahometans suffer them to live with some freedom, and in the full exercise of their religion. Some years ago many of them fled into India, where their posterity remain to this day.

They are a poor harmless sort of people, zealous in their superstition, rigorous in their morals, and exact in their dealings: they profess the worship of one God alone, the belief of a resurrection, and a future judgment, and utterly detest all idolatry, though the Mahometans believe them to be the most guilty of it. It is true, they perform their worship before fire, for which they have an extraordinary veneration, as believing it to be the most perfect emblem of the deity. They have the same veneration for Zoroaster that the Jews have for Moses, esteeming him a prophet sent from God.

GAWSE, or GAWZE, in commerce, a very slight, thin, open kind of stuff, made of silk, and sometimes of thread; there are also figured gawzes, and some with gold or silver flowers on a silk ground.

GAZONS, in fortification, pieces of fresh earth, covered with grass, and cut in form of a wedge, about a foot long and half a foot thick, to line the outsides of works made of earth, as ramparts, parapets, &c. The first bed of gazons is fixed with pegs of wood; the second bed should be so laid as to bind the former, by being placed over its joints; and so continued till the works are finished. Betwixt these beds it is usual to sow all sorts of binding herbs, in order to strengthen the rampart.

GEERS, in country-affairs, the trappings and other harness belonging to draught-horses or oxen.

GEESE, in ornithology. See GOOSE.

GEHENNA, a term mentioned in several parts of Scripture, which our English translators have rendered hell. See HELL.

GELATINOUS, in pharmacy and medicine, any thing approaching to the glutinous consistence of a gelatina, or jelly.

GELD, in our old customs, a Saxon word signifying money, or tribute: also a compensation for some crime committed. See the article GILD.

GELDER-ROSE, the name by which some call the opulus, or water-elder.

GELDING, the operation of castrating any animal, particularly horses.

This operation consists in cutting out the testicles; in performing which, three things are to be observed: first, regard is to be had to their age; next, to the season of the year; and, lastly, to the state of the moon. For the first, if the operation is to be performed on a colt; he may be gelded at nine or at fifteen days old, if the testicles be come down, in regard the sooner he is gelt the better it will be for his growth, shape, and courage; though a horse may be gelt at any age, if proper care be taken in the cure. As for the second, the best time is about April or May, or else about the latter end of September. And for the third, the wane of the moon is the fittest time for performing this operation.

The manner of gelding is as follows: the beast being cast down on some soft place, the operator takes the stones between his foremost and his great finger, and slitting the cod, presses the stones forth: then taking a pair of nippers, made very smooth, either of steel, box, or brasil-wood, he claps the strings of the stones between them, very near to where the stones are set on, and presses them so hard, that there may be no flux of the blood; then, with a thin, drawing cauterizing iron, made red-hot, sears away the stone.

This done, he takes a hard plaster made of rosin, wax, and washed turpentine, well dissolved together, and melts it on the head of the strings: that being done, he sears them, and melts more of the salve, till such time as he has laid a good thickness of it upon the strings.

This being done to one stone, the nippers are loosened, and the like is done to the other; and the two slips of the cod are then filled with white salt, and the outside of the cod is anointed with hogs-grease; and thus they let him rise, and keep him in a warm stable, without tying him up.

If he swells much in his cods or sheath, they chase him up and down; and make him trot an hour in a day, and he soon recovers.

The manner of gelding a hog is as follows: the operator, after having made two cross slips, or incisions, on the midst of the stones, presses them out, and anoints the sore with tar. But another more general method, yet somewhat more dangerous, if not well done, is first to cut the stone on the top, and after having drawn the one forth, the operator puts in his fingers at the same slip, and, with a lancet, cuts the skin between the two stones, and by that slit presses out the other stone. Then having cleansed out the blood, he anoints the part with fresh grease: and thus there is but one incision made in the cod. Boar-pigs ought to be gelt about six months old; yet they are commonly gelded about three weeks or a month old.

GELDING *of a Lamb* may be performed from the age of three days to three weeks or more, in the following manner: one is to hold the lamb between his legs, or in his lap, and turn him on his back, holding his fore-feet upright together (but if any black spots are seen in his flank, he must not be cut at all); then the cutter holding the tip of the cod in his left hand, cuts the lap of it an inch quite away; which done, he, with the foremost fingers and thumbs of both hands, should softly slip down the cod over the stones, to the belly, and with his teeth, holding the left stone in his mouth, he draw it softly out the length of the string; after which he is to draw out the other stone in the same manner; then he spits in the cod, and anoints the lamb's flanks with fresh grease, and so lets him go, and keeps stirring him up and down for two or three hours.

GEM, *Gemma*, in natural history, a common name for all precious stones, of which there are two classes, the pellucid and semipellucid.

The bodies composing the class of pellucid gems are bright, elegant, and beautiful fossils, naturally and essentially compound, ever found in small detached masses, extremely hard, pellucid, and of great lustre; composed of a very firm and pure matter, without any admixture of earthy substance, giving fire with steel, not fermenting with acid menstruums, and very difficultly calcinable in the fire.

The bodies composing the class of semipellucid gems, are stones naturally and essentially compound, not inflammable nor soluble in water, found in detached masses, and composed of crystalline matter debased by earth: however, they are but slightly debased, and are of great beauty and brightness, of a moderate degree of transparency, and are usually found in small masses.

Many authors, not only among the ancients but the moderns, are full of the virtues and medicinal properties of precious stones; but their reputation, in this respect, is now greatly fallen.

Imitation or counterfeiting of GEMS *in Glass.*—The art of imitating gems in glass, is too considerable to be passed without notice; some of the leading compositions therein, we shall briefly mention upon the authority of Neri. See GLASS.

These gems are made of pastes, and are no way inferior to the native stones, when carefully made and well polished, in brightness or transparence, but want their hardness. See the article PASTE.

The general rules to be observed in making the pastes are these. 1. That all the vessels in which they are made be firmly luted, and the lute left to dry before they are put into the fire. 2. That such vessels be chosen for the work

work, as will bear the fire well. 3. That the powders be prepared on a porphyry ſtone, not in a metal mortar, which would communicate a tinge to them. 4. That the juſt proportion in the quantity of the ſeveral ingredients be nicely obſerved. 5. That the materials be all well mixed, and if not ſufficiently baked the firſt time, to be committed to the fire again, without breaking the pot: for if this be not obſerved, they will be full of bliſters and air-bladders. 6. That a ſmall vacuity be always left at the top of the pot, to give room to the ſwelling of the ingredients.

To make paſte of extreme hardneſs, and capable of all the colours of the gems, with great luſtre and beauty.—Take of prepared cryſtal, ten pounds; ſalt of polverine, ſix pounds; ſulphur of lead, two pounds; mix all theſe well together into a fine powder; make the whole with common water into a hard paſte; and make this paſte into ſmall cakes of about three ounces weight each, with a hole made in their middle; dry them in the ſun, and afterwards calcine them in the ſtraighteſt part of a potter's furnace. After this, powder them, and levigate them to a perfect fineneſs on a porphy-ſtone, and ſet this powder in pots in a glaſs-furnace to purify for three days: then caſt the whole into water; and afterwards return it into the furnace, where let it ſtand fifteen days, in which time all foulneſs and bliſters will diſappear, and the paſte will greatly reſemble the natural jewels. To give this the colour of the emerald, add to it braſs thride calcined; for a ſea-green, braſs ſimply calcined to a redneſs; for a ſapphire, add zaffer, with manganeſe; and for a topaz, manganeſe and tartar. All the gems are thus imitated in this by the ſame way of working as the making of coloured glaſſes; and this is ſo hard, that they very much approach the natural gems.

The colour of all the counterfeit gems made of the ſeveral paſtes, may be made deeper or lighter, according to the work for which the ſtones are deſigned; and it is a neceſſary general rule, that ſmall ſtones for rings, &c. require a deeper colour, and large ones, a paler: beſides the colours made from manganeſe, verdigreaſe, and zaffer, which are the ingredients commonly uſed, there are other very fine ones which care and ſkill may prepare. Very fine red may be made from gold, and one not much inferior to that from iron; a very fine green from braſs or copper; a ſky-colour from ſilver; and a much finer one, from the granates of Bohemia.

GEMARA, in Jewiſh antiquity, a collection of deciſions and determinations on the law, wrote after the Miſchna was completed.

It was called gemara, or perfection, becauſe it was conſidered as ſo perfect an explication of the law, that after it no further additions could be made, or any thing more deſired. It is otherwiſe called the Talmud. See TALMUD.

GEMELLUS, in anatomy, the name of two muſcles, both of which are ſmall, flat, and narrow, and ſituated almoſt tranſverſely one above the other, between the tuberoſity of the iſchium and the great trochanter, immediately below the pyriformis, and parted by the tendon of the obturator internus.

The ſuperior and ſmalleſt gemellus is fixed to the lower part of the ſpine of the iſchium, to the ſuperior part of the ſmall iſchiatic notch, and is continued under the acetabulum, where it is bent downwards. The inferior and largeſt gemellus is fixed to the ſuperior and back part of the tuberoſity of the iſchium, and bending upwards towards the other line, together with it forms a ſort of irregular ſemicircle.

GEMINATED COLUMN. See the article COLUMN.

GEMINI, the twins, in aſtronomy, one of the twelve ſigns of the zodiac, the third in order, beginning with aries. See the articles SIGN and ZODIAC.

This conſtellation, according to different authors, contains from 24 to 89 ſtars. It is repreſented by the figure of two twin-children, looking each other affectionately in the face, and ſuppoſed to be Caſtor and Pollux.

GEMMA, *Gem*, in natural hiſtory. See the article GEM.

Sal GEMMÆ is the pureſt and fineſt foſſile ſalt, and an extremely bright and beautiful foſſil. It is conſiderably hard and firm, and at leaſt as pellucid as rock cryſtal; but is frequently coloured throughout with a milky-white, which takes off greatly from its luſtre; and as cryſtal is liable to be tinged with red, green, and yellow, ſo as to reſemble rubies, ſapphires, emeralds, and topazes, ſo this ſalt is ſometimes tinged with theſe ſeveral colours; but rarely preſerves the tranſparency of cryſtal under the ſame circumſtances. See the article SALT.

GENDARMES, or GENS D'ARMES, in the French armies, a denomination given to a ſelect body of horſe, on account of their ſucceeding the ancient gendarmes, who were thus called from their being completely cloathed in armour.

The king's body guards, the light horſe of the royal houſe, and the muſqueteers, are at preſent reputed to belong to the gendarmerie.

The grand gendarmes are a troop compoſed of about two hundred and fifty gentlemen, who guard the king's perſon. The king himſelf is their captain, and one of the prime peers their captain-lieutenant, who has under him two lieutenants, three enſigns, three guidons, and other officers. There are beſides theſe, gendarmes of the queen, the daupbin, &c.

GENDER, *Genus*, among grammarians, a diviſion of nouns, or names, to diſtinguiſh the two ſexes. See NOUN and SEX.

This was the original intention of gender; but, afterwards, other words which had no proper relation, either to the one ſex or the other, had genders aſſigned them, rather out of caprice than reaſon, which is at length eſtabliſhed by cuſtom. Hence genders vary according to the languages, or even according to the words introduced from one language into another. Thus *arbor*, in Latin, is feminine; but *arbre*, in French, is maſculine: and *dens*, in Latin, is maſculine; but *dent*, in French, is feminine. Nay, a gender has ſometimes changed in the ſame language, according to time and occaſion. Thus *aluus*, according to Priſcian, was anciently maſculine, but afterwards became feminine; and *navire* was anciently feminine in French, but is now maſculine. In Engliſh we have no genders; indeed we expreſs the difference of ſex by different words; as boar, ſow; boy, girl, &c. We have alſo twenty-four feminines diſtinguiſhed from the males by varying the termination of the female into eſs; as actor, actreſs; prince, princeſs; heir, heireſs, &c. and we have a few words in which the feminine is diſtinguiſhed from the maſculines by the termination ix, as executor, executrix; adminiſtrator, adminiſtratrix, &c. which is all our language knows of any thing like genders.

The eaſtern languages, as well as the vulgar languages of the weſt, have only two genders, the maſculine and the feminine. The Greek and Latin have beſides, the neuter, common, and doubtful gender. This laſt indeed is not common, for it properly belongs only to the names of ſome animals, which are promiſcuouſly joined both to maſculine and feminine adjectives, to expreſs their male or female, as *bos*, *canis*, *ſus*, &c. They have alſo the epicœne gender, which is not a different one, but ſerves promiſcuouſly for either; including both the kinds under one ſingle gender and termination: thus *vulpes*, a fox, though it ſignifies either the male or female, is really of the feminine gender, in Latin. And ſo *cuſtodiæ*, watchmen or centinels, are really feminine, though they ſignify men. This is common to all languages that have them. The Latin and Greek, in the neuter gender, do not regard them, having no relation to the male or female ſex, but what fancy gives them, and the termination of certain words.

The Oriental languages frequently neglect the uſe of genders; and the Perſian language has none at all, which is no diſadvantage; the diſtinction of genders being entirely uſeleſs.

GENEALOGY, γενεαλογια, an enumeration of a ſeries of anceſtors; or a ſummary account of the relations and alliances of a perſon or family, both in the direct and collateral line.

GENERAL TERMS, among logicians, thoſe which are made the ſigns of general ideas.

All things that exiſt, Mr. Locke obſerves, being particulars, it might be expected that words ſhould be ſo too in their ſignification: but we find it quite contrary; for moſt

moſt of the words that make all languages are general terms. This is the effect of reaſon and neceſſity. For,

Firſt, It is impoſſible that every particular thing ſhould have a diſtinct name, becauſe it is impoſſible to have diſtinct ideas of every particular thing, to retain its name, with its peculiar appropriation to that idea.

Secondly, It would be uſeleſs, unleſs all could be ſuppoſed to have theſe ſame ideas in their minds: for names applied to particular things, whereof I alone have the ideas in my mind, could not be ſignificant or intelligible to another, who is not acquainted with all thoſe particular things which had fallen under my notice.

Thirdly, It would be of no great uſe for the improvement of knowledge; which, though founded in particular things, enlarges itſelf by general views; to which things, reduced into ſorts under general names, are properly ſubſervient.

In things where we have occaſion to conſider and diſcourſe of individuals and particulars, we uſe proper names: as in perſons, countries, cities, rivers, mountains, &c. Thus we ſee that jockeys have particular names for their horſes, becauſe they often have occaſion to mention this or that particular horſe, when he is out of ſight.

Afterwards, obſerving that a great many things reſemble each other in ſhape, and other qualities, we frame a general idea that takes in only the qualities in which thoſe many particulars agree; and to this idea we give the name *man*, for example, in which there is nothing new; that which is peculiar to each individual being left out, and only what is common to all retained. And thus we come to have a general idea, and a general name. By the ſame method the mind proceeds to more general notions and names, as thoſe of animal, ſubſtance, being, thing, and ſuch univerſal terms as ſtand for any ideas whatſoever.

As to the ſignification of general words, it is evident they do not barely ſignify one particular thing; neither do they ſignify a plurality. But they ſignify a genus, kind, or ſort of things. See the articles ABSTRACTION and GENUS.

GENERAL *of an Army*, in the art of war, he who commands in chief. See ARMY.

A general ought to be a man of great courage and conduct, to have great experience, and to be of good quality. His conduct appears in eſtabliſhing his magazines in convenient places; in examining the country, that he may not engage his troops too far, while he is ignorant of the means of bringing them off; in ſubſiſting them; and in knowing how to take the moſt advantageous poſts, either for fighting or ſhunning a battle. His experience inſpires his army with confidence, and an aſſurance of victory; and his quality, by creating reſpect, augments his authority. By his liberality he gets intelligence of the ſtrength and deſigns of the enemy, and by this means is enabled to take the moſt ſucceſsful meaſures. A general ought likewiſe to be fond of glory, to have an averſion to flattery, to render himſelf beloved, and to keep a ſtrict diſcipline.

The office of a general is to regulate the march and encampment of the army; in the day of battle to chooſe out the moſt advantageous ground; to make the diſpoſition of the army; to poſt the artillery; and where there is occaſion, to ſend his orders by his aids de camp. At a ſiege he is to cauſe the place to be inveſted; to order the approaches and attacks; to viſit the works, and to ſend out detachments to ſecure his convoys.

GENERAL is alſo uſed for a particular march, or beat of drum; being the firſt which gives notice, commonly in the morning early, for the infantry to be in readineſs to march.

GENERATING *Line*, or *Figure*, in geometry, is that which by its motion produces any other plane or ſolid figure. Thus, a right line moved any way parallel to itſelf, generates a parallelogram; round a point in the ſame plane, with one end faſtened in that point, it generates a circle. One entire revolution of a circle, in the ſame plane, generates the cycloid; and the revolution of a ſemi-circle round its diameter, generates a ſphere, &c. See the articles CYCLOID, SPHERE, &c.

GENERATION, *Generatio*, in phyſiology, the act of procreating and producing a thing which before was not; or, according to the ſchoolmen, it is the total change or converſion of one body into a new one, which retains no marks of its former ſtate. Thus, we ſay, fire is generated, when we perceive it to be where before there was only wood, or other fuel: in the ſame manner a chick is ſaid to be generated, when we perceive it where before there was only an egg; or the egg is changed into the form of a chick.

In generation there is not properly any production of new parts; but only a new modification, or manner of exiſtence, of the old ones.

When almighty God, ſays Dr. Blair, created the world, he ſo ordered and diſpoſed of the *materies mundi*, that every thing produced from it ſhould continue ſo long as the world ſhould ſtand. Not that the ſame individual ſpecies ſhould always remain; for they were in proceſs of time to periſh, decay, and return to the earth from whence they came; but that every like ſhould produce its like, every ſpecies produce its own kind, to prevent a final deſtruction of the ſpecies, or the neceſſity of a new creation. For which end he laid down certain regulations, by which each ſpecies was to be propagated, preſerved, and ſupported, till, in order and courſe of time, they were to be removed hence: for without that thoſe very beings, which were created at firſt, muſt have continued to a final diſſolution of all things; which almighty God of his infinite wiſdom, did not think fit. But that he might ſtill the more manifeſt his omnipotence, he ſet all the engines of his providence to work, by which one effect was to produce another, by means of certain laws or rules, laid down for the propagation, maintenance, and ſupport of all created beings. This his divine providence is called nature, and theſe regulations are called the laws or rules of nature, by which it ever operates in its ordinary courſe; and whatever recedes from that, is ſaid to be preternatural, miraculous, or monſtrous.

GENERATION *of Animals*. According to Ariſtotle, the males contain the principle, and the females the matter of generation: for though both were furniſhed indeed, with a ſeminal liquor, yet the ſemen of the males alone was prolific. The moderns, on the other hand, as well thoſe who contend for the ſyſtem of generation from eggs, as they who adopt that of the animalcules in the male ſeed, pretend that females have no ſuch ſeminal liquor at all, and that what was commonly taken for it was ſome other animal fluid.

There are great and many difficulties which attend the moſt plauſible account of the firſt formation of the parts of an animal, and the beginning of motion in its fluids: for though both reaſon and experience convince us, that all the parts of an animal did exiſt before generation; yet how this matter comes to aſſume ſo very different a form, as that of an embryo, is by no means agreed on.

Harvey is of opinion, that all females are furniſhed with eggs, and that the embryoes, or young animals, are formed in the ſame manner as a chick in the egg of any bird. Generation, according to this celebrated phyſician, is effected wholly by means of the uterus, or womb; which conceives the fœtus by a kind of contagion communicated to it by the male-ſeed, much in the ſame way as the load-ſtone communicates magnetiſm to iron. This contagion, he thinks, acts not only on the uterus, but is communicated to the whole body of the female, which is altogether prolific; though the uterus he acknowledges is the only part that is capable of conceiving the fœtus, juſt as the brain is alone capable of forming ideas and notions. Agreeably to this doctrine of Harvey, Steno, and other anatomiſts, have pretended to diſcover certain eggs in the ovaries or teſticles of women; which Mr. Buffon denies to be the caſe, affirming, that there are no ſuch eggs to be found in the teſticles or ovaries of women.

We cannot enter into a detail of the reaſonings for and againſt the ſyſtem of generation from eggs, and ſhall therefore only obſerve, that its advocates pretend to have diſcovered eggs in all the females on which they made obſervations; that the largeſt of thoſe found in women did

did not exceed the bigneſs of a pea; that they are extremely ſmall in young girls under fourteen, but that age and commerce with men makes them grow larger; that there are more than twenty ſuch eggs in each ovary or teſticle; that they are fecundated in the ovary by the ſpirituous and volatile part of the male-ſeed; that they afterwards are detached and fall into the uterus through the Fallopian tubes; that here the fœtus is formed of the internal ſubſtance of the egg, and the placenta of the exterior part. See the article FOETUS.

Leewenhoek is the author of another ſyſtem of generation, from animalcules in the male ſeed. He tells us, he diſcovered many thouſands of theſe in a drop leſs than a grain of ſand. They are found in the ſemen of all males whatever, but not in that of females; and are ſo ſmall, that 3,000,000,000 of them are not equal to a grain of ſand, whoſe diameter is but the hundredth part of an inch. When any of theſe animalcules gets into an egg, fit to receive it, and this falls into the womb through the Fallopian tubes, the humours which diſtil through the veſſels of the womb, penetrating the coats of the egg, ſwell and dilate it, as the ſap of the earth does ſeed thrown into it. The placenta begins to appear like a little cloud, upon one ſide of the external coat of the egg; and, at the ſame time, the ſpine of the embryo-animalcule is grown ſo big, as to become viſible; and a little afterwards, the cerebrum and cerebellum appear like two bladders; and the eyes ſtand next goggling out of the head; then the beating of the heart, or punctum ſaliens, is plainly to be ſeen; and the extremities diſcover themſelves laſt of all.

Theſe animalcules are of different figures, ſome like tadpoles, and others like eels. In the ſemen of a man, and in that of a dog, there have been diſcovered two different kinds of them, the one ſuppoſed to be males, and the other females. Some even pretend to have ſeen animalcules diſengage themſelves from the membranes that ſurround them; and that they then appeared perfectly like men, with legs, arms, &c. like thoſe of the human body.

All the advocates for the ſyſtem of generation from animalcules ſtrongly oppoſe that from eggs. They contend, that theſe animalcules cannot be looked upon as the inhabitants of the ſemen, ſince they were of greater extent than the liquor itſelf, not to mention that no ſuch animals are found in any other liquors of the body; and ſince females have nothing ſimilar to theſe animals, they think it manifeſt that the prolific principle reſides in males. When they are aſked to what purpoſe ſerves ſuch an immenſe profuſion of human animalcules, they anſwer, that it is agreeable to the ordinary courſe of nature, both in the animal and vegetable part of the creation. They likewiſe ſtrengthen their ſyſtem, by alledging the many examples we have of ſimilar transformations in the inſect-claſs of animals, which, from caterpillars and ſmall worms, become winged animals of the butterfly, or fly-kinds.

By this ſyſtem, ſays Mr. Buffon, the firſt woman cannot be ſaid to have contained the whole race of mankind, as being all, according to it, the true poſterity of the firſt man, and in their animalcule-ſtate contained only in him. On this principle he proceeds to invalidate the ſyſtem of generation from animalcules: for ſuppoſing the ſize of a man to be 1, then will that of one of the ſpermatic animalcules be $\frac{1}{1000000000}$; and as a man is to an animalcule of the firſt generation in the ſame ratio, that this animalcule is to an animalcule of the ſecond generation, it follows that this laſt will be expreſſed by the fraction $\frac{1}{1000000000000000000}$. In this manner he computes the ſize of the animalcules of ſeveral generations, all ſuppoſed to be living animals, notwithſtanding that their minuteneſs exceeds the power of imagination to conceive; and then tells us, that the ſyſtem of generation from eggs is liable to the ſame objections, whereof the detail may be ſeen in his *Hiſt. Natur. tom.* 2. *p.* 157, *& ſeq.*

As to Buffon's own ſyſtem, he thinks that every part, both of animals and vegetables, contains an infinite number of organic molecules; that theſe molecules aſſume ſucceſſively different forms, and are put into different motions, according to the circumſtances they are in; but that they are much more numerous in the ſeminal liquors of both ſexes, and the ſeeds of plants, than in other parts; that theſe organic molecules make the matter of nutrition; that this matter is always active, and tends to organization, forming itſelf into different ſhapes, according to the moulds it meets with. When the quantity of this organic matter is but ſmall, as in man, and moſt large animals, generation only takes place at the age of maturity, and even then the number of animals produced is but ſmall. The caſe is juſt the reverſe in animals which abound with this matter, as in fiſhes, and moſt birds.

With reſpect to the generation of mankind, the ſame author thinks it a certain fact, that the male-ſeed is received into the womb of the woman; and that, for this purpoſe, it is highly probable the internal orifice opens during the act of coition. The female-ſeed alſo makes its way into the womb, where being mixed with that of the male, they both together contribute to the formation of the fœtus; which is either male or female, according as the ſeed of the man or woman abounds moſt with organic molecules; and the infant reſembles either the father or mother, according to the different combinations of theſe molecules. Both theſe ſeminal liquors he thinks equally active in the formation of the fœtus, and that they fix and counterballance each other; the molecules of each parent being thereby determined to form ſimilar parts to thoſe of the individual that furniſhed them, as the head, trunk, arms, legs, &c. He thinks the molecules proceeding from the genital parts fix themſelves firſt; and that the other molecules arrange themſelves ſucceſſively round theſe, in the ſame order which they before occupied in the parent. When a great quantity of the ſeminal liquors of both ſexes is received into the womb, there are formed different ſpheres of attraction in different parts of theſe liquors; the conſequence of which is, that ſeveral fœtuſes are formed at the ſame time. See VEGETATION.

Nearly a-kin to Mr. Buffon's ſyſtem is that of Mr. Maupertuis, which he has explained in his *Venus Phyſique*. He obſerves, that all the variety, obſervable among mankind, may have been accidental at firſt; but being once eſtabliſhed in the conſtitution of the parents, they become natural to their poſterity. To illuſtrate this, he gives an inſtance of a ſexdigitary family at Berlin, who had ſix fingers, or ſix toes, and frequently both; and that this peculiarity was tranſmitted equally by the father and mother, but was loſt by alliances with thoſe who had but the uſual number of fingers or toes.

He farther obſerves, that moſt animals, excepting mankind, have ſtated ſeaſons for procreation, and that the females go with young ſome a longer, others a ſhorter time. Mares go from eleven to twelve months; cows and hinds go nine months, as do alſo women; foxes and wolves, five months; and bitches go only ſeven weeks; cats nine weeks; and rabbits but thirty-one days. Moſt birds are hatched in twenty-one days; the canary birds, and ſome others, are hatched in thirteen or fourteen days. It appears, therefore, that there is an endleſs variety in the time and manner of the generation of animals.

Thoſe who deſire a more full account of theſe ſyſtems of generation may conſult Harvey, Leewenhoek, Buffon, &c.

Parts of GENERATION. The parts of generation, in men, are the teſticles, vaſa deferentia, veſiculæ ſeminales, and penis. See the article TESTICLE, &c.

Thoſe, in women, are the pudendum or vulva, the clitoris, nymphæ, vagina, uterus or womb, ovaries, and Fallopian tubes. See the articles PUDENDUM, CLITORIS, &c.

GENERATION *of Fiſhes.* The opinion of moſt naturaliſts, that the female fiſhes firſt depoſit their ſpawn, and that the males afterwards eject the ſemen upon it, is denied by Linnæus; who thinks it impoſſible that the eggs of any animal ſhould be impregnated out of its body. He thinks it much more probable, that the males always eject their ſemen ſome time before the females depoſit their ſpawn; and that, by ſwallowing this ſemen, the ſpawn is impregnated in the body of the fiſh. Nay, he tells us, that he himſelf ſaw three or four females, in the ſpawning time, gather about the male, and greedily

ſwallow the ſemen he ejected. This he obſerved in ſome ſpecies of the eſox, pearch, and eſpecially the cyprinus; but he recommends farther enquiry to be made on this ſubject.

GENERATION *of Inſects* is now certainly known to be from eggs; which the female depoſits in places, where, at a proper ſeaſon, they are hatched into animals like their parents; or into maggots, or worms, which, after ſeveral tranſformations, at laſt appear in the form of their parents.

GENERATION *of Plants.* The impregnation of the female palm-tree by the male, has been known in the moſt ancient times. Herodotus, the father of hiſtory, tells us, that the Greeks called ſome of theſe trees male, the fruit of which they bound to the other kind, which bears dates; that the ſmall flies, wherewith the male abounded, might aſſiſt in ripening the fruit of the female-tree. The remote age in which Herodotus wrote, ſufficiently apologizes for his believing, that what was really brought about by the farina fœcundans of the male flower, was to be attributed to the inſects frequently found therein, and which perhaps frequently carry this farina from the male to the female. The proceſs of impregnation, according to Theophraſtus, was this: while the male plant was in flower, they cut off a branch of theſe flowers, and ſcattered the duſt and down therein upon the flowers of the female plant; by which means the female did not caſt her fruit, but preſerved them to maturity. This has been lately verified at Berlin, where a female palm-tree bore fruit for many years; but the fruit never ripened, and when planted, did not vegetate, merely becauſe there was no male palm in the place: for having procured a branch of male flowers from Leipſic, twenty German miles from Berlin, they ſuſpended it over the female flowers of their tree; and the experiment ſucceeded ſo well, that the female tree produced more than an hundred perfectly ripe fruit; and the experiment being repeated, it bore above two thouſand ripe fruit, which being planted produced young trees.

It is in the flowers of vegetables only, that the parts ſubſervient to generation are produced; and theſe flowers are either male, female, or hermaphrodite. Male flowers are thoſe poſſeſſed of the organs of generation, analogous to the male parts of animals; ſuch are the ſtamina and apices, called, by Linnæus, filaments and antheræ. The female flowers are only endowed with parts like thoſe, which perform the office of generation in females; and theſe are the piſtil and its appurtenances, which Linnæus divides into three parts, the germen, ſtyle, and ſtigma. The hermaphrodite flower, which conſtitutes the great bulk of the vegetable creation, is poſſeſſed of all theſe parts in itſelf, and is therefore capable of propagating its ſpecies without any foreign aſſiſtance; which, by many inconteſtable experiments, it has been found neither the male nor female flower ſimply is able to do. The impregnation of hermaphrodite flowers may be performed within their own calyx; but before a ſeparate female flower can be ſo, the farina fœcundans of the male flower muſt neceſſarily be conveyed to it thro' the circumambient air; which is the reaſon why the quantity of the produce of ſuch plants is much more precarious, than that of plants which have hermaphrodite flowers: for if, during the flowering of theſe ſeparate male and female plants, the weather proves either very wet or ſtormy, their produce of fruit will be very inconſiderable, from the ſpoiling or haſty diſſipation of the male farina. Thus, independent of froſts, the fruit of the nut and filbert-tree will be moſt numerous in thoſe years, in which the months of January and February are the leaſt ſtormy and wet, becauſe at that time their flowers are produced. For the ſame reaſons, a ſtormy or wet May deſtroys the cheſnuts; and the ſame weather, in July, prodigiouſly leſſens the crop of maiz, or Indian corn, as its ſpikes of male-flowers ſtand lofty, and at a conſiderable diſtance from the female.

Some of the more ſkilful modern gardeners put in practice, with regard to melons and cucumbers, the very method mentioned by Theophraſtus two thouſand years ago, in regard to the palm tree. As theſe plants, early in the ſeaſon, are in this climate confined to frames and glaſſes, the air in which they grow is more ſtagnant than the open air; whereby the diſtribution of the farina fœcundans, ſo neceſſary towards the production of the fruit for the propagation of the ſpecies, is much hindered. To obviate the inconvenience thence ariſing, they collect the male flowers when fully blown; and preſenting them to the female ones by a ſtroke of the finger, they ſcatter the farina fœcundans therein, which prevents the falling of the fruit before it is ripe.

By far the greater part of plants produce hermaphrodite flowers; but ſome there are which have ſeparate male and female-flowers growing from the ſame root, as maiz, nettles, box, elm, birch, oak, beech, hazel, hornbeam, plane-tree, pine, fir, cypreſs, cedar, melons, cucumbers, gourds, and ſeveral others; in many of theſe, the male and female flowers ſtand at a conſiderable diſtance. There are other plants which produce their neceſſary organs upon different roots, as the palm-tree, hops, the willow-tree, miſletoe, ſpinach, hemp, poplar, french and dog's mercury, the yew-tree, juniper, and ſeveral others. Among theſe, the valiſnieria of Linnæus, as to the manner in which its male-flower impregnates the female, is one of the moſt ſingular prodigies in nature. It grows in rivulets, ditches, and ponds, in many parts of Europe. The male plant, which is continually covered with water, has a ſhort ſtalk, upon the top of which its flowers are produced. As this top never reaches the ſurface of the water, the flowers are thrown off from it, and come unopened to the ſurface of the water; where, as ſoon as they arrive, by the action of the air, they expand themſelves, and ſwim round the female flowers, which are blown at the ſame time. Theſe laſt have a long ſpiral foot-ſtalk, by which they attain the ſurface of the water, and remaining there in flower a few days are impregnated by the male-flowers detached from the ſtalk at the bottom.

It is obſervable, that the operations of nature are carried on moſt uſually by certain general laws, from which however ſhe ſometimes deviates. Thus almoſt all plants have either hermaphrodite flowers, or male and female flowers, growing from the ſame root, or male and female flowers from different roots; but there are a few of another claſs, which from the ſame root furniſh either male hermaphrodite flowers, or female and hermaphrodite ones: of this kind are the mulberry-tree, the muſa, or plantain-tree, white hellebore, pellitory, arrach, the aſh-tree, and a few others.—*Watſon*, in Phil. Tranſ. Vol. 47. p. 169—183.

Some object to this theory of the generation of plants, from having obſerved ſome plants, which were termed female, growing ſingly; and though at a very great diſtance from any male plants of the ſame kind, producing perfect fruits, which grew when ſown. Mr. Miller tells us, he himſelf was ſtaggered in his opinion, on having obſerved a female plant of white briony, which grew ſingly in a garden, where there were no other plants of the ſame kind; which, nevertheleſs, for ſeveral years, produced berries, which grew and flouriſhed perfectly well. This put him upon examining the plant more carefully than he had done before, when a great many male-flowers were found intermixed with the female ones; and he adds, that he has frequently obſerved the ſame in many other plants, which are generally male and female in diſtinct plants, yet have ſometimes both ſexes on the ſame plant.

From what has been ſaid, it appears very plain, that the embryo of the female flower muſt be impregnated by the farina fœcundans, or male duſt, in order to render the fruit perfect; but how, or in what manner, it is performed, is what we can only gueſs at; ſince, in the generation of animals, our greateſt naturaliſts differ widely, as has been ſhewn above, in their opinions concerning the particular method how it is performed. If, ſays the reverend Dr. Hales, I may be allowed to indulge conjecture, I would propoſe it to the conſideration of naturaliſts, whether, from the manifeſt proof we have that ſulphur attracts air, a hint may not be taken to enquire whether this may not be the primary uſe of the farina fœcundans, to attract and unite with itſelf, elaſtic or other refined active particles. That this farina abounds with ſulphur, and that a very refined ſort, is probable from the ſubtile oil which chemiſts obtain from the chives of ſaffron: and if this be the uſe of it, was it poſ-

ſible

Gervese's Engine
Fig. 2.

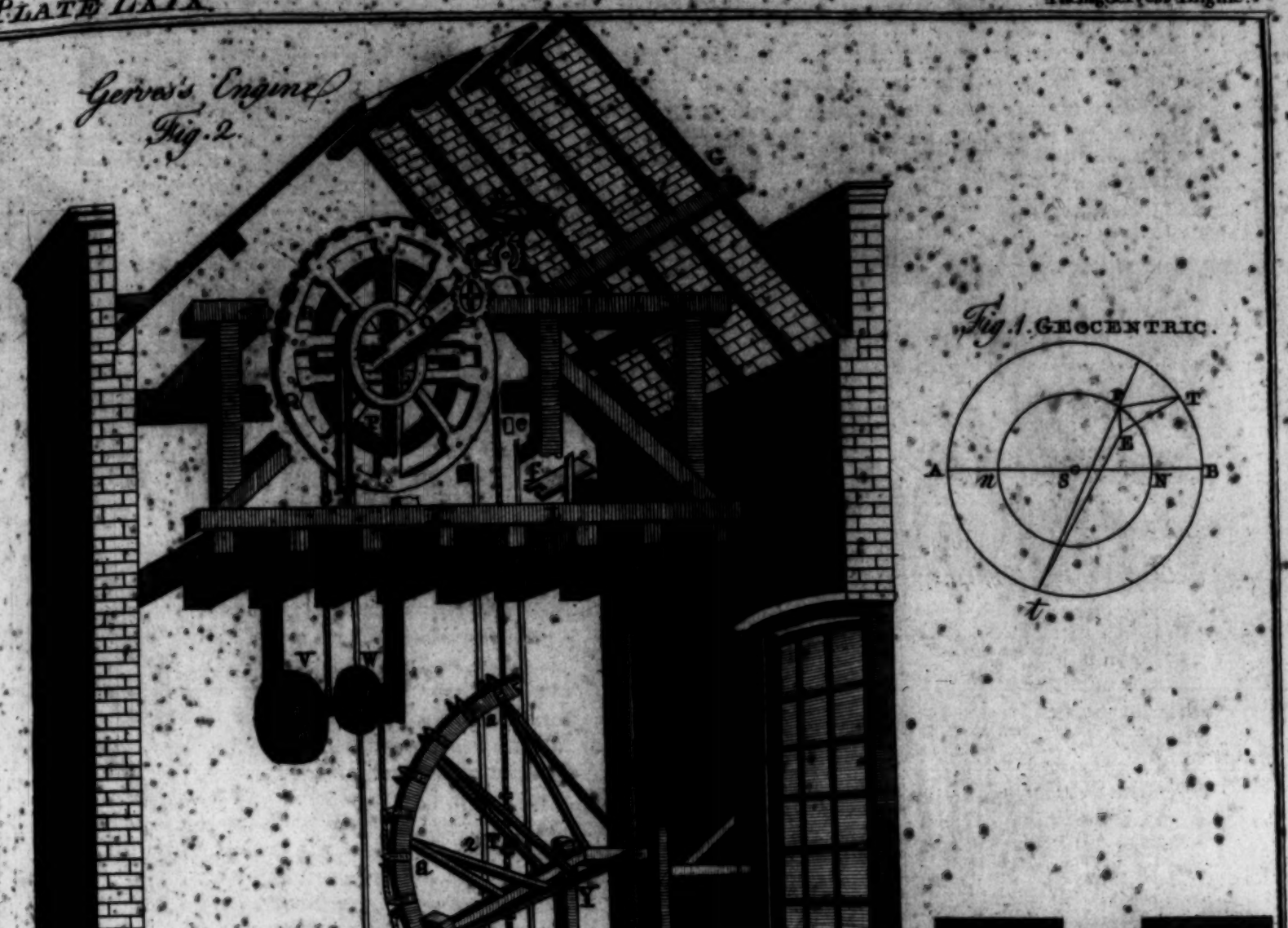


Fig. 1. GEOCENTRIC.

5 JA 59

ſible that it could be more aptly placed than on the ſlender points of the ſtamina, where it might eaſily, with the leaſt breath of wind, be diſperſed in the air; thereby ſurrounding the plant, as it were, with an atmoſphere of ſublimed ſulphureous pounce! Theſe uniting with particles of air, may, perhaps, be inſpired at ſeveral parts of the plant, and eſpecially at the piſtil, and be thence conveyed to the capſula ſeminalis. And if to theſe united ſulphureous and aerial particles, we ſuppoſe ſome particles of light to be joined (for Sir Iſaac Newton has found that ſulphur attracts light ſtrongly); then the reſult of theſe three by far the moſt active principles in nature will be a punctum ſaliens, to invigorate the ſeminal plant: and thus we are at laſt conducted, by the regular analyſis of vegetable nature, to the firſt enlivening principle of their minuteſt origin.

GENERICAL NAMES, among philoſophers, the ſame with general terms. See the article GENERAL TERMS, ſupra.

GENESIS, among mathematicians, ſignifies the formation or production of ſome figure or quantity.

GENESIS, among divines, a canonical book of the Old Teſtament, and the firſt of the Pentateuch, or five books of Moſes. The Hebrews call it Bereſchith, or, In the beginning, theſe being the firſt words in the book. The Greeks gave it the name of Geneſis, from its beginning with the hiſtory of the creation of the world. It includes the hiſtory of two thouſand three hundred and ſixty-nine years, and beſides the hiſtory of the creation, contains an account of the original innocence and fall of man; the propagation of mankind; the riſe of religion; the general defection and corruption of the world; the deluge; the reſtoration of the world; the diviſion and peopling of the earth; and the hiſtory of the firſt patriarchs down to Joſeph, at whoſe death it ends.

It was eaſy for Moſes to be ſatisfied of the truth of what he delivers in this book, becauſe it came down to his time through a very few hands. For, from Adam to Noah, there was one man (Methuſelah) who lived to ſee them both: in like manner, from Noah to Abraham, Shem converſed with them both; Iſaac alſo did with Abraham and Joſeph, from whom theſe things might eaſily be conveyed to Moſes by Amram, who was cotemporary with Joſeph. Moſes is ſuppoſed to have written this book, during his retirement in the land of Midian, before he conducted the Iſraelites out of Egypt.

GENET, GENNET, or JENNET, in the manege, denotes a ſmall ſized, well proportioned Spaniſh horſe.

GENETHLIACUM, or GENETHLIAC POEM, verſes made on the birth of ſome prince, or other illuſtrious perſon, in which the poet, by a kind of prediction, promiſes him great advantages, great proſperity, and glorious victories.

GENEVA, a city near the confines of France and Switzerland, on the river Rhone, about ſixty miles north-weſt of Lyons: eaſt long. 6°; north lat. 46° 20'. Geneva is a fortified town, about two miles in circumference, ſituated at the weſt-end of a lake ſixty miles long, and twelve broad, called the lake of Geneva. It is a republic, governed by a council of 200, and a ſenate of twenty-five members; and is ſaid to contain 30,000 inhabitants.

GENEVA, or GIN, among diſtillers, an ordinary malt-ſpirit, diſtilled a ſecond time, with the addition of ſome juniper-berries. See the article JUNIPER.

Originally, the berries were added to the malt in the grinding; ſo that the ſpirit thus obtained was flavoured with the berries from firſt, and exceeded all that could be made by any other method. At preſent, they leave out the berries entirely, and give their ſpirits a flavour by diſtilling them with a proper quantity of oil of turpentine; which, though it nearly reſembles the juniper-berries, has none of their valuable virtues.

GENIAL, an epithet given by the pagans to certain gods who were ſuppoſed to preſide over generation.

GENICULI, among botaniſts, the knots or joints in the ſtalks of plants; whence they are denominated geniculate plants.

GENIOGLOSSI, in anatomy, two muſcles which lie immediately under the geniohyoideus. They ariſe fleſhy from the fore-part of the lower jaw internally, and inlarging themſelves, are inſerted in the root of the tongue. When theſe act, they pull the tongue forwards, and thruſt it out of the mouth.

GENIOHYOIDÆUS, in anatomy, is a muſcle which ariſes in the middle of the chin, above the mylohyoides, and near the ſynchondroſis of the jaw: its termination is in the baſe of the os hyoides. See the articles MYLOHYOIDES, SYNCHONDROSIS, &c.

GNIPA, in botany, a genus of plants, the flower of which conſiſts of a ſingle, rotated petal; its tube is very ſhort, and of a funnel-like ſhape; and the limb large, and divided into five deep ſegments. The fruit is a fleſhy berry, of an oval figure, ſmall at each end, truncated, and containing two cells, in which are a number of depreſſed angulated ſeeds.

GENIS, a town of Savoy, ſituated on the river Guier, twelve miles weſt of Chambery.

GENISTA, GREEN-WEED, or DYER'S-WEED, a genus of plants, with papilionaceous flowers; and the fruit a roundiſh, turgid, and unilocular pod, containing a ſingle kidney like ſeed.

GENITIVE, in grammar, the ſecond caſe of the declenſion of nouns. The regulation of one thing conſidered as belonging in ſome manner to another, has occaſioned a peculiar termination of nouns, called the genitive caſe: But in the vulgar tongues, they make uſe of a ſign to expreſs the relation of this caſe. In Engliſh they prefix the particle *of*, in French *de*, or *du*, &c. though in ſtrictneſs there are no caſes in either of theſe languages; inaſmuch as they do not expreſs the different relations of things by different terminations, but by additional prepoſitions, which is otherwiſe in the Latin, &c.

In the Hebrew tongue, the genitive caſe is marked in a very different manner from that of the Greek and Latin; for whereas in thoſe languages the noun governed is varied, in the Hebrew the noun governing undergoes the alteration.

GENIUS, a good or evil ſpirit, or dæmon, whom the ancients ſuppoſed ſet over each perſon, to direct his birth, accompany him in life, and be his guard.

Plato gives the following account of the genii.

They are ſpirits who never were engaged in matter, nor were ever joined to bodies. Of theſe genii Plato is of opinion that every man has his own, who watches over him, and is a witneſs not only of his actions, but of his very thoughts; and that, when the perſon dies, the genius conducts the ſoul of which he had the charge, to judgment, and aſſiſts at the trial: if the accuſed perſon falſifies, the genius convicts him; if he ſpeaks the truth, he confirms it; and it is upon his evidence that ſentence is pronounced.

GENIUS, in matters of literature, &c. a natural talent or diſpoſition to do one thing more than another; or the aptitude a man has received from nature to perform well and eaſily that which others can do but indifferently, and with a great deal of pains.

From the diverſity of genius, the difference of inclination ariſes in men, whom nature has had the precaution of leading to the employments for which ſhe deſigns them, with more or leſs impetuoſity in proportion to the greater or leſſer number of obſtacles they have to ſurmount, in order to render themſelves capable of anſwering this vocation. Thus the inclinations of men are ſo very different, becauſe they follow the ſame mover, that is, the impulſe of their genius. This, as with the painter, is what renders one poet pleaſing, even when he treſpaſſes againſt rules; while others are diſagreeable, notwithſtanding their ſtrict regularity.

The genius of theſe arts, according to the Abbé du Bos, conſiſts in a happy arrangement of the organs of the brain; in a juſt conformation of each of theſe organs; as alſo in the quality of the blood, which diſpoſes it to ferment, during exerciſe, ſo as to furniſh a plenty of ſpirits to the ſprings employed in the functions of the imagination. Here he ſuppoſes that the compoſer's blood is heated; for that painters and poets cannot invent in cool blood; nay, that it is evident they muſt be wrapt into a kind of enthuſiaſm when they produce their ideas. Ariſtotle mentions a poet who never wrote ſo well as when his poetic fury hurried him into a kind of frenzy. The admirable pictures we have in Taſſo of Armida and Clorinda,

Clorinda, were drawn at the expence of a diſpoſition he had to real madneſs, into which he fell before he died. Do you imagine, ſays Cicero, that Pacuvius wrote in cold blood? No, it was impoſſible. He muſt have been inſpired with a kind of fury, to be able to write ſuch admirable verſes.

GENOA, a city and archbiſhop's ſee of Italy, and capital of the republic of the ſame name, is built on a ſtrand near the ſea, and riſes gradually to the top of a hill: the houſes, which are lofty and well built, riſing like the ſeats of a theatre, afford a fine proſpect at ſea. The harbour is large and deep, and the principal ſtreet, from one end to the other, reſembles a double row of palaces: eaſt long. 9° 30′, and north lat. 44° 30′.

This city, which is fortified by a double wall, is ſix miles round, and contains thirty pariſh churches, twenty colleges, and as many convents and religious houſes. The legiſlative authority is lodged in the great ſenate, conſiſting of the ſigniory and four hundred noblemen and principal citizens, elected annually out of the freemen. The ſigniory conſiſts of the doge and twelve other members, who hold their places two years. Four parts in five of the ſenate muſt agree to the enacting of laws. The doge is obliged to reſide in the palace the two years he is in office; and after they are expired, he retires to his own houſe, where his adminiſtration is either approved or condemned; and if the latter, he is proceeded againſt as a criminal.

The territories of the republic lie in the form of a creſcent, along the coaſt of the Mediterranean, extending 150 miles; but the country no where reaches above twenty miles from the ſea, and in ſome places not ten.

GENS D'ARMES. See GENDARMES.

GENTIAN, *Gentiana*, in botany, a genus of plants, the flower of which conſiſts of a ſingle petal, tubulated and imperforated at the baſe; and at the edge, divided into five ſegments, various in figure: the fruit is an oblong, cylindric, acuminated capſule, ſlightly bifid at the top, formed of two valves, and containing only one cell: the ſeeds are numerous and ſmall; the receptacles are two, and grow to the two valves of the capſule.

The root of this plant is large, remarkably tough, and of a firm texture. It is brought to us from Germany, where it is in many places cultivated as liquorice is amongſt us; and is to be choſen freſh, tough, of a middle ſize, free from the ſmall fibres, and well dried; though if it be ſcorched, it is to be rejected.

This root is one of the beſt ſtomachic bitters that the materia medica affords: it procures an appetite, and greatly aſſiſts digeſtion. But if we give credit to ſome authors, this is one of the leaſt of its virtues; they have recommended it as a febrifuge and an alexipharmic, and as the moſt certain remedy for the bite of a mad dog. On this occaſion it is not only recommended internally but externally, a cataplaſm made of venice-treacle and the powder of this root, being ordered to be applied to the wound. It is alſo ſaid to be a certain remedy for agues, and one of the beſt known medicines againſt the plague.

GENTILE, in matters of religion, a pagan, or worſhipper of falſe gods.

The origin of this word is deduced from the Jews, who called all thoſe who were not of their nation, by the name of גוים, gojim, i. e. gentes, which in the Greek tranſlations of the Old Teſtament, is rendered by τα εθνη; in which ſenſe it frequently occurs in the New Teſtament, as in Matt. vi. 32. *All theſe things the nations or gentiles ſeek.* Whence the Latin church alſo uſed *gentes*, in the ſame ſenſe as our gentiles, eſpecially in the New Teſtament. But the word *gentes* ſoon got another ſignification, and no longer meant all ſuch as were not Jews, but thoſe only who were neither Jews nor Chriſtians, but followed the ſuperſtitions of the Egyptians, Greeks, Romans, &c. In this ſenſe it continued among the Chriſtian writers, till their manner of ſpeech, together with their religion, was publicly and by authority received in the empire, when gentiles, from *gentes*, came into uſe: and then both words had two ſignifications, viz. in treatiſes or laws concerning religion, they ſignified pagans, neither Jews nor Chriſtians: and in civil affairs, they were uſed for all ſuch as were not Romans.

GENUS, among metaphyſicians and logicians, denotes a number of beings, which agree in certain general properties, common to them all: ſo that a genus is nothing elſe but an abſtract idea, expreſſed by ſome general name or term.

It is plain, therefore, that by a genus we do not barely ſignify one particular thing, nor yet a plurality of things; but a ſort or kind of things, all agreeing in certain general properties.

Thus animal is ſaid to be a genus in reſpect of man and brute, in regard man and brute agree in the common nature and character of animal: ſo a right lined figure of four ſides, is a genus in reſpect of a parallelogram, and a trapezium; and ſo likewiſe is ſubſtance, in reſpect of ſubſtance extended, which is body; and thinking ſubſtance, which is mind.

GENUS is alſo uſed for a character or manner applicable to every thing of a certain nature or condition: in which ſenſe it ſerves to make capital diviſions in divers ſciences, as muſic, rhetoric, anatomy, and natural hiſtory.

GENUS, in muſic, by the ancients called *genus melodiæ*, is a certain manner of dividing and ſub-dividing the principles of melody; that is, the conſonant and diſſonant intervals into their concinnous parts.

GENUS, in natural hiſtory, a ſub-diviſion of any claſs or order of natural beings, whether of the animal, vegetable, or mineral kingdoms, all agreeing in certain common characters.

The genera of animals ought to be eſtabliſhed upon the moſt natural, obvious, and diſtinctive characters. Thus it would be abſurd to range the ox and hog under the ſame genus, notwithſtanding they both have divided hoofs; and it would be equally ſo to make the roe deer, rain-deer, and elk, belong to different genera, merely becauſe the figure of their horns differs conſiderably. Hence the characters of the genera of animals are to be taken from the figure, ſituation, number, and proportions of their parts; which conſtitute ſuch a reſemblance, as eaſily diſtinguiſhes them from the ſpecies of any other genus.

In the claſs of quadrupeds, beſides a general reſemblance, the different genera are diſtinguiſhed from each other by the number and figure of their teeth, the ſhape of their feet, horns, and the like.

In the claſs of birds, the generical characters are drawn from the ſhape of their beak, and the number and diſpoſition of their toes.

In the claſs of amphibious animals, the generical characters are founded on the number of the cruſts or ſcales on the bellies and tails of the ſerpent-kind, and on the figure of the tail, and the number and ſhape of toes in the lizard, frog, and tortoiſe kinds.

As to the genera of fiſhes, they are founded on a certain agreement between a number of ſpecies, ariſing from the ſimilitude of their eſſential external parts; which always conſiſt in the ſituation of theſe parts, for the moſt part alſo in number, and frequently in their figure and proportion.

The inſect claſs are diſtinguiſhed into genera, from the number, figure, &c. of their antennæ, feet, ſnout, &c.

With reſpect to the vegetable kingdom, all plants and trees are reduced to genera from the conſideration of the number, ſituation, figure, and proportion of the parts of fructification.

In the ſame manner, the genera of foſſils are eſtabliſhed upon the figure, hardneſs, conſiſtence, inflammability, and other obvious properties of the ſubſtances that compoſe the mineral kingdom.

GEOCENTRIC, in aſtronomy, is applied to a planet or its orbit, to denote it concentric with the earth, or as having the earth for its center, or the ſame center with the earth. See the articles EARTH and PLANET.

GEOCENTRIC *Latitude of a Planet* is its diſtance from the ecliptic, as it is ſeen from the earth, which, even though the planet be in the ſame point of her orbit, is not

not conſtantly the ſame, but alters according to the poſition of the earth in reſpect to the planet. For let BAT *t* (plate LXIX. *fig.* 1.) be the orbit of the earth, PN *n* the orbit of the planet, which ſuppoſe to be at P; from which let fall on the plane of the ecliptic the perpendicular PE. In whatever part of her orbit the earth is, this line PE will always ſubtend the angle which meaſures the geocentric latitude of the planet. Suppoſe, therefore, the earth at T, and Venus in P, where ſhe comes neareſt to the earth, in which poſition Venus is ſeen in her inferior conjunction with the ſun, and her geocentric latitude is meaſured by the angle PTE. But if Venus ſhould be in the ſame ſituation, P, and the earth were at *t*, and from thence Venus were obſerved in her ſuperior conjunction with the ſun, where ſhe is at her greateſt diſtance from us, her geocentric latitude would be anſwerable to P*t* E, which is much leſs than the angle PTE, becauſe the diſtance P*t* is greater than PT.

What we have here ſaid of the latitude of Venus, is likewiſe true of that of Mercury, and upon the ſame account. See HELIOCENTRIC and LATITUDE.

GEOCENTRIC *Place of a Planet*, the place wherein it appears to us from the earth, ſuppoſing the eye there fixed: or it is a point in the ecliptic to which a planet ſeen from the earth is referred.

GEODÆSIA, the ſame with ſurveying. See the article SURVEYING.

GEOGRAPHICAL MILE, the ſame with the ſea-mile; being one minute, or the ſixtieth part of a degree of a great circle on the earth's ſurface. See the article DEGREE.

GEOGRAPHY, the doctrine or knowledge of the terreſtrial globe; or the ſcience that teaches and explains the properties of the earth, and the parts thereof which depend upon quantity.

Geography, as defined by Varenius, is that part of mixed mathematics, which explains the ſtate of the earth, and of its parts depending on quantity, viz. its figure, place, magnitude, and motion, with the celeſtial appearances, &c. In conſequence of this definition, that author divides geography into general and ſpecial, or univerſal and particular.

By univerſal geography, is underſtood that part of the ſcience which conſiders the whole earth in general, and explains its properties without regard to particular countries. This diviſion is diſtinguiſhed into three parts, abſolute, relative, and comparative. The abſolute part reſpects the body of the earth itſelf, its parts and peculiar properties, as its figure, magnitude, and motion; its lands, ſeas, and rivers, &c. The relative part accounts for the appearances and accidents that happen to it from celeſtial cauſes; and, laſtly, the comparative contains an explanation of thoſe properties which ariſe from comparing different parts of the earth together.

Special or particular geography is that diviſion of the ſcience which deſcribes the conſtitution and ſituation of each ſingle country by itſelf; and is two-fold, viz. chorographical, which deſcribes countries of a conſiderable extent; or topographical, which gives a view of ſome place, or ſmall tract of the earth.

Hence the object or ſubject of geography is the earth, eſpecially its ſuperficies and exterior parts.

The properties of geography, according to the ſame writer, are of three kinds, viz. celeſtial, terreſtrial, and human. The celeſtial properties are ſuch as affect us by reaſon of the apparent motion of the ſun and ſtars. Theſe are eight in number. 1. The elevation of the pole, or the diſtance of a place from the equator. 2. The obliquity of the diurnal motion of the ſtars above the horizon of the place. 3. The time of the longeſt and ſhorteſt day. 4. The climate and zone. 5. Heat, cold, and the ſeaſons of the year; with rain, ſnow, wind, and other meteors. 6. The riſing, appearance, and continuance of the ſtars above the horizon. 7. The ſtars that paſs through the zenith of a place. 8. The celerity of the motion with which, according to the Copernican hypotheſis, every place conſtantly revolves.

The terreſtrial properties are thoſe obſerved in the face of each country, and are ten in number. 1. The limits and bounds of each country. 2. Its figure. 3. Its magnitude. 4. Its mountains. 5. Its waters, viz. ſprings, rivers, lakes, and bays. 6. Its woods and deſarts. 7. The fruitfulneſs and barrenneſs of the country, with its various kinds of fruits. 8. The minerals and foſſils. 9. The living creatures there. 10. The longitude and latitude of the place.

The third kind of obſervations to be made in every country is called human, becauſe they chiefly regard the inhabitants of the place, and theſe are alſo ten in number. 1. Their ſtature, ſhape, colour, and the length of their lives; their origin, meat, and drink. 2. Their arts, and the profits which ariſe from them, with the merchandize and wares they barter one with another. 3. Their virtues and vices, learning, capacities, and ſchools. 4. Their ceremonies at births, marriages, and funerals. 5. The language which the inhabitants uſe. 6. Their political government. 7. Their religion and church government. 8. Their cities and famous places. 9. Their remarkable hiſtories. 10. Their famous men, artificers, and inventions of the natives.

Theſe are the three kinds of occurrences to be explained in ſpecial geography.

In univerſal geography, the abſolute diviſion of the earth, and the conſtitution of its parts, are examined; and the celeſtial phænomena in general are to be applied to their reſpective countries in ſpecial geography.

The principles of geography, or thoſe from which arguments are drawn for proving of propoſitions in that ſcience, are, according to Varenius, of three ſorts. 1. Geometrical, arithmetical, and trigonometrical propoſitions. 2. Aſtronomical precepts and theorems. 3. Experience, being that upon which the greateſt part of geography, and chiefly the ſpecial, is founded.

In proving geographical propoſitions, we are to obſerve that ſeveral properties, and chiefly the celeſtial, are confirmed by proper demonſtrations; but in ſpecial geography, excepting the celeſtial, almoſt every thing is explained without demonſtration; being either grounded on experience and obſervation, or on the teſtimony of out ſenſes: nor can they be proved by any other means. There are alſo ſeveral propoſitions proved, or rather expoſed to view, by the terreſtrial globe, or by geographical maps.

Other propoſitions cannot be ſo well proved, yet are received as apparent truths. Thus, though we ſuppoſe all places on the globe, and in maps, to be laid down in the ſame order as they are really on the earth; nevertheleſs, in theſe matters, we rather follow the deſcriptions that are given by geographical writers.

The manner in which we have treated the ſeveral geographical articles that occur throughout this work, may be ſeen under each head, and our diviſion of the ſcience may be ſeen in the introduction.

Geography is very ancient, at leaſt the ſpecial part thereof; for the ancients ſcarce went beyond the deſcription of countries. It was a conſtant cuſtom among the Romans, after they had conquered and ſubdued any province, to have a map or printed repreſentation thereof, carried in triumph, and expoſed to the view of the ſpectators. Hiſtorians relate, that the Roman ſenate, about an hundred years before Chriſt, ſent geographers into divers parts to make an accurate ſurvey and menſuration of the whole globe, but they ſcarce ever ſaw the twentieth part of it.

Before them, Necho, king of Egypt, ordered the Phœnicians to make a ſurvey of the whole coaſt of Africa, which they accompliſhed in three years. Darius procured the Ethiopic-ſea, and the mouth of the Indus, to be ſurveyed; and Pliny relates, that Alexander, in his expedition into Aſia, took two geographers to meaſure and deſcribe the roads; and that from their itineraries, the writers of the following ages took many particulars. Indeed this may be obſerved, that whereas moſt other arts and ſciences are ſufferers by war, geography and fortification alone have been improved thereby. Geography, however, muſt have been exceedingly defective, as a great part of the globe was then unknown, particularly all America, the northern parts of Europe and Aſia, with the Terra Auſtralis, and Magellanica; and as they were ignorant of the earth's being capable to be ſailed round, and of the torrid zone's being habitable, &c.

The honour of reducing geography to art and ſyſtem,

was reſerved for Ptolemy, who, by adding mathematical advantages to the hiſtorical method in which it had been treated of before, has deſcribed the world in a much more intelligible manner: he has delineated it under more certain rules, and by fixing the bounds of places from longitude and latitude, hath diſcovered others miſtakes, and has left us a method of diſcovering his own.

The principal writers upon geography, among the ancients, are Ptolemy, Pliny, and Strabo: among the moderns, Joannes de Sacroboſco, Cluverius, Heylin, Ricciolus, Weigelius, de Chales, and, above all, Varenius, with Jurin's additions; to which may be added Leibnecht, Sturmius, Morden, Gordon, Salmon, &c.

GEOMETRICAL, in general, an appellation given to whatever belongs to, or is ſtrictly connected with, geometry. See the article GEOMETRY.

GEOMETRICAL *Conſtruction of Equations.* See the article CONSTRUCTION.

GEOMETRICAL CURVE. See CURVE.

GEOMETRICAL LOCUS, or PLACE. See the article LOCUS.

GEOMETRICAL PACE. See PACE.

GEOMETRICAL PLANE, in perſpective. See the article PLANE.

GEOMETRICAL PROGRESSION and PROPORTION. See PROGRESSION and PROPORTION.

GEOMETRICAL *Solution of a Problem* is when it is ſolved according to the rules of geometry, and by ſuch lines as are truly geometrical, and agreeable to the nature of the problem.

GEOMETRY, γεωμετρια, originally ſignified no more than the art of meaſuring the earth, or any diſtances or dimenſions within it; but at preſent, it denotes the ſcience of magnitude in general; comprehending the doctrine and relations of whatever is ſuſceptible of augmentation or diminution, conſidered in that light.

Hence, to geometry may be referred the conſideration not only of lines, ſurfaces, and ſolids; but alſo of time, velocity, number, weight, &c.

Plato thought the word geometry an improper name for this ſcience, and accordingly ſubſtituted in its place the more extenſive one of menſuration; and, after him, others gave it the title of pantometry, as demonſtrating not only the quantities of all manner of magnitudes, but alſo their qualities, ratios, poſitions, transformations, relations, &c. And Proclus calls it the knowledge of magnitudes and figures, and their limitations; alſo of their motions, and affections of every kind.

Origin and Progreſs of GEOMETRY. This ſcience had its riſe among the Egyptians, who were in a manner compelled to invent it, to remedy the confuſion which generally happened in their lands, from the inundations of the river Nile, which carried away all boundaries, and effaced all the limits of their poſſeſſions. Thus this invention, which at firſt conſiſted only in meaſuring the lands, that every perſon might have what belonged to him, was called geometry, or the art of meaſuring land; and it is probable, that the draughts and ſchemes, which they were annually compelled to make, helped them to diſcover many excellent properties of theſe figures; which ſpeculations continued to be gradually improved, and are ſo to this day.

From Egypt geometry paſſed into Greece, where it continued to receive new improvements in the hands of Thales, Pythagoras, Archimedes, Euclid, &c. The elements of geometry, written by this laſt in fifteen books, are a moſt convincing proof to what perfection this ſcience was carried among the ancients. However, it muſt be acknowledged, that it fell ſhort of modern geometry, the bounds of which, what by the invention of fluxions, and the diſcovery of the almoſt infinite orders of curves, are greatly enlarged.

Diviſion of GEOMETRY. This ſcience is uſually diſtinguiſhed into elementary, and higher or ſublime geometry.

The firſt, or elementary geometry, treats of the properties of right lines, and of the circle, together with the figures and ſolids formed by them. The doctrine of lines comes firſt, then that of ſurfaces, and laſtly that of ſolids.

The higher geometry comprehends the doctrine of the Conic ſections, and numerous orders of curves.

Geometry is again divided into ſpeculative and practical; the former treating of the properties of lines and figures, as Euclid's Elements, Apollonius's Conic Sections, &c. and the latter ſhewing how to apply theſe ſpeculations to the uſe of menſuration, navigation, ſurveying, taking heights and diſtances, gauging, gunnery, &c.

Uſefulneſs of GEOMETRY. The uſefulneſs of this ſcience extends to almoſt every art and ſcience. It is by the help of it that aſtronomers turn their obſervations to advantage, regulate the duration of times, ſeaſons, years, cycles, and epochas; and meaſure the diſtance, motions, and magnitudes of the heavenly bodies. It is by it that geographers determine the figure and magnitude of the whole earth; and delineate the extent and bearings of kingdoms, provinces, harbours, &c. It is from this ſcience too, that architects derive their juſt meaſures, in the conſtruction of public edifices as well as of private houſes.

It is by the aſſiſtance of geometry that engineers conduct all their works, take the ſituation and plans of towns, the diſtances of places, and the meaſure of ſuch things as are only acceſſible to the ſight. It is not only an introduction to fortification, but highly neceſſary to moſt mechanics, eſpecially carpenters, joiners, mathematical-inſtrument-makers, and all who profeſs deſigning.

On geometry likewiſe depends the theory of muſic, optics, perſpective, drawing, mechanics, hydraulics, pneumatics, &c.

GEORGE, or *Knights of St.* GEORGE, has been the denomination of ſeveral military orders, whereof that of the garter is one of the moſt illuſtrious. See the article GARTER.

Croſs of St. GEORGE, a red one in a field argent, which makes part of the Britiſh ſtandard. See CROSS and GARTER.

GEORGIAN MONKS and NUNS, religious of Georgia, in Aſia, who follow the rule of St. Baſil. See the article BASIL.

GEORGIC, a poetical compoſition upon the ſubject of huſbandry, containing rules therein, put into a pleaſing dreſs, and ſet off with all the beauties and embelliſhments of poetry.

The ſtyle proper to a georgic muſt be worked up with a great deal of thought and vigour, that the words may be lively, and every thing the poet deſcribes may immediately riſe up to the reader's view. Heſiod and Virgil are the two greateſt maſters in this kind of poetry. In Virgil's Georgics are contained the moſt uſeful rules for huſbandry in all its branches. Virgil has infinitely exceeded Heſiod in this ſort of writing: he began his Georgics at the perſuaſion of Mæcenas, and was near ſeven years about them: they are, with reſpect to the diction, the moſt finiſhed of all his works, and even of all the poems that ever were compoſed in Latin. The moderns have produced nothing in this kind, except Rapin's book of Gardening; the celebrated poem entitled Cyder, by Mr. Philips, who, if he had enjoyed the advantage of Virgil's language, would have been ſecond to Virgil in a much nearer degree; and the Hop-Garden, by Mr. C. Smart.

GERANITES, in natural hiſtory, an appellation given to ſuch of the ſemipellucid gems, as are marked with a ſpot reſembling a crane's eye.

GERANIUM, crane's bill, in botany, a genus of plants, the flower of which conſiſts of five large, patent, oval, and vertically cordated petals; the fruit is a capſule, of the form of a crane's bill.

Geranium ſtands recommended by authors, as one of the greateſt vulneraries and aſtringents of the vegetable world, particularly for ſtopping hæmorrhages, exceſs of the menſes, &c.

GERM, among gardeners, the ſame with bud. See the article BUD.

GERMAN, in genealogy, denotes entire or whole: thus, a brother-german is one both by the father's and mother's ſide; and couſins-german are the children of brothers or ſiſters.

GERMAN,

GERMAN, or GERMANIC, alſo denotes any thing belonging to Germany; as the German empire, German flute, &c.

GERMANDER, in botany, the Engliſh name of the teucrium of Linnæus. See the article TEUCRIUM.

Water-GERMANDER, a plant called by botaniſts ſcordium. See SCORDIUM.

GERMANY, an extenſive empire of Europe, ſituated between 5° and 19° eaſt longitude, and between 45° and 55° north latitude; bounded by Denmark and the Baltic ſea on the north, by Poland and Hungary on the eaſt, by Switzerland and the Alps on the ſouth, and by France, Holland, &c. on the weſt.

It is divided into ten circles, three of which lie on the north, viz. Upper and Lower Saxony, and Weſtphalia; three on the ſouth, viz. Auſtria, Bavaria, and Swabia; three about the middle, viz. Franconia, and the Upper and Lower Rhine; the tenth, which conſiſted of the duchy of Burgundy and the ſeventeen provinces of the Netherlands, have long been detached from the empire.

There are in Germany upwards of three hundred ſovereign princes and ſtates, moſt of them arbitrary in their reſpective territories.

GERMEN, or GERM, the ſame with bud. See the article BUD.

GERMINATION, the firſt ſprouting of the ſeeds of plants. See VEGETATION.

GERVES's *Engine*, a curious engine for raiſing water to ſupply a gentleman's ſeat, &c.

If there be a ſpring affording but a ſmall quantity of water, and having but a ſmall fall, ſuppoſe 10 feet, it is poſſible by the loſs of ſome of the water to raiſe the reſt to ſupply a gentleman's ſeat, or any place where it is wanted; but in a leſs quantity than what runs waſte, if the place to which the water is to be raiſed be higher than the fall of the ſpring. For example, the fall of one hogſhead 10 feet will raiſe very near a hogſhead 10 feet: one hogſhead, falling 10 feet, will raiſe very near ¼ of a hogſhead 40 feet. This has been thought of by Schottus a great many years ago, and he gave a draught of it; but it was never put in execution (at leaſt to any good purpoſe) till the late George Gerves, carpenter, erected an engine for this purpoſe, for Sir John Cheſter, Bart. at his ſeat at Chicheſter, in Buckinghamſhire.

Explanation of Plate LXIX. *fig.* 2. repreſenting Gerves's engine.

A. Is a ſmall ſpring of water, running four gallons per minute, conveyed 72 yards into B.

B. A ciſtern holding about 12 gallons, with a fall from B to C.

C. A ciſtern 10 feet below B, where the waſte is conveyed off along D.

D. A drain, or ſewer.

E. A plan of the building by a ſcale of 8 feet in an inch.

FG. A ſection of the houſe built over the well or ciſtern, drawn by a ſcale of 4 feet in an inch; with

HIK. Three floors for the conveniency of fixing and ordering the engine; on the uppermoſt is

LMN. A frame of timber, on which the moving part is ſupported (part broken off in the figure, to ſhew the work;) acroſs this frame lies

O. An horizontal axis, three feet and an half long, moving on two gudgeons in braſſes. Upon this axis are framed three wheels.

(1) P. A wheel 2 feet diameter ſhrouded, whoſe ſole is 5 inches broad, and ſhod with iron.

(2) Q. The largeſt wheel 6 feet diameter, lying cloſe by the other, 1 inch and an half broad on the ſole, and ſhrouded; this is ſpiraled 2 inches, both in ſole and ſhrouds.

(3) R. A wheel 3 feet 10 inches diameter, fixed on the ſides of the ſpokes of the wheel Q, and ſhrouded; this is ſpiraled ¼ of an inch.

P. Upon the wheel P is fixed a chain, made flat and very flexible, which, after it has wrapped once round, is made double to ſtride on each ſide the ſingle part, to prevent its fretting and galling, and to keep exactly the perpendicular.

SS. To this chain is hung SS, a long rod of iron, at the bottom of which the greater bucket *d* is fixed.

Q. Upon the wheel Q is fixed a ſmaller chain made flat as the other; and, when this wheel has made one revolution from left to right, the ſpiral ſole takes up as much of the chain as is between T and T 2. The lower part of the chain from T 2 to T 3 has croſs bars, which fall upon the edge of the ſhroud in notches plated with iron; which, by the help of the ſpiral, not only prevent this part of the chain from riding upon the other, but help to equiponderate the increaſe of weight of the other chain SS.

R. Upon the wheel R is faſtened a rope, one end of which goes about V.

V. A wheel of 2 feet diameter, to which that end is fixed; and on the ſame axis is fixed W.

W. Another wheel one foot diameter, to which is faſtened a rope, which goes over a pulley to a ſliding weight in a box at X.

X. Being the ſtilyard end of Y *a a*.

Y *a a*. A quadrant wheel moving on the axis Y; the rope falling upon pullies, running betwixt iron plates, upon the circumference.

Z. Is a lead weight, fixed to counter-balance the weight of the chains, keeping exactly an equilibrium in every poſition they move in.

O. Upon one end of the axis O is a ſtrong iron wheel, giving motion to a fly *b*, which regulates the motion of the engine.

TT. Upon one end of the chain TT is a copper bucket *c*, whoſe capacity is about 5 gallons, having a valve in the bottom on the left hand, and a waſte pipe near the top on the right: upon the lower end of the rod SS, is hung *d*.

d. A copper bucket containing about 15 gallons; in the bottom of this is a valve opened by a trigger falling upon a ſtud at the bottom of the well.

i i. Are iron-rods for the guiding of the buckets, whoſe ears have braſs rolls in them, and incloſe three ſides of each rod, which is ſquare.

The operation.

When the leſſer bucket deſcends, it falls upon a trigger at 4, which is jointed to a treddle at 5, expreſſed with pointed lines, moving on an axis at 6, which by a rod at 7 opens a valve in the bottom of the ciſtern B; whence the water, by a braſs cock and branch-pipe, is conveyed underneath into both buckets, *c* and *d*.

When the leſſer bucket has received about four gallons and an half, it runs out at the pipe or ſpout into a leaden trough, which conveys the water underneath the ciſtern into the great bucket, till it overpoiſes the leſſer; which deſcending, and raiſing the leſſer bucket, the valve ſhuts, and the water that is left in the trough and branch-pipe runs into the greater bucket *d*, accelerating the motion, which falling 10 feet, the leſſer bucket riſes 30 feet; which taking up the trough *f*, and its trigger ſtriking upon a ſtud at *e*, its valve is opened, and its water runs out into a ſmall ciſtern at *f*, and down a pipe *g g*, and ſo is conveyed to the place deſigned: at the ſame time a ſtud opens the valve of the greater bucket, the water running along D, the drain or ſewer.

When both buckets are empty, the leſſer overpoiſes the greater, and deſcends down to the ciſtern, bringing up the greater, where they fill as before.

To regulate the weight of the chains in every poſition, as they act in winding on and off the wheels P and Q, the ſpiraling of the wheels helps in ſome meaſure; but the quadrant wheel and ſtilyard X, with the weight Z, compleat the equilibrium, by acting with the greateſt force in the horizontal poſition, when the chain T is all down, and acts with its whole weight upon the wheel Q: then, as that chain is drawn up, its acting weight being thereby diminiſhed, the ſtilyard X is moving down towards its perpendicular, where the weight Z ceaſes to influence the motion of the wheel R; at which time the ſliding weight runs down to keep the rope tight.

At the firſt moving down of the leſſer bucket, the weight X ſlides up to a ſhoulder, before any motion is given to the ſtilyard; but, whilſt the chain T evolves from its wheel Q, its acting weight increaſing; and, at the ſame time, the chain S wrapping itſelf upon the wheel P, its acting weight decreaſing; the ſtilyard, by riſing higher, brings the line of direction of the weight Z

farther from the center of the quadrant, and ſo lays a greater force or obſtruction to retard the wheel R, and continually keeps a counter-balance.

The fly *b* regulates the motion of the engine to an equal velocity; and, by its running forwards, after the buckets are quite up or down, holds them ſteady till they begin to fill or empty, and prevents their recoiling back.

This engine, at a ſlow motion, carries up one bucket full in five minutes; but, if the ſpring run double the quantity, it would go up twice in the ſame time; and an engine, in this kind, may be made to raiſe one hogſhead per minute, or more, if required; the waſte water not being the hundredth part of what is ſpent by a water-wheel, to raiſe an equal quantity of water to the ſame height.

GERUND, in grammar, a verbal noun of the neuter gender, partaking of the nature of a participle, declinable only in the ſingular number, through all the caſes except the vocative; as, nom. *amandum*, gen. *amandi*, dat. *amando*, accuſ. *amandum*, abl. *amando*.

Grammarians are very much embarraſſed to ſettle the proper nature and character of gerunds. It is certain they are no verbs, nor diſtinct moods of verbs, in regard they do not mark any judgment or affirmation of the mind, which is the eſſence of a verb; beſides their having caſes, which verbs have not. Some, therefore, will have them to be adjectives paſſive, whoſe ſubſtantive is the infinitive of the verb: on this footing they are denominated verbal nouns, or nouns formed of verbs, and retaining the ordinary regimen thereof. See the article NOUN.

The gerunds are derived from active, neuter, and deponent verbs; and, for the moſt part, they follow their ſignification; as, *docendum*, from *doceo*; *currendo*, from *curro*; *loquendum*, from *loquor*.

GESTATION, among phyſicians, the ſame with pregnancy. See the article PREGNANCY.

GESTURE, in rhetoric, conſiſts chiefly in the proper action of the hands and face. It is a kind of natural language, that ſupplies the uſe of ſpeech in perſons born dumb. See the article ACTION.

GEUM, *Avens*, in botany, a genus of plants, the corolla of which conſiſts of five roundiſh petals, with narrow ungues of the length of the cup, and inſerted into it; there is no pericarpium; the common receptacle of the ſeeds is oblong, hairy, and placed on the cup, which is, at that time, reflex: the ſeeds are numerous, compreſſed, hiſpid, and each furniſhed with a long geniculated ſtyle.

GIAGH, in chronology, a cycle of twelve years; in uſe among the Turks and Cathayans.

Each year of the giagh bears the name of ſome animal: the firſt, that of a mouſe; the ſecond, that of a bullock; the third, of a lynx or leopard; the fourth, of a horſe; the fifth, of a crocodile; the ſixth, of a ſerpent; the ſeventh, of a horſe; the eighth, of a ſheep; the ninth, of a monkey; the tenth, of a hen; the eleventh, of a dog; and the twelfth, of a hog.

They alſo divide the day into twelve parts, which they call giaghs, and diſtinguiſh them by the name of ſome animals. Each giagh contains two of our hours, and is divided into eight kehs, as many as there are quarters in our hours.

GIBBOUS, in aſtronomy, a term uſed in reference to the enlightened parts of the moon, whilſt ſhe is moving from the firſt quarter to the full, and from the full to the laſt quarter: for all that time the dark part appears horned, or falcated; and the light one hunched out, convex, or gibbous. See the article MOON.

GIFT, in law, a conveyance, by which either lands or goods are paſſed: it is of larger extent than a grant, being applied to things moveable and immoveable.

GIGG, or JIGG, in muſic, denotes a briſk and lively air; or an airy kind of dance, to a ſprightly meaſure.

GILBERTINES, a religious order founded in England by St. Gilbert, in the reign of Henry I. The nuns followed the rule of St. Benedict, and the monks that of St. Auguſtin. There were many monaſteries of this order in different parts of England.

GILDING, the art of ſpreading or covering a thing with gold, either in leaf or liquid. See the article GOLD.

We have this advantage over the ancients, in the manner of uſing and applying the gold, that the ſecret of painting in oil, lately diſcovered, furniſhes us with means of gilding works, capable of enduring all the violences of time and weather, which theirs could not.

There are ſeveral methods of gilding in uſe among us, as gilding in water, gilding in oil, gilding by fire, &c.

The Method of Water-GILDING. — Water-gilding requires more preparation than oil-gilding, and is chiefly on wooden works, and thoſe made of ſtucco; and theſe too muſt be ſheltered from the weather. A ſize is uſed for this way of gilding made of ſhreds, &c. of parchment or gloves boiled in water to the conſiſtence of a jelly. If the thing to be gilt be of wood, it is firſt waſhed with this ſize, boiling hot, and then ſet to dry; and afterwards with white paint mixed up with the ſame ſize. Some uſe Spaniſh white for this purpoſe, and others plaſter of Paris, well beaten and ſifted. This ſized paint muſt be laid on with a ſtiff bruſh; which is to be repeated ſeldomer or oftener according to the nature of the work, as ten or twelve times in flat or ſmooth works, but ſeven or eight will be ſufficient in pieces of ſculpture. In the former caſe they are applied by drawing the bruſh over the work, in the latter by dabbing it. When the whole is dry, they moiſten it with fair water, and rub it over with ſeveral pieces of coarſe linnen, if it be on the flat; if not, they beat or ſwitch it with ſeveral ſlips of the ſame linnen, tied to a little ſtick, to make it follow and enter all the cavities and depreſſures thereof.

Having thus finiſhed the white, the next thing to be done is to colour it with yellow ochre; but if it be a piece of ſculpture in relievo, they firſt touch it up, and repair the ſeveral parts, which may have happened to have been disfigured by the ſmall iron inſtruments, as gouges, chiſſels, &c. The ochre uſed for this purpoſe muſt be well ground and ſifted, and mixed up with the ſize beforementioned. This colour is to be laid on hot; and in works of ſculpture, ſupplies the place of gold, which ſometimes cannot be carried into all the depreſſures and cavities of the foliages and other ornaments. A lay is alſo applied over this yellow, which ſerves for the ground on which the gold is to be laid: this lay is uſually compoſed of Armenian bole, blood-ſtone, black lead, and a little fat; to which ſome add ſoap, and oil of olives; others, burnt-bread, biſtre, antimony, glaſs of tin, butter, and ſugar-candy. Theſe ingredients being all ground down together with hot ſize, three lays of this compoſition is applied upon the yellow, the one after the other has been dried; being cautious not to put any into the cavity of the work to hide the yellow.

The bruſh, uſed for this purpoſe, muſt be a ſoft one; and when the matter is become very dry, they go over it again with a ſtronger bruſh, to rub it down, and take off the ſmall grains that ſtick out, in order to facilitate the burniſhing of the gold.

To be prepared for gilding, you muſt have three ſorts of pencils; one to wet, another to touch up and amend, and a third to flatten; alſo a gilding cuſhion, for ſpreading the leaves of gold on when taken out of the book; a knife to cut them, and a ſquirrel's tail fitted with a handle; or elſe a piece of fine ſoft ſtuff on a ſtick, to take them up directly and apply them. You are firſt to begin with wetting your pencils; by which the laſt lay laid on with water is moiſtened, that it may the better receive and retain the gold. Then you are to lay the leaves of gold on the cuſhion, and if whole, you muſt take them up with the ſquirrel's tail, but if in pieces, with the other inſtrument, or the knife wherewith they are cut, and lay and ſpread them gently on the parts of the work you had moiſtened before. If the leaves, as they frequently do, happen to crack or break in laying on, theſe breaches muſt be made up with ſmall bits of leaf, taken up upon the repairing pencil, and the whole work is to be ſmoothed either with the ſame pencil, or another ſomething larger; the gold being preſſed into the dents, into which it could not be ſo eaſily carried by the ſquirrel's tail.

The work having been thus far gilded, muſt be ſet to dry, in order to be burniſhed or flatted. See the article BURNISHING.

The laſt operation is the applying the vermeil in all the little lines and cavities; and to ſtop and amend any little faults

5 JA 59

PLATE LXX.

1st Compartment.

2d Compartment.

3d Compartment.

faults with ſhell-gold. The compoſition called vermeil is made of gum guttæ, vermilion, and a little of ſome ruddy-brown, ground together with Venetian varniſh and oil of turpentine. Some gilders, inſtead of this, make ſhift with fine lacca, or dragon's blood, with gum-water.

Sometimes inſtead of burniſhing the gold, they burniſh the ground or compoſition laid on the laſt before it, and only afterwards waſh the part over with the ſize. This method is chiefly practiſed for the hands, face, and other nudities in relievo; which, by this means, do not appear ſo very brilliant as the parts burniſhed, tho' much more ſo than the parts perfectly flat.

To gild a piece of work, and yet preſerve white grounds, they apply a lay of Spaniſh white, mixed with a weak fiſh-glue, on all the parts of the ground, whereon the yellow or the laſt lay might run.

See plate LXX. firſt compartment.

Fig. 1. A woman laying on the ſize.

Fig. 2. A workman applying the vermeil.

Fig. 3. A workman ſmoothing and preſſing the gold into the dents.

Fig. 4. A workman repairing the defects.

Fig. 5. A workman laying on the ſized paint.

Fig. 6. A workman grinding the colours.

The Method of GILDING *in Oil.* — This operation requires much leſs apparatus than that before-mentioned. The baſis or matter whereon the gold is laid, in this method, is the remains of colours found ſettled to the bottom of the pots in which painters waſh their pencils. This matter, which is very viſcid or ſticky, is firſt ground, and then paſſed through a linen-cloth, and thus laid on the matter to be gilt, after it is waſhed once or twice over with ſize; and if it be wood, with ſome white paint.

When this is almoſt dry, but yet is ſtill unctuous enough to catch and retain the gold, the leaf-gold is laid on, either whole, if the work be large, or cut to pieces, if ſmaller: the leaves of gold are taken up and laid on with a piece of fine, ſoft, well-carded cotton; or ſometimes by a palat for the purpoſe, or ſometimes with the knife with which the leaves were cut, according to the parts of the work that are to be gilded, or the breadth of the gold that is to be laid on. As the gold is laid on, they paſs over it a coarſe ſtiff pencil or bruſh, to make it ſtick and as it were incorporate with the ground; and after this they mend any cracks that may have happened in it, either with the ſame pencil or one that is ſmaller, as has been ſhewn before in water-gilding.

This kind of gilding is chiefly uſed for domes and roofs of churches, courts, banquetting-houſes, &c. and for figures of plaſter of Paris, lead, &c.

The Method of GILDING *with liquid Gold.* — This is performed by gold reduced to a calx and amalgamated with mercury, in the proportion of about an ounce of mercury to a dram of gold. To perform this, they heat a crucible red-hot, and then put the gold and mercury into it, ſtirring them gently about till the gold be found melted and incorporated into a maſs with the mercury. When this is done, they caſt them into water, to waſh and purify them; and out of that into other waters, where the amalgama, which is almoſt as liquid as if there were nothing but quick-ſilver in it, may be preſerved a long time for uſe.

Before they proceed to lay this amalgamated gold on the metal, they firſt render the metal rough, by waſhing it over with aqua-fortis, or aqua-ſecunda; and afterwards rinſe the metal in fair water, and ſcour it a little with fine ſand, and then it is ready for the gold.

They next cover over the metal with the mixture of gold and mercury, taking it up with a ſlip of copper, or a bruſh made of braſs-wire, ſpreading it as even as poſſible, to do which they wet the bruſh from time to time in fair water. Then they ſet the metal to the fire, upon a grate, or in a ſort of cage, under which ſtands a pan of coals; and in proportion as the mercury, evaporating and flying off, diſcovers the places where gold is wanting, they take care to ſupply them by adding new parcels of amalgama.

Then the work is rubbed over with the wire-bruſh, dipped in beer or vinegar, which leaves it in a condition to be brought to a colour, which is the laſt part of the proceſs, and which the gilders keep to themſelves as a mighty ſecret.

The Method of GILDING *by Fire on Metal.* — To prepare the metal, they ſcratch it well, or rake it; then poliſh it with a poliſher, and afterwards ſet it to the fire to blue, i. e. to heat till it appear of a blue colour. When this has been done, they clap on the firſt lay of leaf-gold, rubbing it lightly down with a poliſher; and expoſe it thus to a gentle fire. They uſually give it but three ſuch lays, or four at the moſt, each lay conſiſting of a ſingle leaf for common works, and of two for extraordinary ones: after each lay, it is ſet a-freſh to the fire; and after the laſt lay, the gold is in condition to be burniſhed.

See plate LXX. ſecond compartment.

Fig. 1. A workman nealing the metal to be gilded.

Fig. 2. Tubs with water for quenching the metal.

Fig. 3. A ſtone and muller for grinding colours.

Fig. 4. A workman poliſhing the metal.

Fig. 5. A workman laying on the gold.

Fig. 6. A workman laying on the lacquer on an emboſſed piece of metal.

Fig. 7. A workman laying on the vermeil.

Fig. 8. A workman burniſhing the gilded metal.

To gild Paper. — Grind bole-armoniac with rain-water, and give one laying of it; when it is dry, take glair of eggs, and add to it a little ſugar-candy and gum-water, which lay over the former, and upon this, when it is dry enough, lay leaf-ſilver, or leaf-gold.

To gild the Leaves of Books. — Take bole-armoniac, eight penny-weight; ſugar-candy, two penny-weight: mix and grind them with glair of eggs: then on a bound book (while it is in the preſs, after it hath been ſmeared with glair of eggs, and is dried) ſmear the ſaid compoſition, let it dry, then rub it well and poliſh it; then with fair water wet the edges of the book, and ſuddenly lay on the gold, preſs it down gently with cotton, let it dry, and then poliſh it with a tooth.

GILDING *on Leather.* This operation is performed in the ſame manner as that of gilding paper. But when the leather is intended to be decorated with flowers, or other devices, the figures are either drawn or printed on the leather, with the common ſize, and the deſigns covered with leaf gold; and after the ſuperfluous gold is bruſhed off, it is burniſhed.

See plate LXX. third compartment.

Fig. 1. A workman drawing the figures.

Fig. 2. A workman covering the deſigns with leaves of gold or ſilver.

Fig. 3. A workman ſmoothing the leather with a burniſher.

Fig. 4. A workman paring a belt of leather on a ſtone previous to its being gilt.

Fig. 5. The rolling-preſs for printing the deſigns.

GILL, a meaſure of capacity, containing a quarter of a pint.

GILL is alſo a name for ground-ivy, which, being infuſed in ale, makes what is known by the name of gill-ale; a ſort of medicated ale, ſaid to be abſterſive and vulnerary.

GIN, or GENEVA, among diſtillers. See the article GENEVA.

GIN, in mechanics, a machine for raiſing great weights, fitted with a windlaſs and winches at each end, where eight or nine men heave, and round which a rope is reeved, that goes over a pulley at the top; and the whole ſupported by three feet, forming a triangle.

GINGER, *zinziber*, in botany. See the article ZINZIBER.

GINGER-BREAD, a richer kind of bread, the flavour and taſte whereof are heightened and improved with ſpices, and particularly with ginger, whence the name.

The preparation of ginger-bread is as follows: grate two-penny white loaves into two pounds of almonds well blanched and pounded; then add two ounces of ginger, finely ſcraped, liquorice, and aniſe in powder, of each half an ounce; add to theſe five or ſix ſpoonfuls of roſemary-water; and knead all into a paſte, with a pound of ſugar; mould it, and roll it thin, then print it, and dry it in a ſtove.

Others make it of treacle, citron, lemon, and orange-peel, with candied ginger, coriander and carraway-

ſeeds, mixed up with as much flour as will make it into a paſte.

GINGER-WINE is made as follows: take three gallons of water, an ounce of race-ginger, and three pounds of ſugar; boil them for an hour, and then put into it three lemons, and a little good yeaſt; cloſe up the veſſel, and let it ſtand five days: if it has ſo worked as to be clear in that time, it may be bottled; if not, let it ſtand longer, until it has worked ſufficiently; and in ten days after it may be drank.

GINGIVÆ, the gums, in anatomy, a hard ſort of fleſh, inveſting the alveoli, or ſockets of the teeth.

The gums conſiſt of the common membrane of the mouth, and the perioſteum of the jaws, to which they adhere very cloſely and firmly. They are furniſhed with a vaſt number of blood-veſſels, whence their florid red colour; and they ſerve for the covering of the jaws, and the keeping the teeth faſt in their ſockets.

GINGLYMUS, γιγλυμος, one of the three ſubdiviſions of that kind of articulation called diarthroſis. See the articles ARTICULATION and DIARTHROSIS.

The ginglymus is that juncture of the bones wherein they mutually receive and are received by one another, as is the caſe of the articulation of the humerus and cubitus. See HUMERUS, &c.

The ginglymus is again ſubdivided chiefly into three kinds; the firſt is when the ſame bone at the ſame extremity receives, and is reciprocally received by another bone, after the manner of an hinge, as that of the cubitus and humerus: the ſecond is when a bone receives another at one of its extremes, and is received into another, as the vertebræ do: the third is that where a bone is received into another after the manner of a wheel, or the axis of the wheel in a box; ſuch is that of the ſecond vertebra of the neck in the firſt.

GINSENG, in botany, a famous plant greatly eſteemed in China.

The root of the ginſeng is of an oblong figure, never growing to any great ſize, being generally about four or five inches long, and its thickneſs that of one's little finger. It is of a firm texture, its ſurface is furrowed and wrinkled in different places. It is of a browniſh colour on the outſide, and ſomewhat yellowiſh within; and is ſo pure and fine, that it ſeems tranſparent. The top of the root, when it is ſent entire to us, is found compoſed of knots, or tubera, placed over one another in an irregular manner: theſe are formed of the bottoms of the decayed ſtalks of the ſeveral preceding years. When the root is fair and entire, it is eaſy to know by theſe how old it is; but very old roots not being ſo much in repute, the people who gather ginſeng have often the precaution to cut off ſome, or even all thoſe knobs, before they dry the root.

Ginſeng is of a very agreeable and aromatic ſmell, tho' not very ſtrong; its taſte is acrid and aromatic, and has ſomewhat bitter in it. It is to be choſen ſound and firm, moderately heavy, not too tough, and of a good ſmell. Before it be bought, it will be prudent to cut every root through, for the Chineſe, of whom we have it, frequently find a way to introduce pieces of lead into it, to increaſe the weight.

The roots of the ginſeng and ninzin are ſo much alike in their ſhape, colour, and virtues, that they are frequently miſtaken for one another, and by the generality of authors underſtood to be the ſame, notwithſtanding that they belong to two very different plants, and are of two different genera.

The Chineſe and Tartars collect the root of this plant with infinite pains, at two ſeaſons of the year, ſpring and autumn. They are forbid to touch them with any iron-inſtrument, ſo that they can only clean them with wooden knives. They waſh them in a decoction of millet-ſeed, and afterwards hang them over the fumes of the ſame liquor, which they boil in conſiderable quantities for that purpoſe, in a cloſe veſſel, in the upper part of which the root is ſuſpended, over the ſurface of the liquor: after this they dry it for uſe, thus it becomes tranſparent. The ſmall fibres which are taken off, they boil in water, and make an extract of them, which they uſe in the ſame intention with the root.

The Chineſe value the ginſeng ſo highly, that it ſells with them for three times its weight in ſilver. They, as well as the Aſiatics in general, think the ginſeng almoſt an univerſal medicine: they have recourſe to it in all diſeaſes, as the laſt remedy, and readily give themſelves over when it will not cure them; but the virtues moſt generally aſcribed to it, are thoſe of a reſtorative, a provocative, and a cordial. It is famous in the eaſt for giving ſtrength to thoſe who have diſabled themſelves by the too free uſe of women: there they alſo recommend it greatly in the ſmall-pox, fevers of all kinds, diſorders of the ſtomach and bowels, and tell us that diarrhœas and dyſenteries are cured by it: but they caution people not to give it in too large doſes to perſons of a florid ſanguine conſtitution, on whatever occaſion it may be neceſſary to them. The European phyſicians eſteem it a good medicine in convulſions, vertigoes, and all nervous complaints, and recommend it as one of the beſt reſtoratives known.

Its doſe is from ten grains to twenty, in powder; and from one dram to two to the pint, in infuſions.

GIRANDOLE, a kind of branched candle-ſtick.

GIRDERS, in architecture, ſome of the largeſt pieces of timber in a floor.

Their ends are uſually faſtened into ſummers and breaſt-ſummers, and joiſts are framed in at one end to the girders.

The ſize of girders and ſummers, upon the rebuilding of London, were ordained by act of parliament, to be in length from ten to twenty-ſix feet, in breadth from eleven to ſeventeen inches, and in depth from eight to fourteen inches. It was alſo ordained by the ſame ſtatute, that no girder or ſummer ſhould be leſs than ten inches in the wall, and that their ends ſhould be laid in loam; as alſo that they be of good hearty oak, as free from knots as may be, becauſe that will be the leaſt ſubject to breaking, and may with more ſafety be relied on in this croſs and tranſverſe work.

Chriſtians of the GIRDLE, the Chriſtians of Aſia, particularly thoſe of Syria and Meſopotamia, who to this day wear a large leathern girdle, being enjoined thereto by Motavakkel, tenth caliph of the family of the Abaſſides, in the year 856, as a badge of their profeſſion.

Order of the GIRDLE. See CORDELIER.

GIRDLE, in architecture. See CINCTURE.

GIRKIN, a term uſed by gardeners for a ſmall kind of cucumber.

GIRONNE, or GIRONNY, in heraldry, a coat of arms divided into girons, or triangular figures, meeting in the center of the ſhield, and alternately colour and metal.

GIRT, in the menſuration of timber, denotes the circumference of a tree. See the article TIMBER.

GIRT, in the ſea language, the ſituation of a ſhip riding at anchor with two cables, which are drawn ſo extremely tight by mechanical powers, as to prevent the ſhip from turning or veering round on the change of the wind or tide, one of the cables bearing ſtrongly againſt her keel: in this poſition ſhe muſt ride with her broadſide or ſtern to the wind and tide, till one or both of the cables are ſlackened ſo as to ſink under the keel, that the ſhip may not be retarded in her motion.

GISON, or GEISON, in Jewiſh antiquity, ſignifies, according to Joſephus, a little wall, about breaſt high, made round the temple of Jeruſalem, and round the altar of burnt-ſacrifices, to keep the people at a diſtance. This author, in his books of Antiquities, makes the giſon three cubits high, and but one in his hiſtory of the Jewiſh war.

GIVEN, among mathematicians and philoſophers, the ſame with data. See the article DATA.

GLACIS, in building, an eaſy, inſenſible ſlope, or declivity.

The deſcent of the glacis is leſs ſteep than that of the talus. In gardening, a deſcent ſometimes begins in talus, and ends in glacis. See the article TALUS.

The glacis of the corniche is an eaſy imperceptible ſlope in the cymatium, to promote the deſcent and draining off the rain-water.

GLACIS, in fortification, that maſs of earth which ſerves as a parapet to the covered way, ſloping eaſily towards the champaign, or field.

The

The glacis, otherwiſe called eſplanade, is about ſix feet high, and loſes itſelf by an inſenſible diminution in the ſpace of ten fathoms. See ESPLANADE.

GLADE, in gardening and agriculture, an opening and light paſſage made through a wood, by lopping off the branches of trees along that way.

GLADIATORS, in antiquity, perſons who fought generally in the arena at Rome, for the entertainment of the people.

GLAMA, a ſpecies of Peruvian camel, with the back even, and the breaſt gibboſe.

GLAND, in anatomy, a ſmall body, formed by the interweaving of veſſels of every kind, covered with a membrane, uſually provided with an excretory duct, and deſtined to ſeparate ſome particular fluid from the maſs of blood, or to perfect the lymph. See BLOOD and LYMPH.

Many of the anatomical writers of the very firſt claſs, and among theſe ſome who have written profeſſedly of the glands, and have made it their peculiar buſineſs to examine nicely into their nature, and explain their ſtructure, have yet, from mere difficulty of aſcertaining adequate ideas of the term, evaded giving a definition or general deſcription of the glands; and in conſequence of this, numberleſs errors, and an almoſt inextricable confuſion, has crept into the ſtudy of this important part of the human ſtructure.

Other authors, who have had more boldneſs, if not greater abilities than thoſe who have avoided meddling with definitions of theſe parts, have ventured to eſtabliſh what they call glands: but theſe differ ſo much from one another in what they would eſtabliſh as general certainty, and have produced ſuch imperfect and erroneous definitions, that they have all either included parts which themſelves own not to be glands in the definition, or they have limited the term to ſome particular ones, and excluded what themſelves and every body elſe allow to be glands out of the number.

Glands are parts of a peculiar ſtructure; they are of various figures, colours, and conſiſtencies, as they are deſtined to different offices. The ancients ſuppoſed them formed of a different kind of fleſh from that of the reſt of the body; but the parts to which they have given the name of glands, though they are as different from one another as poſſible in figure, ſize, and colour, yet they are eaſily known, and diſtinguiſhed as glands by all the world; notwithſtandiug the difficulty of giving a definition or even a general character of a gland, which ſhall include all the true glands, and take in no other parts of the body with them.

Many writers on this ſubject have aſſerted, that wherever there is a ſecretion of any kind performed, there is a gland; but this is not true, for there are many ſecretions performed in the body, and thoſe even of the largeſt and moſt important kind, where there are no glands to perform them: the chyle is ſecreted in the inteſtines without the aſſiſtance of glands; the ſemen is ſecreted in the teſticles; and the pituita in the pituitary ſinuſes of the brain, where there are no glands at all. On the other hand alſo it is to be obſerved, that there are glands received and allowed by all writers as ſuch, which do not appear to perform any ſecretions at all; and the ancients themſelves agreed in giving the name of glands to ſeveral parts, though they were not aſſured that they ſecreted any thing, nor even in ſome caſes believed that they did. But Mery, in ſeveral papers in the Memoirs of the Paris Academy, not only proves that all the ſecretions are not performed by means of glands, but that many of the ſecretions of moſt importance to the body are performed without glands. We are to add alſo, that every beginner in anatomy, at this time, knows a gland to be ſuch when he ſees it, without knowing any thing of its uſe. There are therefore other characters by which a gland may be known, though by its office and uſe it cannot.

Other writers, of the number of whom is the great Malphigi, in diſſections of particular bodies, having found veſicles in the brain, liver, kidneys, and other parts of the body, thence declared them to be glandulous in their ſtructure: but in theſe caſes, the bodies diſſected were all morbid ones; and as the ſame veſicles are not found in healthful ones, nor indeed any thing analogous to them, it is a ſufficient proof that they are not natural parts of their ſtructure; and beſides, veſicles and glands are different. See VESICLE and VASCULOUS.

It is evident that the ancients called certain parts of the human body glands, and that for no other reaſon but becauſe they found them compoſed of a peculiar kind of fleſhy ſubſtance, of a peculiar habit, or external appearance, without paying any the leaſt regard either to their internal ſtructure, their ſpherical figure, (by which character ſome define them) or their uſe.

If it be aſked, ſays Heiſter, what this particular habit in the glands is? or how we are to know it? the anſwer is, that the peculiar complication and arrangement of the veſſels, from which there ariſes a form obviouſly diſtinguiſhable at ſight from the muſcles, the fat, the bones, the membranes, the veſſels, and in fine from every other part of the human fabric, gives a ſufficiently certain, determinate, and ſtriking notice of it.

The differences of the glands among themſelves, as eſtabliſhed by many authors, are very numerous: it will not be neceſſary to run into the whole diſquiſition; we ſhall only ſelect a few which are more generally eſtabliſhed than the reſt, and of more immediate and real uſe. We ſhall firſt divide them into two general kinds, the ſimple, called alſo conglobate glands, and the conglomerate. See the articles CONGLOBATE and CONGLOMERATE.

The glands differ alſo greatly in regard to their conſiſtence: ſome of them are conſiderably hard and firm, and others extremely ſoft and tender: of the latter kind in particular are the glands ſituated in the articulations of the bones of the ſeveral parts of the body.

They differ alſo very conſiderably in colour. Some of them are of a pale, whitiſh, red, or fleſhy colour; others of a ſtrong, deep red; others yellowiſh, or browniſh, and ſome evidently blackiſh.

Their differences in figure are as conſiderable alſo as thoſe in colour: ſome of them are round, others oval, others oblong, and many others of figures as different as well can be from any one of theſe regular ones: the pancreas, the thyroide, and the thymus, are inſtances of this; ſome of them have obtained their names from their peculiar figure: of this number are the glandula pinealis, the miliares, and others. See the articles PANCREAS, THYROIDE, THYMUS, &c.

The Uſes of the GLANDS are alſo as different as their colours or figures: ſome of them are ſalival, mucoſe, and lymphatic; others are mucilaginous, ſebaceous, and waxy; others lachrymal, pituitary, &c. and from theſe their ſeveral contents or ſecretions, they are termed lachrymal, &c. See the articles SALIVAL, LYMPHATIC, MUCILAGINOUS, &c.

The Situation of the GLANDS is another article in which they differ, and from which many of them have their ſeveral names; ſuch are the parotides, maxillares, linguales, thyroide, palatine, labial, jugular, cervical, axillary, inguinal, lumbary, inteſtinal, meſenteric, renal, &c. See the articles PAROTIDE, MAXILLARY, LINGUAL, &c.

And, finally, the ſize of the glands is a thing in which they differ moſt obviouſly and eſſentially.

Of the GLANDS *in particular*. The particular glands of the body, or ſuch as are truly and properly of this denomination, are, according to Heiſter, as follow; and firſt of the glands of the head.

In the ſinuſes of the dura mater, and out of them, at the ſides, there are found a number of ſmall glands deſcribed by Pacchonius; and there are ſometimes others viſible in the foveæ of the os frontis, and about the diviſions of the veſſels, between the dura mater and the arachnoides. Theſe glands ſeem deſtined for the ſecreting of a fluid to moiſten the dura mater. Other glands of the brain are the pineal gland, and the pituitary gland. See the articles PINEAL, PITUITARY, DURA MATER, and BRAIN.

In the exterior part of the head, that is, out of the cavity of the ſkull, we have the parotids, and maxillary glands, the ſublinguals, the linguals, the labials, the palatine, and the buccinals, which are diſtributed here and there about the membrane of the mouth; and are each deſcribed in their places. In the orbit alſo there is the lachrymal glands; under the eyes are the ſebaceous or

ſeraceous

ſeraceous glands, the tonſils in the fauces, the mucoſe glands in the pituitary membrane of the noſtrils, and the ceruminoſe glands of the ears, each of which are deſcribed under their ſeveral heads. See the articles EYE and EAR.

The principal gland of the neck is the thyroides, beſides which there are alſo found in the neck a great number of leſſer ones, diſtributed here and there among the muſcles and fat. Their figure, their number, and their ſituations, vary in different ſubjects; but in general thoſe in the anterior part of the neck are called jugulars; and thoſe in the hinder part, occipitales and cervicales. The uſe of theſe is hitherto uncertain; it is generally ſuppoſed that they are of ſervice to the lymphatic veſſels, but what ſort of uſe they can be of to them, does not ſo eaſily appear. See the articles THYROIDES, JUGULARES, OCCIPITALES, CERVICALES, and NECK.

Ruyſch and Morgagni have alſo deſcribed and figured glands in the epiglottis: and Morgagni has deſcribed others in the other parts of the larynx, particularly about the arytænoide cartilages, as alſo in the trachea: but theſe are often ſo ſmall, that they are ſcarce diſcoverable in diſſection.

The œſophagus, eſpecially towards its upper part, has a great number of glands; and it is common to find a little aperture or oſculum in the center of each, which has much the appearance of an excretory duct.

In the thorax we meet with the gland thymus; as alſo with the glandulæ bronchiales: theſe laſt are very obſervable glands, ſituated externally in the larger diviſions of the trachea and bronchia. They are of a blackiſh colour; and their uſe, like that of many others of the glands of this part of the body, is yet very little known. It had been long ſuppoſed that they ſerved to ſecrete a liquid which they diſcharged into the bronchia, for the lubricating and moiſtening theſe parts; but Vercellonius will have it, that they ſecrete a fluid whoſe uſe is to be aſſiſtant in the digeſtion of our food, and that they diſcharge it into the œſophagus through certain extremely minute ducts. See the articles THORAX, THYMUS, BRONCHIA, &c.

About the fifth vertebra of the back, there is ſometimes found in the thorax a remarkable gland adhering to the poſterior part of the œſophagus: this is uſually called glandula dorſalis. It is, in different ſubjects, of various ſizes. It is often of the ſize of a kidney-bean; ſometimes of that of an almond, and ſometimes conſiderably larger; in others, it is much leſs than the ſmaller, and ſometimes it is wholly wanting; or at leaſt ſo extremely minute and inconſiderable, that the beſt diſſectors are not able to find it. Sometimes alſo two glands are found in this part in the place of one. Vercellonius is of opinion, that this gland is alſo placed there for the ſecretion of a fluid ſerving to aſſiſt the digeſtion of our food in the ſtomach: but Fantonus, and ſome others, ſuppoſe, that theſe glands diſcharge a fluid of a mucous nature into the cavity of the œſophagus: ſeveral authors affirm, that in dogs theſe glands are found tumid, and inhabited by a number of oblong and ſlender red worms. See DORSUM, VERTEBRA, and OESOPHAGUS.

In the abdomen there are very conſiderable numbers of glands: the largeſt of them is the pancreas; after this in ſize come the glandulæ renales, or capſulæ atrabiliariæ; after theſe the meſeriacs, and the inteſtinals of Brunner and Peyer in the inteſtines. See ABDOMEN, &c.

The glands of the ſtomach are very eaſily diſtinguiſhable in dogs and hogs; but in human ſubjects, it is difficult to find them: many anatomiſts have doubted them. Morgagni, however, diſcovered them ſo fairly in human ſubjects, that there is no doubt left about them.

About the vertebra of the loins, near where the receptaculum chyli is ſituated, and about the os ſacrum, and the diviſions of the iliac veſſels, are many glands of various ſizes and figures: they are commonly called lumbares, ſacræ, and iliacæ, and they have numerous lymphatics entering into them, and diſcharging their contents into the receptaculum chyli. The lumber glands have been ſometimes found ſwelled to the bigneſs of a man's fiſt.

In the concave part of the liver, about the ingreſs of the vena portæ and the neck of the gall-bladder; as alſo about the ſpleen, near the ingreſs of the veſſels, there are frequently found conglobate glands, of about the bigneſs of kidney-beans: theſe are called by authors hepatic glands, cyſtic glands, and by other names formed from the names of the parts they are near; and they ſeem to ſerve the lymphatic veſſels. See the article LIVER.

About the left orifice of the ſtomach, there ſometimes alſo is found, according to Vercellonius, a gland which he ſays is equal to a kidney-bean in ſize; he alſo ſays that it has ducts opening into the cavity of the ſtomach. In hogs this gland is very conſpicuous, but in human ſubjects it is not ſo.

Many authors have told us, that in the omentum, in every part where the fat lies, there are a number of glands whoſe office it is to ſecrete it. Diſſection ſhews us a few about that part where it is joined to the pylorus; and as to the reſt, it is not neceſſary that there ſhould be glands, becauſe there is fat: for that may be, and is, indeed, in great abundance ſecreted immediately from the arteries.

In the gall-bladders of oxen there are often found a number of ſmall glands of a yellow colour, not unlike the ceruminous glands in the auditory paſſage.

In human ſubjects the ſame kind of glands are alſo ſometimes found. The bladder and the ureters have alſo ſometimes a number of ſmall glands, but they are very indeterminate in number and ſize, and are not always indeed found in the ſame place, eſpecially about the ureters. Thoſe about the bladder are uſually ſituated towards the neck of it, and are ſometimes tolerably conſpicuous.

In the parts of generation of man there occur, 1. The glandulæ Cowperi. 2. The glandulæ Littri. And, 3. The odoriferous glands of Tyſon. See PENIS. As to the latter ones, thoſe of them which are ſituated in the interior part of the prepuce, are much more obvious than thoſe about the coronæ penis, where it is very difficult to diſtinguiſh them from the nervous papillæ of the ſame part. 4. We meet with the proſtatæ. 5. The glands of the veſiculæ ſeminales; but theſe are rarely ſeen diſtinct. Terraneus alſo deſcribes ſix ſmall glands in the urethra virilis. See the articles PREPUCE, PROSTATÆ, VESICULÆ SEMINALES, and URETHRA.

In the parts of generation in women, we are to refer to the number of the glands, 1. Thoſe which Morgagni diſcovered in the nymphæ: theſe have a very near alliance with the glandulæ odoriferæ of the penis in men. 2. Authors tell us of the glands in the female as well as the male urethra: but the diſſector will find only little foramina and ducts in the place of them. 3. About the extremity of the urethra, however, in the vagina, there are ſometimes found evident glands, ſituated beneath them: theſe, as well as the glands of the nymphæ, are often very turgid in the time of parturition. 4. The veſicles ſometimes met with near the internal orifice of the uterus, and taken by ſome for a new ovary, are not properly glands, though ſome people have been very poſitive that they were ſuch; having nothing of the habit and peculiar appearance of glands, and being in truth only veſicles. 5. Some have alſo maintained that there are glands in the uterus, by which the menſtrual diſcharges are ſecreted; but this notion ariſes only from the falſe hypotheſis, that where there are no glands, there can be no ſecretion. See the articles VAGINA and UTERUS.

Among the glands which belong to the articulations, and the extremities, we are to mention, firſt, the axillary ones. 2. The inguinal glands; theſe laſt, being ſituated on each ſide in the groin near the crural veſſels, are in various diſeaſes apt to grow tumid, and inflamed. Abſceſſes are often formed in them; but their uſe in the body is not eaſily underſtood. 3. The glands, called from their diſcoverer glandulæ Harveianæ, in the articulations: they are alſo called from the matter they ſecrete glandulæ mucoſæ. Theſe are the ſofteſt of all the glands in the body; they ſecrete a mucous ſoft fluid, which ſerves to lubricate the joints, and render their motions eaſy, and to prevent their growing dry, and cohering together.

About the ſcapula, the flexure of the elbow, the hand, the knee, and the foot, there are alſo found here and

there ſome ſmall glands; as alſo in ſome places between and among the muſcles: but as their number and ſituation, as well as their ſize and figure, are very uncertain and variable, it is not neceſſary to recount them here.

We are, however, yet to ſpeak of the cutaneous glands. Verheyen tells us, that Steno had diſcovered, that there is a gland ſituated under every diſtinct pore of the ſkin, from whence there ariſes a veſſel for the conveyance of the matter of ſweat, which terminates at the ſurface of the cutis: and hence Verheyen, though he does not ſay that he had ever ſeen any of theſe glands himſelf, ventures to give them a place among the parts he deſcribes; and calls them ſubcutaneous glands. The pores of the ſkin are ſo extremely numerous, that if, according to theſe authors, there were a gland belonging to every one of them, the glands muſt be almoſt infinite in number. But in diſſection, when the cutis has been carefully cleared from the fat that is under it, it is certain no ſuch glands are ſeen, either in the ſeparated fat, or on the lower ſurface of the cutis: there are indeed always found little portions of the fat here and there inſinuating themſelves into the little foveolæ, or holes in the cutis; but pieces of fat will be diſtinguiſhed from glands with very little difficulty by an expert anatomiſt. From this, and from innumerable ſearches after theſe glands, it appears, that there are indeed no ſuch glands as thoſe called ſubcutaneous. See the article CUTIS.

GLANDERS, in the manege, a diſeaſe in horſes, conſiſting of a thick, ſlimy, corrupt humour, running from the noſtrils, of a different colour, according to the different degrees of malignity, or as the infection has been of a ſhorter or longer continuance; being white, yellow, green, black, or bloody.

Authors aſcribe this diſeaſe to various cauſes: ſome to infection; others, to a diſorder of the lungs; others, to the ſpleen; ſome to the liver; and others, to the brain. After it has been of ſo long a ſtanding, as that the matter is become of a blackiſh colour, which is uſually in its laſt ſtage, they ſuppoſe it to come from the ſpine; and hence they call it the mourning of the chine.

Kernels and knots are uſually found under the caul in this diſorder; and as theſe grow bigger and more inflamed, ſo the glanders increaſe more.

For the cure of the glanders Mortimer gives the following receipt.

Take a pint of children's chamber lye; two ounces of oil of turpentine; half a pint of white vinegar; four ounces of flower of brimſtone; half a handful of rice; boil this compoſition till it comes to a pint, and give it to the horſe faſting; and let him faſt after it ſix hours from meat, and twelve from water.

GLANDULAR, or GLANDULOUS, among anatomiſts, ſomething abounding with, or partaking of the nature of, glands.

GLANDULE, or GLANDULA, a term uſed by anatomiſts to expreſs a ſmall gland. See GLAND.

GLANS, in anatomy, the anterior extremity of the penis, called by other different names, as the head of the penis, the nut of the penis, and the balanus of the penis. See the article PENIS.

GLANS is alſo uſed to denote the tip or extremity of the clitoris, from its reſemblance both in form and uſe to that of the penis. The principal difference conſiſts in this, that it is not perforated as is the glans of the penis.

GLASS, a kind of factitious, brittle, and tranſparent body, produced by the action of fire upon a fixed ſalt and ſand that readily melts.

When, or by whom, the art of making glaſs was invented is uncertain. Some will have it to have been known before the flood, but without any proof. However, glaſs could not be unknown to the ancients; for a kiln of bricks can hardly be burnt, or a batch of pottery ware made, but ſome of the bricks and ware will be at leaſt ſuperficially turned into glaſs.

Pliny tells us that the diſcovery was owing to the following accident: Some merchants being driven by ſtreſs of weather to the mouth of the river Belus in Syria, were obliged to make a fire on the ground to dreſs their victuals; and there being a great quantity of the plant kali on the ſpot, ſome of the aſhes of this plant were accidentally mixed with the ſand of the place, which produced a vitrification. This hint the Sidonians improved, and brought it into uſe.

Venice, for many years, excelled all Europe in the fineneſs of its glaſſes; but lately the French and Engliſh have excelled the Venetians; ſo that we are no longer ſupplied from abroad.

The manufactured glaſs at preſent in uſe may be divided into three general kinds, white tranſparent glaſs, coloured glaſs, and common green or bottle glaſs. Of the firſt kind, there is a great variety of ſorts, according to the ſeveral purpoſes intended to be ſerved by it, either for making domeſtic utenſils, or lights for incloſed places: and of the ſecond, there is likewiſe a ſtill greater multiplicity of ſpecies, differing in their colour, or other properties, according to the occaſions for which they are wanted: but of the laſt, there is no diſtinguiſhed difference of ſort, except what the accidental manner of preparation and management, practiſed according to the ſkill or art of particular directors of manufactories may occaſion.

From the nature of vitrification, it appears, that all fixed bodies are capable of being the materials of perfect glaſs under ſome circumſtances; but as the means of vitrification are limited with regard to the manufactured glaſs, ſuch bodies only are proper to become the ingredients of the perfect kinds of it, as are eaſily to be procured in due quantity, and admit of being vitrified by the heat of a furnace either alone, or by their commixture with others, which may promote this change in them: and in the caſe of the imperfect ſorts, bodies that are not capable of being vitrified by the means there employed, are alſo taken in as materials, where they are required to give the particular properties wanted in each peculiar ſort. The principal ſubſtances, therefore, that are choſen for the compoſition of manufactured glaſs, are, ſand flints, and other foſſile bodies of a ſtony and earthy texture; metals and ſemi-metals of all kinds previouſly prepared by calcination, or other operations; arſenic and zaffer, which are prepared parts of a foſſile; and all ſalts of a fixed kind.

Among theſe ſubſtances there are ſome, which are ſtrongly reluctant to the vitreous fuſion, and could ſcarcely alone be ever converted to glaſs; at leaſt not by the heat of any furnaces; and yet are ſuch as are moſt capable of giving firmneſs and tenacity to that in which they are admitted; as alſo of being more copiouſly provided at a ſmall expence. There are others, on the contrary, that vitrify in a much leſs heat than that commonly employed in the working of glaſs; and have likewiſe this attendant properly along with their own proneneſs to vitreous fuſion, that they accelerate and produce it in many of thoſe that are otherwiſe more repugnant to it; and cauſe them, by their commixture, to vitrify in a greatly leſs degree of heat than they otherwiſe would.

This property of promoting vitrification is called technically fluxing the bodies on which they ſo act; and on the proper application of this principle to practice lies the main ſtreſs of ſkill in the art of compounding glaſs; as the ſavings in the original coſt of the ingredients, in time and in fuel, as well as the qualities of glaſs produced, depend chiefly on the thorough intelligence in this view of the nature of the bodies proper to become ingredients of it. The next important relation, in which bodies ſtand with reſpect to the compoſition of glaſs, is the effect they may have on its colour by their admixture: in order to deſtroy all kinds of which in ſome caſes, and to produce them in others, ingredients are frequently added, that are not otherwiſe neceſſary; as being no way ſubſervient to the general view. This conſtitutes therefore the other great object of ſkill in the art of making glaſs: for the knowing properly how to take away all colour from the tranſparent white glaſs, and to impart any kind deſired to proper compoſitions on other occaſions, is of the next great moment to the being able, by the moſt cheap and eaſy means, to procure a due vitrification.

According to the above ſpecified intentions, in which

the ſeveral ſubſtances ſerving for the materials of glaſs are uſed, they may be properly diſtinguiſhed into three kinds, as making the body, flux, and colorific matter.

The ſubſtances which have been employed in forming the body of glaſs are ſand, by which is only to be underſtood the white kinds, flints, talc, ſpar, and ſeveral other ſtony foſſils. All theſe vitrify of themſelves too ſlowly to produce perfect glaſs by the degree of heat that can be applied to them when in large maſſes; which makes them therefore require the addition of thoſe other kinds, whoſe fluxing power may remedy this defect in them; while they on the other hand, being of low price, and to be procured in unlimited quantities, and giving that hardneſs, ſtrength, and inſolubility, which cannot be had in any glaſs formed of other ſubſtances without them, are yet eſſential and indiſpenſibly neceſſary ingredients in all kinds of manufactured glaſs.

The ſubſtances which are uſed as fluxing ingredients in glaſs, are red lead, pearl-aſhes, nitre, ſea ſalt, borax, arſenic, and wood-aſhes containing the calcined earth and lixiviate ſalts as produced by incineration. The preſence of ſome of theſe bodies is always equally neceſſary with that of thoſe which form the body in all the compoſitions of manufactured glaſs. But the uſe of them both, with reſpect to choice and proportion, is greatly varied in different works; even where the ſame kind of glaſs is intended to be produced; as the general nature of them has never been hitherto underſtood by the directors of ſuch works; and they have only implicitly followed the beſt receipts they could procure, carefully keeping them a ſecret, when they happened either by communication or their accidental diſcovery to be poſſeſſed of ſuch improvement, as gave them any advantages over their fellow operators.

The ſubſtances which have been applied as colorific matter in manufactured glaſs, are extremely numerous and various; as all the ſpecies of metals and ſemi-metals, with many other mineral and foſſile bodies, have been uſed for the producing ſome colour or other; and make a large field of ſpeculative and practical knowledge. The art of ſtaining glaſs, with all the variety of colours in the greateſt degree of force and brightneſs, is not however of ſo much importance commercially conſidered, as the knowing how to baniſh and exclude, with eaſe and certainty, the colours which of themſelves ariſe in moſt of the compoſitions for glaſs intended to be perfectly tranſparent and colourleſs: for this laſt purpoſe, nitre and magneſia are the principal ſubſtances employed in the manufactories of this country; and extremely well anſwer the end, tho' not without enhancing the expence of the glaſs by the uſe of the firſt; and in a ſmall degree injuring its tranſparency by that of the latter; as may be demonſtrated by principles that are unqueſtionable in themſelves, though wholly unknown to thoſe who are practically concerned in theſe matters.

From theſe three kind of ſubſtances duly combined together by commixture and adequate heat, or in ſome caſes from the two firſt only, all the ſorts of manufactured glaſs at preſent in uſe are formed. The general manner of doing which is to reduce thoſe kinds of bodies that are in groſſer maſſes, to powder; and then, all the ingredients being thoroughly well mixed together by grinding, and put into proper pots, to place them in a furnace where the heat is ſufficient to bring them to a due ſtate of fuſion, in which they are to be continued till the vitrification be completed.

This proper degree of vitrification muſt be diſtinguiſhed by the tranſparent and equal appearance of the matter when a ſmall portion is taken out and ſuffered to cool: except in the caſe of thoſe ſorts where the glaſs is not perfect, with regard to which, a judgment muſt be made from their having attained or wanting that peculiar appearance, which the particular ſort is required to have. It may be proper to ſubjoin, that in all caſes, the vitrification is ſooner and more eaſily made perfect in proportion as the ingredients are reduced to the ſtate of a finer powder, and more intimately commixed.

We have obſerved, that the materials formerly employed to give a body to glaſs are, ſand, flints, talc, ſpar, and ſome other ſtony foſſils; but ſand is, at preſent, the almoſt only kind of ſubſtance which is uſed in this intention in the Britiſh manufactures of glaſs.

The kind of ſand moſt fit for making the white tranſparent kinds of glaſs, is that brought from Lynn in Norfolk, by the name of which place it is diſtinguiſhed: and there is alſo another kind of this, but inferior, brought from Maidſtone in Kent. It is white and ſhining; and, examined by means of a microſcope, appears to be ſmall fragments of rock cryſtal; from which it does not ſeem, by any experiments, to differ in its qualities, and the glaſs formed of it may therefore properly be conſidered as made of cryſtal.

The materials being all prepared and duly mixed, the matter muſt be put into the pots and urged to fuſion, by a heat proportioned to the ſtrength of the flux in the compoſition, and this muſt be continued till the whole maſs become one uniform fluid; and have acquired the qualities neceſſary in that particular kind of glaſs which is intended to be produced. There is an attention to another object, however, required in the mean time, which is, the taking off the ſcum and foulneſs that will ariſe on the glaſs in the action of the ingredients on each other, and the coction of the matter. This is to be done by means of proper ladles; and ſhould be effectually performed before the glaſs be worked; otherwiſe it will be ſo fouled by this ſubſtance, as to be rendered of very little value. This matter is called ſandover; and is ſold to the colourmen, who diſpoſe of it to the potters; and they uſe it in the compoſitions of their glazings.

The exact time for keeping the ſeveral compoſitions of glaſs in fuſion, in order to their perfect vitrification, can by no means be ſettled by rule: for there is ſo much variation in the diſpoſition of different parcels of materials of the ſame kind to vitrify; and likewiſe ſo great an uncertainty with reſpect to the degrees of heat maintainable even in the ſame furnace, that it muſt be left to the judgment of the operator. But where the power of the flux is weaker, as may be gathered from the nature and proportions of the ingredients in the compoſition, or where the heat is leſs intenſe, a greater time will neceſſarily be required, than in the caſe of ſtronger fluxes, and briſker fires. No damage can, however, accrue from allowing a longer fuſion than may be neceſſary to give the glaſs the appearance of being perfect, except the loſs of time and conſumption of fuel: for with reſpect to the white tranſparent glaſs, it is always improved in its hardneſs, and clearneſs, by a larger coction.

In order to examine whether the glaſs have attained to its due ſtate of vitrification, an iron rod, of which the end ſhould be bright, or at leaſt entirely free from ruſt, muſt be dipped in the melted matter: and what adheres to it ſhould be firſt tried, with reſpect to its ductility or readineſs to ſuffer itſelf to be drawn out in long threads; and if this quality be found in it to a ſufficient degree, being ſuffered to cool, it ſhould be carefully inſpected, to form a judgment of its colour and clearneſs. If it be tranſparent, colourleſs, and free from all ſpecks and bubbles, it may be concluded perfect, and fit to be wrought: but if it want theſe marks, more time muſt be given, according to the degree of defectiveneſs: and, after a reaſonable allowance of ſuch time, it muſt be examined again by the ſame means; and if not yet perfect, a further time muſt be given, and then the ſame trial made again.

Working or blowing of Window or Table GLASS. See the article BLOWING *of Glaſs*.

*Caſting or running of large Looking-*GLASS *Plates.* — The furnace G (plate LXXI. *fig.* 1.) is of a very large dimenſion, environed with ſeveral ovens, or annealing furnaces, called carquaſſes, beſides others for making of frit, and calcining old pieces of glaſs. This furnace, before it is fit to run glaſs, coſts three thouſand five hundred pounds. It ſeldom laſts above three years, and even in that time it muſt be refitted every ſix months. It takes ſix months to rebuild it; and three months to refit it. The melting pots are as big as large hogſheads, and contain about 2000 weight of metal. If one of them burſts in the furnace, the loſs of the matter and time amounts to 250 l. The heat of this furnace is ſo intenſe, that a bar of iron laid at the mouth thereof becomes red hot in leſs

leſs than half a minute. The materials in theſe pots are the ſame as deſcribed before; and A is the man breaking the frit for that purpoſe. When the furnace is red hot, theſe materials are put in at three different times, becauſe that helps the fuſion; and in twenty-four hours they are vitrified, refined, ſettled, and fit for caſting. H is the bocca, or mouth of the furnace, K is the ciſtern that conveys the liquid glaſs it receives out of the melting-pots in the furnace to the caſting table. Theſe ciſterns are filled in the furnace, and remain therein ſix hours after they are filled; and then are hooked out by the means of a large iron chain, guided by a pully marked I, and placed L, by two men P, P. This carriage has no middle piece; ſo that when it has brought the ciſtern to the caſting table M, they ſlip off the bottom of the ciſtern, and out ruſhes a torrent of flaming matter O, upon the table: this matter is confined to certain dimenſions by the iron rules N, N, N, which are moveable, retain the fluid matter, and determine the width of the glaſs; while a man R, with the roller Q reſting on the edge of the iron rulers, reduceth it as it cools to an equal thickneſs, which is done in the ſpace of a minute. This table is ſupported on a wooden frame, with truſtles for the convenience of moving to the annealing furnace; into which, ſtrewed with ſand, the new plate is ſhoved, where it will harden in about ten days. After this the glaſs needs only be ground, poliſhed, and foliated for uſe.

Grinding and poliſhing of Plate GLASS. Glaſs is made tranſparent by fire, but it receives its luſtre by the ſkill and labour of the grinder and poliſher, the former of whom takes it rough out of the hands of the maker.

In order to grind plate-glaſs, they lay it horizontally upon a flat ſtone table (*fig.* 2.) made of a very fine grained free-ſtone; and for its greater ſecurity they plaſter it down with lime, or ſtucco; for otherwiſe the force of the workmen, or the motion of the wheel, with which they grind it, would move it about.

This ſtone-table is ſupported by a ſtrong frame, A, made of wood, with a ledge quite round its edges, riſing about two inches higher than the glaſs. Upon this glaſs to be ground is laid another rough glaſs not above half ſo big, and ſo looſe as to ſlide upon it; but cemented to a wooden plank, to guard it from the injury it muſt otherwiſe receive from the ſcraping of the wheel, to which this plank is faſtened; and from the weights laid upon it, to promote the grinding or friture of the glaſſes. The whole is covered with a wheel, B, made of hard light wood, about ſix inches in diameter; by pulling off which backwards and forwards alternately, and ſometimes turning it round, the workmen who always ſtand oppoſite to each other, produce a conſtant attrition between the two glaſſes, and bring them to what degree of ſmoothneſs they pleaſe, by firſt pouring in water and coarſe ſand; after that a finer ſort of ſand as the work advanceth, till at laſt they muſt pour in the powder of ſmalt. As the upper or incumbent glaſs poliſhes, and grows ſmoother, it muſt be taken away, and another from time to time put in its place.

This engine is called a mill by the artiſts, and is uſed only in the largeſt ſize glaſſes; for in the grinding of the leſſer glaſſes, they are content to work without a wheel, and to have only four wooden handles faſtened to the four corners of the ſtone, which loads the upper plank, by which they work it about.

When the grinder has done his part, who finds it very difficult to bring the glaſs to an exact plainneſs, it is turned over to the care of the poliſher, who with the fine powder of Tripoli-ſtone, or emery, brings it to a perfect evenneſs and luſtre. The inſtrument made uſe of in this branch, is a board, *c*, *c*, furniſhed with a felt, and a ſmall roller, which the workman moves by means of a double handle at both ends. The artiſt in working this roller aſſiſted with a wooden hoop, or ſpring, to the end of which it is fixed; for the ſpring, by conſtantly bringing the roller back to the ſame points, facilitates the action of the workman's arm.

*Burroughs's Machine for grinding and poliſhing Plate-*GLASS. See the article BURROUGHS's *Machine*.

Grinding and poliſhing of Optic GLASSES. See GRINDING and POLISHING.

Painting in GLASS. The ancient manner of painting in glaſs was very ſimple, and conſequently very eaſy; it conſiſted in the mere arrangement of pieces of glaſs of different colours in ſome ſort of ſymmetry, and conſtituted what is now called Moſaic work. See the article MOSAIC.

In proceſs of time they came to attempt more regular deſigns, and alſo to repreſent figures heightened with all their ſhades; yet they proceeded no farther than the contours of the figures in black with water-colours, and hatching the draperies after the ſame manner on glaſſes of the colour of the object they deſigned to paint. For the carnation, they uſed glaſs of a bright red colour; and upon this they drew the principal lineaments of the face, &c. with black.

But in time, the taſte for this ſort of painting improving conſiderably, and the art being found applicable to the adorning of churches, baſiliacs, &c. they found out means of incorporating the colours in the glaſs itſelf, by heating them in the fire to a proper degree, having firſt laid on the colours. The colours uſed in painting or ſtaining of glaſs are very different from thoſe uſed in painting either in water or oil colours. See the article COLOUR.

For black, take ſcales of iron, one ounce; ſcales of copper, one ounce; jet, half an ounce; reduce them to powder, and mix them. For blue, take powder of blue, one pound; ſal nitre, half a pound; mix them and grind them well together. For carnation, take red chalk, eight ounces; iron ſcales and litharge of ſilver, of each two ounces, gum arabic, half an ounce diſſolved in water; grind all together for half an hour very ſtiff; then put it in a glaſs and ſtir it well, and let it ſtand to ſettle fourteen days. For green, take red lead, one pound; ſcales of copper, one pound; and flint, five pounds; divide them into three parts; and add to them as much ſal nitre; put them into a crucible, and melt them with a ſtrong fire; and when it is cold, powder it, and grind it on a porphyry. For gold colour, take ſilver, an ounce; antimony, half an ounce; melt them in a crucible; then pound the maſs to powder; and grind it on a copper plate; add to it yellow oker, or brick duſt calcined again, fifteen ounces; and grind them well together with water. For purple, take minium, one pound; brown ſtone, one pound; white flint, five pounds; divide them into three parts, and add to them as much ſal nitre as one of theſe parts; calcine, melt, and grind it as you did the green. For red, take jet, four ounces; litharge of ſilver, two ounces; red chalk, one ounce; powder them fine; and mix them. For white, take jet, two parts; white flint, ground on a glaſs very fine, one part; mix them. For yellow, take Spaniſh brown, ten parts; leaf ſilver, one part; antimony, half a part; put all into a crucible, and calcine them well.

In the windows of ancient churches, &c. there are to be ſeen the moſt beautiful and vivid colours imaginable, which far exceed any of thoſe uſed by the moderns, not ſo much becauſe the ſecret of making thoſe colours is entirely loſt, as that the moderns will not go to the charge of them, nor be at the neceſſary pains, by reaſon that this ſort of painting is not now ſo much in eſteem as formerly. Thoſe beautiful works which were made in the glaſs-houſes were of two kinds.

In ſome the colour was diffuſed through the whole ſubſtance of the glaſs. In others, which were the more common, the colour was only on one ſide, ſcarce penetrating within the ſubſtance above one third of a line; though this was more or leſs according to the nature of the colour; the yellow being always found to enter the deepeſt. Theſe laſt, though not ſo ſtrong and beautiful as the former, were of more advantage to the workmen, by reaſon that on the ſame glaſs, though already coloured, they could ſhew other kind of colours where there was occaſion to embroider draperies, enrich them with foliages, or repreſent other ornaments of gold, ſilver, &c.

In order to this, they made uſe of emery, grinding or wearing down the ſurface of the glaſs, till ſuch time as they were got through the colour to the clear glaſs. This done, they applied the proper colours on the other

ſide of the glaſs. By this means, the new colours were hindered from running and mixing with the former, when they expoſed the glaſſes to the fire, as will appear hereafter.

When indeed the ornaments were to appear white, the glaſs was only bared of its colour with emery, without tinging the place with any colour at all; and this was the manner by which they wrought their lights, and heightenings, or all kinds of colour.

The firſt thing to be done, in order to paint, or ſtain glaſs, in the modern way, is to deſign, and even colour the whole ſubject on paper. Then they chooſe ſuch pieces of glaſs as are clear, even, and ſmooth, and proper to receive the ſeveral parts, and proceed to diſtribute the deſign itſelf, or papers it is drawn on, into pieces ſuitable to thoſe of the glaſs; always taking care that the glaſſes may join in the contours of the figures, and the folds of the draperies; that the carnations, and other finer parts, may not be impaired by the lead with which the pieces are to be joined together. The diſtribution being made, they mark all the glaſſes as well as papers, that they may be known again: which done, applying every part of the deſign upon the glaſs intended for it, they copy, or transfer, the deſign upon this glaſs with the black colour diluted in gum water, by tracing and following all the lines and ſtrokes as they appear through the glaſs with the point of a pencil.

When theſe ſtrokes are well dried, which will happen in about two days, the work being only in black and white, they give a ſlight waſh over with urine, gum arabic, and a little black; and repeat it ſeveral times, according as the ſhades are deſired to be heightened, with this precaution, never to apply a new waſh till the former is ſufficiently dried.

This done, the lights and riſings are given by rubbing off the colour in the reſpective places with a wooden point or the handle of a pencil.

As to the other colours above-mentioned, they are uſed with gum-water, much as in painting in miniature; taking care to apply them lightly for fear of effacing the out-lines of the deſign; or even, for the greater ſecurity, to apply them on the other ſide; eſpecially yellow, which is very pernicious to the other colours, by blending therewith. And here too, as in pieces of black and white, particular regard muſt always be had not to lay colour on colour, or lay on a new lay, till ſuch time as the former are well dried.

It may be added, that the yellow is the only colour that penetrates through the glaſs, and incorporates therewith by the fire; the reſt, and particularly the blue, which is very difficult to uſe, remaining on the ſurface, or at leaſt entering very little. When the painting of all the pieces are finiſhed, they are carried to the furnace, or oven, to anneal, or bake the colours.

The furnace here uſed is ſmall, built of brick, from eighteen to thirty inches ſquare; at ſix inches from the bottom is an aperture to put in the fuel, and maintain the fire. Over this aperture is a grate, made of three ſquare bars of iron, which traverſe the furnace, and divide it into two parts. Two inches above this partition is another little aperture, through which they take out pieces to examine how the coction goes forward. On the grate is placed a ſquare earthen pan, ſix or ſeven inches deep; and five or ſix inches leſs every way than the perimeter of the furnace. On the one ſide hereof is a little aperture, through which to make trials, placed directly oppoſite to that of the furnaces deſtined for the ſame end. In this pan are the pieces of glaſs to be placed in the following manner. Firſt the bottom of the pan is covered with three ſtrata, or layers, of quick lime pulverized; thoſe ſtrata being ſeparated by two others of old broken glaſs, the deſign of which is to ſecure the painted glaſs from the too intenſe heat of the fire. This done, the glaſſes are laid horizontally on the laſt or uppermoſt layer of lime.

The firſt row of glaſs they cover over with a layer of the ſame powder, an inch deep; and over this, they lay another range of glaſſes, and thus alternately till the pan is quite full; taking care that the whole heap always end with a layer of the ſame powder.

The pan being thus prepared, they cover up the furnace with tiles, on a ſquare table of earthen ware, cloſely luted all round, only leaving five little apertures, one at each corner, and another in the middle, to ſerve as chimnies. Things thus diſpoſed, there remains nothing but to give the fire to the work. The fire for the firſt two hours muſt be very moderate, and muſt be increaſed in proportion as the coction advances, for the ſpace of ten or twelve hours; in which time it is uſually completed. At laſt the fire, which at firſt was charcoal, is to be of dry wood, ſo that the flame covers the whole pan, and even iſſues out at the chimnies.

During the laſt hours, they make eſſays, from time to time, by taking out pieces laid for the purpoſe through the little aperture of the furnace and pan, to ſee if the yellow be perfect, and the other colours in good order. When the annealing is thought ſufficient, they proceed with great haſte to extinguiſh the fire, which otherwiſe would ſoon burn the colours, and break the glaſſes.

GLASS *of Lead*, a glaſs made with the addition of a large quantity of lead; of great uſe in the art of making counterfeit gems.

The method of making it is this: Put a large quantity of lead into a potter's kiln; and keep it in a ſtate of fuſion, with a moderate fire, till it is calcined to a very grey, looſe powder: then ſpread it on the kiln, and give it a greater heat, continually ſtirring it, to keep it from gathering into lumps; continue this ſeveral hours, till the powder become of a fair yellow; then take it out, and ſift it fine: this is called calcined lead. Take of this calcined lead fifteen pounds, and cryſtalline or other frit, twelve pounds; mix theſe well together; put them into a pot, and ſet them in the furnace for ten hours; then caſt the whole, which will now be perfectly melted, into water; ſeparate the looſe lead from it; and return the metal into the pot; and after ſtanding in fuſion twelve hours more, it will be fit to work. This glaſs is capable of all the colours of the gems in great perfection.

Log-GLASSES, in the marine, glaſſes that run a half minute and quarter-minute, to meaſure the ſhip's way at the time of heaving the log. See this operation fully explained under the article LOG.

Watch GLASSES, certain glaſſes to meaſure and divide the watches at ſea; they are of four and two hours, and of half an hour. See the article WATCH.

GLAUBER's SALT, a cathartic or purging ſalt, thus made. Take of the cake that remains after the diſtillation of Glauber's ſpirit of ſea-ſalt; diſſolve it in hot water, and filtre the ſolution through paper: then reduce the ſalt into cryſtals. It is given in doſes from half an ounce to an ounce.

GLAUCOMA, in ſurgery, a diſeaſe of the eye, wherein the cryſtalline humour is turned of a bluiſh or greenish colour, and its tranſparency thereby impaired. See CATARACT.

The word is Greek, and derived from γλαυκὸς, a ſea-green, or greyiſh colour.

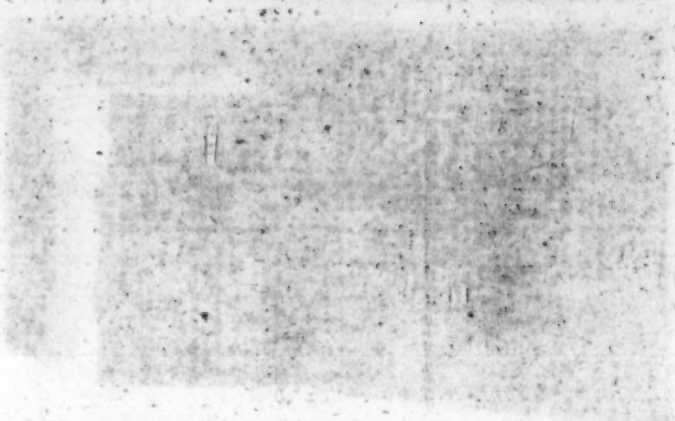
GLAZIER, an artificer who works in glaſs, and whoſe principal buſineſs is in fitting panes of glaſs to ſaſhes, pictures, &c. and in making lead lights for window frames, and cleaning of ſaſh-windows, &c.

GLAZING, in pottery, a compoſition applied to veſſels of earth, &c. to render them more beautiful, and prevent fluids from penetrating them.

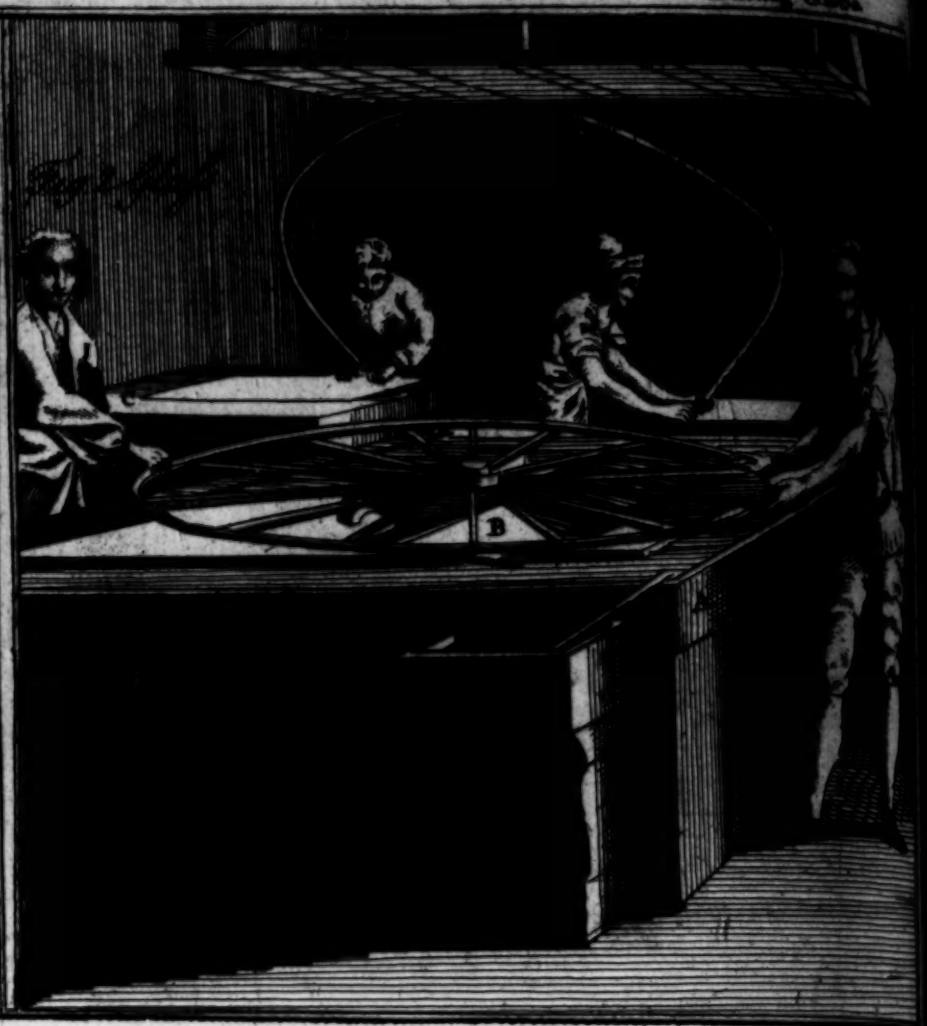
Black GLAZING is made of lead-aſhes, eighteen meaſures; iron-filings, three; copper-aſhes, three; and zaffer, two meaſures. This, when melted, will make a brown black; and, if you want it blacker, add more zaffer to it.

Blue GLAZING is thus prepared: take lead-aſhes, one pound; clear ſand or pebble, two pounds; ſalt, two pounds; white calcined tartar, one pound; Venice, or other glaſs, ſixteen pounds; and zaffer, half a pound; mix them well together, and melt them for ſeveral times, quenching them always in cold water. If you would have it fine and good, it will be proper to put the mixture into a glaſs furnace for a day or two.

Brown GLAZING is made of common glaſs and magneſe, or brown ſtone, of each one part; and lead of glaſs twelve parts.



5 JA 59



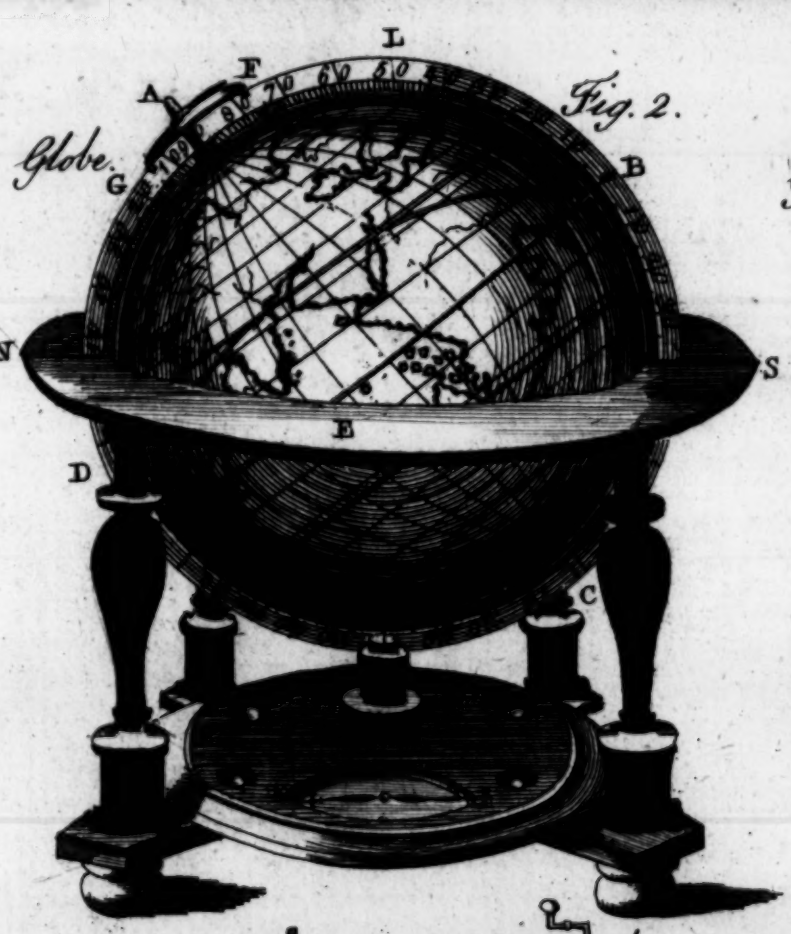


Fig. 2.

Fig. 3.

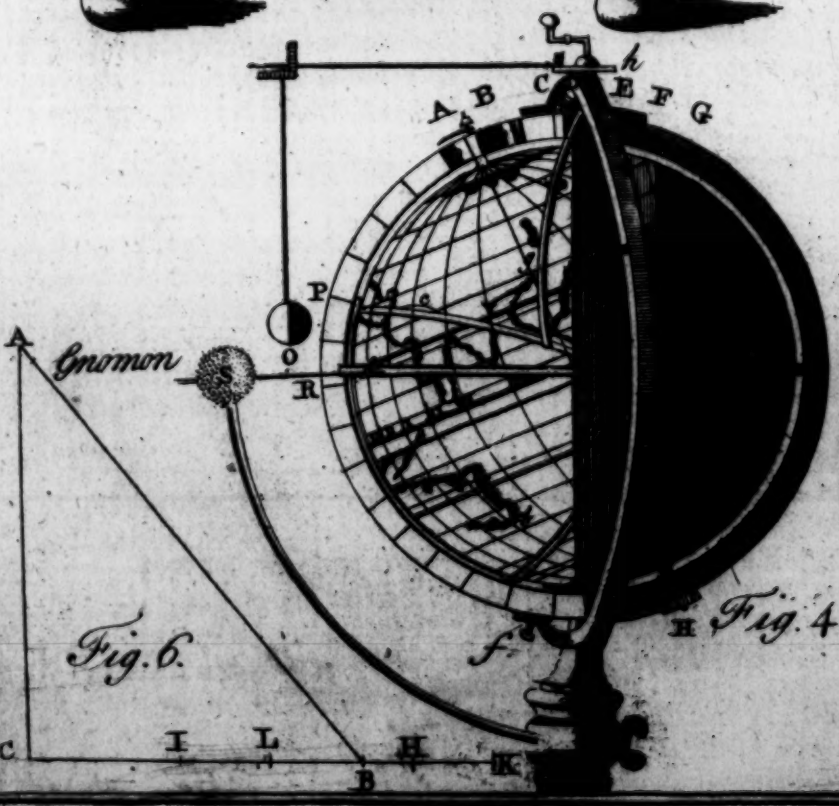


Fig. 4.

Fig. 5.

Fig. 6.

W The PATENT GLOBES

Fleſh-colour GLAZING is made of twelve parts of lead-aſhes, and one of white glaſs.

Gold-coloured GLAZING. — To make gold-coloured glazing, take of litharge three parts; of ſand or calcined flint, one part; pound and mix theſe very well together, then run them into a yellow glaſs with a ſtrong fire. Pound this glaſs and grind it into a ſubtile powder, which moiſten with a well ſaturated ſolution of ſilver, and make it into a paſte; which put into a crucible, and cover it with a cover. Give at firſt a gentle degree of fire, then increaſe it, and continue it till you have a glaſs, which will be green. Pound this glaſs again, and grind it to a fine powder; moiſten this powder with ſome beer, ſo that, by means of a hair pencil, you may apply it upon the veſſels, or any piece of earthen ware. The veſſels that are painted or covered over with this glazing, muſt be firſt well heated, then put under a muffle, and as ſoon as the glaſs runs, you muſt ſmoak them, and take out the veſſels. Mr. Heinſius of Peterſburgh, who ſent this receipt to the Royal Society, uſes the words *offlare debes fumum*, which is rendered ſmoak them, in the Tranſactions. Phil. Tranſ. N°. 466.

Green GLAZING may be prepared of eight parts of litharge, eight parts of Venice glaſs, four parts of braſs duſt; or of ten parts of litharge, twelve of flint or pebble, and one of æs uſtum, or copper aſhes.

Iron-colour GLAZING is prepared of fifteen parts of lead aſhes, fourteen of white ſand, five of copper aſhes, one of manganeſe, one of zaffer, and one of iron filings.

Liver-coloured GLAZING is prepared of twelve parts of litharge, eight of ſalt, ſix of pebble or flint, and one of manganeſe.

Purple-brown GLAZING conſiſts of lead aſhes, fifteen parts; clear ſand, eighteen parts; manganeſe, one part; white glaſs, fifteen meaſures; and one meaſure of zaffer.

Red GLAZING is made of antimony, two pounds; litharge, three; and ruſt of iron calcined, one; grind them to a fine powder.

Sea-green GLAZING is made of five pounds of lead aſhes, one pound of tin aſhes, three pounds of flint, three quarters of a pound of ſalt, half a pound of tartar, and half a pound of copper duſt.

White GLAZING. A fine white glazing for earthen ware is thus prepared: take two pounds of lead, and one of tin; calcine them to aſhes: of this take two parts, calcined flint or pebble, one part; and ſalt, one part; mix them well together, and melt them into a cake for uſe.

The white glazing for common ware is made of forty pounds of clear ſand, ſeventy-five pounds of litharge or lead aſhes, twenty-ſix pounds of pot-aſhes, and ten pounds of ſalt: theſe are three times melted into a cake, quenching it each time in clear cold water. Or it may be made of fifty pounds of clean ſand, ſeventy of lead aſhes, thirty of wood aſhes, and twelve of ſalt.

Yellow GLAZING is prepared of red-lead, three pints; antimony and tin, of each two pounds. Theſe muſt be melted into a cake, then ground fine; and this operation repeated ſeveral times. Or it may be made of fifteen parts of lead ore, three parts of litharge of ſilver, and fifteen parts of ſand.

Citron-yellow GLAZING is made of ſix parts of red-lead, ſeven parts of fine red brick-duſt, and two parts of antimony.

GLEBE, among miners, ſignifies a piece of earth, wherein is contained ſome mineral ore. See ORE.

GLEBE, in law, the land belonging to a pariſh church, beſides the tithes.

GLEET, in medicine, the flux of a thin limpid humour from the urethra. See GONORRHŒA.

GLENE, γλανη, in anatomy, a ſhallow cavity of any bone, which receives another bone in articulation. It alſo ſignifies the cavity or ſocket of the eye.

GLOBE, in the language of geometers, is a round ſolid body, formed by the rotation of a ſemi-circle about its diameter, remaining fixed until it return to the place again from whence it began to move; whence that point which was before in the middle of the diameter, and was the center of the generating circle, becomes now the center of the globe itſelf, as being equally diſtant from every point in the generated ſurface.

The artificial ſpherical body, from the exact ſimilitude it has to our ball of earth, as has been proved from manifold obſervations, and particularly from the obſervations made of eclipſes, has been choſen by geographers, as the fitteſt and propereſt inſtrument to delineate upon its outward ſurface the external appearance of this our globe; ſo that the terreſtrial globe is an artificial repreſentation of this our terraqueous globe, upon whoſe convex ſuperficies the form of the habitable world is delineated, and all the parts of the earth and ſea are deſcribed in their natural form, order, diſtance, and ſituation. See plate LXXI. *fig.* 2.

And becauſe the celeſtial bodies appear to us as if they were all placed in the ſame concave ſphere, aſtronomers have likewiſe made uſe of the external ſurface of the globe, to lay down the ſtars upon in their juſt and due poſition and diſtance, and according to their ſeveral magnitudes. So that as the terreſtrial globe is an artificial repreſentation of the ſurface of this our terraqueous globe, as it would appear to us if placed at a convenient diſtance without it, and we could either be conveyed round it, or view it revolving about its own axis; ſo the celeſtial globe is alſo an artificial and lively repreſentation of the ſtarry heaven, ſuppoſing ourſelves placed in the center and the globe to be tranſparent, as it appears to us, when placed upon the convex ſurface of the earth; and which, conſidering its infinite ſmallneſs, with regard to the unmeaſurable diſtance of the fixed ſtars, may be conſidered as the center of the univerſe. See *fig.* 3.

And as the geographers, for the ready diſtinction of places, have divided the ſurface of the earth into ſeveral parts, ſuch as Europe, Aſia, &c. and theſe are divided again into empires, kingdoms, &c. ſo the aſtronomers, that they may the better diſtinguiſh the fixed ſtars from one another, have in like manner divided them into ſeveral aſteriſms or conſtellations, each of which contains a ſyſtem of ſeveral ſtars that are ſeen in the heavens near to one another; and have reduced theſe conſtellations into the forms of certain animals, ſuch as bulls, bears, lions, men, &c. or in the image of things known to us, as of a crown, a harp, &c. which were eſteemed by the ancients upon religious and civil accounts, and are ſtill retained by the modern aſtronomers, to avoid that confuſion which would neceſſarily follow, in comparing their obſervations with thoſe that were formerly made.

And as the ancient aſtronomers for theſe reaſons very judiciouſly incloſed almoſt all the fixed ſtars that were known to them, in about forty eight conſtellations, ſo their ſucceſſors with equal right, when, by their diligent and frequent obſervations, they had greatly increaſed the number of ſtars in their catalogue, filled up moſt of the chaſms with new conſtellations of their own, and which are ſtill retained with great advantage to the obſervators.

Hence it appears that globes are not only the moſt proper contrivances for accounting for all the heavenly appearances ariſing from the diurnal and annual motion of the ſun, or the rotation of the earth about her own axis; but the nobleſt inſtrument as well for informing the mind, and giving it the cleareſt and moſt diſtinct idea of the thing propoſed to be done, as for giving ſolutions to all problems reſulting from it; and it is from a contemplation of theſe bodies and their ſeveral appendages, that aſtronomers have diſcovered ſo many excellent methods for the more eaſy and exact ſolution of the ſeveral aſtronomical and geographical propoſitions; whence it muſt be allowed, that to have a perfect knowledge of them is one of the ſureſt and beſt foundations that can be laid, by any one who would underſtand aſtronomy, geography, navigation, and their dependent ſciences.

Now in order to lay down the places of the ſtars upon the globe in their due ſituation and order, as well as to tranſfer the ſeveral diviſions of the earth, and to deſcribe on the terreſtrial globe the irregular terminations of land and ſea, it was abſolutely neceſſary to have ſome fixed or certain points, and conſequently lines, to begin to countor meaſure from; and this put mankind upon contriving thoſe ſeveral circles that are deſcribed upon the ſurface of the globes, which have their names given to them, ſome

according to the uſes for which they are deſigned, and others upon the account of thoſe places that they are ſuppoſed to poſſeſs; which circles the reader ought to be very well acquainted with, and of which he will meet with a full account under the article SPHERE.

We ſhall therefore proceed to give an account of the ſeveral appurtenances belonging to the globes.

1. The horizon is that great broad circle that divides the globe into two equal parts, termed the upper and lower hemiſpheres.

This circle is diſtinguiſhed into two kinds; the one is called the ſenſible or natural horizon, and is that circle which bounds the utmoſt proſpect of our ſight, when we view the heavens round from any part of the ſurface of the earth or ſea; the other is called the true or mathematical horizon, to which all aſtronomical calculations refer, and which obtains only in the mind, and ſuppoſes the eye to be placed in the very center of the earth, beholding half of the entire firmament at one view; which is repreſented by the uppermoſt ſurface of that broad wooden circle E (*fig.* 2.) upon the upper ſurface of the frame in which the globe is fixed, having two notches, the one in the north and the other in the ſouth part of it, for the brazen meridian to ſtand in.

And as the globe is made to ſlide up and down in theſe notches, this circle is of great uſe in determining the times of the riſing and ſetting of the ſun or ſtars, and their continuance above the horizon; in ſhewing us the reaſon of the increaſe and decreaſe of the length of the day and night, &c. in all places upon the earth by inſpection. Upon this broad horizon are deſcribed ſeveral other ſmall circles.

The firſt or innermoſt contains the twelve ſigns of the zodiac, each ſign being equal to thirty degrees. In the ſecond they are diſtinguiſhed by their proper names, marks, or characters. The third contains the days and months of the year, with the times when the principal fixed feaſts or faſts are to be celebrated.

The outermoſt circle contains the points of the compaſs with the names of the winds, as they are called by our ſeamen.

The next great circle B L D is the meridian, and is repreſented by the brazen frame or circle in which the globe is hung by the two wires which repreſent the two poles of the world, or the two extremities of the axis on which the globe hangs; within which it turns, dividing the globe in two equal parts, called the eaſtern and weſtern hemiſpheres, and from its being made of braſs is generally termed the brazen meridian. This circle is divided into four quadrants anſwering to 360 degrees, the entire circumference of every circle, two of which commence at the equator and increaſe towards each pole, in order to ſhew the declination of the ſun or ſtars on the celeſtial globe, and the latitudes of places on the terreſtrial globe; and the other two 90 degrees commence at either pole, and increaſe towards the equator for the more eaſy and ready adjuſting of the globe to the latitude of any particular place; for as the globe hangs in the meridian, and this is made to ſlide eaſily through the notches made in the north and ſouth points of the horizon, it is very eaſy to elevate or depreſs either pole of the globe, ſo as that it ſhall ſtand at any particular elevation.

And as the globe is made to turn within this circle, upon the two extremities of the axis, called the two poles, this brazen meridian may be made to repreſent the meridian of any place upon the terreſtrial globe, or a circle of right aſcenſion, to any point whatſoever upon the celeſtial globe, and is of great uſe in the ſolution of all problems relating to either globe.

The next great circle is the equinoctial, as it is called on the celeſtial globe, or the equator on the terreſtrial, and divides the globe into two equal parts, called the northern and ſouthern hemiſpheres; this circle is of uſe in determining the right aſcenſion of the ſun or ſtars on the celeſtial globe, and the longitudes of places on the terreſtrial.

The next great circle is the ecliptic, divided into twelve ſigns, and each ſign into thirty degrees, dividing the globe into two equal parts, called the northern and ſouthern hemiſpheres, with regard to the latitudes of the fixed ſtars and planets.

The ſun in his annual motion, according to Ptolemy, paſſes through the ecliptic, and if we add to it a broad ſpace of about eight degrees on each ſide, we ſhall have the zodiac, in which are the twelve aſteriſms, the moſt of which having the likeneſs of ſome living creature, was the occaſion of giving it this name; and becauſe the greateſt latitude of any of the planets never amounts to eight degrees, the motion of the moon, as well as of the reſt of the planets, will always be performed in this ſpace.

The quadrant of altitude is a narrow thin plate of pliable braſs, exactly anſwering to one fourth part of the meridian, and divided into 90 degrees, having a notch, nut, and ſcrew at one end, to faſten it to the zenith in the meridian; and being thus fixed and turned round upon a ſmall pivot, it ſupplied the place of an infinite number of vertical circles, and is very uſeful in determining the altitudes and azimuths of the celeſtial bodies, and in finding the times, &c.

The hour circle is a flat ring of braſs A B, ſo contrived that it may be taken off and fixed about either pole of the globe; and when it is ſo faſtened to the brazen meridian, the pole becomes its center, and to that end of the axis there is fixed an index that turns round as the globe itſelf is turned round, and points out upon the horary circle the hour given or required; for this horary circle being the repreſentation of the equator, which is carried about in one day, upon its upper ſurface are inſcribed the twenty-four hours of the natural day, at equal diſtances from one another; the twelfth hour next towards the zenith repreſenting twelve at noon, and the other neareſt the nadir repreſenting twelve at night; and the hours on the eaſtern ſide repreſenting the morning hours, and thoſe on the weſtern ſide repreſenting the afternoon hours; each hour anſwering to or correſponding with fifteen degrees of the great equinoctial, and is placed there for no other reaſon, but to ſave the trouble of reducing the degrees of the equinoctial into time, and the contrary.

The ſemi-circle of poſition, which is rarely or ever affixed to the globe, is a narrow thin plate of braſs, exactly anſwering to one half of the horizon divided into 180 degrees, and uſually affixed to the north and ſouth ends of the horizon or meridian, and is of uſe in making out the cuſps of the twelve houſes, as they are uſually called, in meaſuring the diſtances between any two places upon the ſurface of the earth, or any two ſtars upon the celeſtial globe, and may ſerve for a double quadrant of altitude, &c. And laſtly, if a mariner's compaſs, duly touched with a loadſtone, be fixed upon the pediment or wooden frame which contains the globe, or in ſome part of the broad wooden horizon, ſo that the true meridian of the compaſs may lie exactly parallel to the plane of the brazen meridian; the globes are prepared for any uſe to which they may be applied, and ready for the ſolutions of all problems that can be propoſed relating to them.

Problems more immediately relating to the terreſtrial GLOBE.

1. To find the diſtance between two places upon the globe: lay the quadrant of altitude upon the globe, ſo that the graduated edge may paſs through both the places, and obſerve how many degrees and minutes are between them: or thus, with a pair of compaſſes, ſet one foot upon the place, and open the compaſſes till the other foot ſtands upon the other place, then carry this diſtance to the equator, and ſetting one foot of the compaſſes upon the firſt meridian, obſerve how many degrees and minutes it is, which you may turn into Engliſh miles, by multiplying by 69.5.

2. To find all places that are at a given diſtance from a place given: for example, to find all places that are ten degrees from London; open a pair of compaſſes till they meaſure ten degrees upon the equator, then ſetting one foot upon London, turn the other round, and it will paſs through all the places that are ten degrees from London. By the ſame method we find all places that are at an equal diſtance from any given place: thus ſetting one foot of a pair of compaſſes upon London, and turning the other round through Rome, we ſee all places that are at the ſame diſtance from London that Rome is; as alſo what places are nearer to, or further from, London than Rome is.

3. To find the latitude of any place upon the globe: bring

bring the place to the meridian, and the degree and minute under which it lies ſhew its latitude; thus, bring London to the meridian, as in *fig.* . and it appears to be in 51° 31′ north latitude. If a place lying under the equator be brought to the meridian, the mark over it will be 00, becauſe it has no latitude. See LATITUDE.

4. To find all places which have the ſame latitude with a given place: ſuppoſe the given place be London, turn the globe round, and all places that paſs under the ſame point of the meridian that London doth, have the ſame latitude with London. To find the difference of latitude of two given places of the globe, as London and Paris: find the latitude of each place, and the difference is eaſily known.

5. To find the longitude of any place upon the globe: bring the place to the meridian, and the degree and minute of the equator the meridian then paſſes through is the longitude: thus, if Rome be brought to the meridian, its longitude will appear to be 12° 45′, upon our Engliſh globes, which have the firſt meridian drawn through London.

6. To find all places which have the ſame longitude with a given place, as Naples, it is ſufficient to bring Naples to the meridian; for all places then under the meridian have the ſame longitude with Naples; to find the difference of longitude of two places, find the longitude of each, and the difference is eaſily known.

7. To find a place upon the globe, its longitude and latitude being given: let the place be Aracta, the longitude of which is 44°. 55′, eaſt, from London, and latitude 36°. 0′ north: bring 44°. 55′ of the equator to the meridian, and under the 36°. of north latitude is Aracta, or the place where it ought to be: for this method will ſerve to inſert a place upon the globe, its longitude and latitude being given.

8. To rectify the globe to the latitude of any place: let the place be London, which lies in 51° 31′ north lat. move the braſs meridian in the notches till the north pole of the globe is elevated 51° 31′ above the north ſide of the horizon, that is, till the elevation of the pole is equal to the latitude, as in *fig.* 2.

9. To rectify the globe to the horizon of any place, as London: rectify the globe to the latitude of London, and bring London to the meridian; the horizon of the globe will then repreſent the horizon of London.

10. To find towards what place of the compaſs any place lies from a given place: if it be enquired towards what point of the compaſs Liſbon lies from London, rectify the globe to the horizon of London, ſcrew the center of the quadrant of altitude to the zenith point of the meridian, and turn the other end round till the graduated edge paſſes through Liſbon; then obſerve what point of the horizon in the circle in the winds the graduated edge paſſes through, which in the preſent caſe will be ſouth-weſt by ſouth, we ſay then Liſbon lies ſouth-weſt by ſouth from London.

11. To find the angle of poſition between any place and a given place: if it be enquired what is the angle of poſition of Liſbon and London, that is, what angle a great circle drawn through thoſe two places makes with the meridian of London, do every thing directed in the laſt problem, and obſerve how many degrees of the horizon are contained between the graduated edge of the quadrant altitude and meridian, which in the preſent caſe will be 33° 45′; the angle of poſition of Liſbon with regard to London is then 33° 45′.

12. To rectify the globe to the meridian of the place where we are, which is the ſame thing as to rectify the globe to the ſituation the earth is in every day when it is noon at that place: ſuppoſe the place is London, rectify the globe to the horizon of London, then turn the frame of the globe about till the north and ſouth points of the horizon of the globe are towards the north and ſouth: the ſouth may be known by the ſun at noon; the north by the pole-ſtar any time of the night: the globe may alſo be rectified to the meridian of any place, by a meridian line, or by a magnetic needle in a compaſs-box.

13. To rectify the globe to the preſent ſituation of the earth at any hour of the day: if you be in London, and would bring the globe into the ſituation the earth is in at four in the afternoon; rectify the globe to the meridian of London, and ſince the rotation of the earth carries the meridian and hour circles of London upon the globe coinciding with the like circles upon the earth, the ſituation of the globe will then correſpond to that of the earth; and if it ſtands in the ſun, it will be illuminated as the earth is.

14. The hour of the day being given at one place, as London, to find what hour it is at any other place upon the globe, as Naples: rectify the globe to the horizon of London, ſet the hour index at twelve at noon, turn the globe round till Naples is at the meridian, the index will then ſhew what hour it is at London, when it is noon at Naples: thus, if it points at 11 in the morning, it ſhews that it is 11 in the morning at London, when it is noon at Naples; and conſequently, whatever is the time given at London, the time of the day at Naples is an hour forwarder in the day; as if it be two in the afternoon at London, it is three in the afternoon at Naples, &c.

15. By knowing the time of any particular phænomenon, to find its poſition in the heavens, and where it may be viſible: bring that part of the globe to which the ſun, moon, or planet, will be vertical at the given time, to the zenith; then will ſuch phænomena as are momentary, be viſible to all the inhabitants of the earth that are now above the horizon: and if you rectify the quadrant, and lay it over each particular place, it will ſhew the altitude of it, as alſo the azimuth; oppoſite to which in the heavens is the vertic circle, in which the object will be found.

Thus the middle poſition of an eclipſe, tranſit, or occultation of the heavenly bodies may be nearly determined to any given place upon earth; but for the beginning and end of the ſame, a new operation will be required.

Problems more immediately relating to the Celeſtial GLOBE.

1. To find the right aſcenſion and declination of any ſtar. The given ſtar being found, bring the center of it to the ſouth-part of the meridian; then, right above it, you will find the declination, and in the equinoctial, the right aſcenſion: the former in the meridian, the latter cut by it.

2. To find the latitude and longitude of any ſtar, and the place of any ſtar, and the place of any planet, if marked on the globe: Firſt, bring the ſolſtitial colure to the brazen meridian, that is, to be directly under it: then elevate or depreſs the pole of that hemiſphere, in which the ſtar is found, till the poles of the ecliptic be exactly in the zenith and nadir, that is, till the ecliptic coincide with the horizon; keeping the globe in this poſition, rectify the quadrant of altitude, and move it till its graduated edge paſs or lie juſt over the center of the given ſtar, and there fix it. Then ſee what degree lies over-againſt the ſtar's center on the quadrant, and what portion of the ecliptic, now lying in the horizon, is cut by the quadrant, and the former will be the latitude of the ſaid ſtar, and the latter its longitude from Aries.

3. To find the riſing and ſetting of any ſtar, &c. The globe being rectified, bring the ſtar, whoſe riſing is required, to the eaſt part of the horizon; then the index of the hour circle will ſhew the hour and minute of its riſing; and in like manner, if the globe is turned to the weſt, it will ſhew the ſetting.

N. B. The riſing and ſetting of any ſtar being found in hours and minutes, the one ſubſtracted from the other, that is, the firſt from the laſt, gives the nocturnal arch, or the time of its ſtay above the horizon: but if the ſetting be leſs than the riſing, add twelve hours thereto, and from the whole deduct the riſing, and there will remain the ſum required.

4. To know at any time what ſtars are aſcending or deſcending, move the globe about, all things being rectified as above, to the given hour, and there fix it; and then obſerving what ſtars lie even with the horizon, thoſe on the eaſt ſide are ſaid to be riſing, and thoſe to the weſt ſetting. Thoſe under the meridian are ſaid to be culminating, being then full ſouth; as thoſe on the eaſt ſide of the globe are aſcending, and thoſe on the weſt deſcending, what are below the horizon being inviſible. Laſtly, if you place the quadrant of altitude over the center of any particular ſtar, it will ſhew you its altitude, and at the ſame time gives, upon the horizon, the azimuth required.

5. How to diſtinguiſh one ſtar from another in the heavens, and know them by their names on the globe. The meridian being placed due north and ſouth, and the globe rectified to the time and latitude required, each part of the globe will correſpond with its reſpective conſtellation in the heavens; ſo that if the globe was tranſparent, and the obſerver's eye placed in the center, every artificial ſtar painted upon it would appear concentric with the real one.

To find their amplitude, and their oblique aſcenſion or deſcenſion, obſerve what degree of the equator riſes or ſets with each, or any one of them, and that is the thing required; or if the amplitude be deſired, ſee upon what point of the compaſs they firſt appear, and then that diſtance from the eaſt, or weſt point of the horizon, reduced into degrees, will give the quantity of the amplitude required.

6. To find the hour of the night. The globe being rectified, bring the given ſtar to the quadrant of altitude, and ſee that the known elevation, which in this caſe muſt always be taken by obſervation with an inſtrument, be cut thereby, then will the hour index point to the time required; or if any known ſtar be in the meridian, the hour will be ſhewn, without knowing the altitude by the index only.—In like manner may be found the hour of the day by the ſun, his altitude being given.

7. To know what ſtars are viſible in any latitude, and in what latitude any particular ſtar firſt appears: rectify the globe according to the latitude of the place required, and then, turning it round, you will, according to the ſeaſon of the year, find what conſtellation will be viſible at that time.

If again you bring any particular ſtar to the meridian, and move the globe ſo as to bring the ſaid ſtar to the horizon, you will find, by allowing for the denſity of the atmoſphere in proportion to their ſeveral magnitudes, in what latitude it will firſt become viſible.

N. B. All thoſe ſtars whoſe diſtance from the elevated pole is leſs than the latitude of the place, never ſet to their reſpective inhabitants; as their oppoſite ones, being equally depreſſed, never riſe.

Patent GLOBES, thoſe with Mr. Neale's improvements, for which he obtained his majeſty's letters patent.

The terreſtrial globe, with theſe improvements, is repreſented in plate LXXI. *fig.* 4. the earth being ſuppoſed in that part of its orbit where the north-pole A is at its neareſt approach to the ſun S, which accordingly by the index or ray S R, points to the tropic of Cancer; *b* is a moveable circle, which, ſet to the latitude of a given place, will cauſe the ſemicircle *c* to point out the zenith of the ſaid place; *d* repreſents the ecliptic, *e* the equator, and *f* a ſcrew by which the annual motion may be ſeparated from the diurnal; *g* is a ſemi-circle which always moves at 90 degrees diſtance from the moon, and thereby becomes the lunar horizon for the northern hemiſphere; *h* is an inclined plane on which the ſtem of the moon P O moves, thereby cauſing the moon itſelf to ſhew its ſeveral latitudes, nodes, &c. and by this plane moving the contrary way, in a little more than nineteen of the annual revolutions of the globe, is ſhewn the retrograde motion of the nodes.

This globe is mounted with the horizon *a* fixed vertically, and placed ſo as to move upon its own axis A H, whereby it repreſents the diurnal motion of the earth. Hence if the globe be turned round its own axis, by means of the winch at top, the ray from the ſun will, in this ſituation, deſcribe the tropic of Cancer: the whole arctic circle will be taken into the enlightened hemiſphere, and that of the antarctic circle will be involved in darkneſs. Let us now ſuppoſe the globe turned thirty times about by the winch, the north-pole will then be ſituated as at B, and the index from the ſun will point to the ſign Leo on the ecliptic *d*: after turning the globe thirty times more, the north-pole will be removed to C, and the index advanced to Virgo; and in this manner may the phænomena of the earth's annual motion be traced through all the ſigns of the ecliptic and ſeaſons of the year; the index or pointer deſcribing a ſpiral line, which every day at noon, or turn of the globe, falls at the diſtance of about fifteen minutes from that of the preceding day. When the earth is ſo far advanced in its orbit, that the index S R points to the equator, the reaſon will appear very clear why the days and nights are then equal all the world over; for both poles are now ſeen in the horizon, which, being the boundary of light and darkneſs, biſects all the parallels of latitude, and cauſes an equal diſtribution of day and night throughout the whole earth.

If the rotation of the globe be continued, the obſerver will ſee the north-pole deſcend juſt as many degrees below the horizon, as the pointer has advanced ſouth of the equator; and when it is arrived at the tropic of Capricorn, all that part of the globe within the arctic circle will be involved in continual darkneſs, whilſt that within the antarctic circle enjoys uninterrupted day.

At the diſtance of 90 degrees from the moon, as has been already obſerved, is placed a ſemi-circle, which being fixed on the center of the moon's motion, always moves round with her; thereby ſhewing, throughout her courſe, all thoſe countries in the northern hemiſphere, to which ſhe is at any particular time riſing, thoſe where ſhe is then ſetting, and thoſe to whom ſhe is then due ſouth; as alſo the exact difference of time between the riſing or ſetting of the ſun and moon.

The celeſtial globe (*fig.* 5.) is mounted not quite ſo differently from the common globes, as the terreſtial one; its horizon being as uſual, and the globe moveable to the latitude of any country; only inſtead of thoſe upright pillars to ſupport the horizon, as in common ones, here ſemicircles are fixed on the pedeſtal, and from the pole of the equator a motion is conveyed to the pole of the ecliptic; where two arms or indexes are placed, on which are fixed the artificial ſun and moon. Theſe, as the globe is turned about its axis by the winch W, keep their exact motions over the ſame, by means of the wheel-work at Q, in like manner as thoſe luminaries do in the heavens; ſo that being once ſet right by an ephemeris, they will remain ſo, and thereby ſhew the riſing and ſetting of thoſe luminaries, with the length of the day and night, together with the true cauſe of all the viciſſitudes of the ſeaſons; and how, notwithſtanding their apparent motion from eaſt to weſt, they really move from weſt to eaſt; the moon, in a very little more than twenty-nine days and a half; and the ſun, in a year. See EARTH, SUN, and MOON.

To the center of the ſun two jointed ſtems are occaſionally ſcrewed on, and to theſe are fixed Mercury and Venus; which by the ſaid joints may be ſet to their proper ſtations, and thereby ſeveral entertaining problems may be ſolved.

From what has been ſaid it is evident, that the uſual problems on the common globes, and moſt of thoſe with the orrery, may be ſolved by theſe curious machines.

Problems peculiar to the patent GLOBES.—1. *To rectify theſe globes.* This, on the celeſtial globe, is performed in the ſame manner as on the common globes: but the terreſtrial globe admits of no ſuch rectification; for inſtead of raiſing or lowering the pole of the globe itſelf, according to the latitude of the place, we muſt here rectify a moveable brazen horizon, ſo as that the given place ſhall be in the zenith of the ſaid horizon. 2. *To rectify the ſun and moon according to theſe globes.* Having found the ſun's place in the ecliptic, in the common way, turn the ſun about by its ſtem till it is directly oppoſite to the ſame ſign and degree of the ecliptic upon the globe. The ſame may alſo be done with reſpect to the moon, having firſt found her place by an ephemeris for that day. 3. *To ſhew on theſe globes the cauſe of an eclipſe of the ſun or moon.* This is ſelf-evident on either globe, by turning them by the winch till the two luminaries come in conjunction with, or oppoſition to each other, provided they happen to be in or near the nodes. 4. *To explain the reaſon why they happen no oftener.* This will appear no leſs evident, by ſetting the moon to any conſiderable latitude, and turning the globe till ſhe comes in conjunction with the ſun; for then the pointer from the ſun will be ſeen to paſs either above or below her, according as ſhe is in north or ſouth latitude; ſo that there can be no eclipſe of the ſun, when the moon is not in or near her nodes. 5. *To exhibit a natural repreſentation of the retrograde motion of the moon's nodes.* This is done by only turning the globe with the winch, and obſerving that the place where the moon

moon croſſes the ecliptic, in its motion round the earth, is every time in different places; which are found to be retrograde, or contrary to the order of the ſigns; that is, they move backward through all the ſigns from eaſt to weſt. 6. *The day and hour of a ſolar eclipſe being given, to find all thoſe places on the globe to which the ſame will be viſible.* Turn the globe till the given day comes oppoſite to the ſun, and the place where you are to the pointer; ſet the index to 12, then turn the globe till the index points to the given hour; ſet the moon in conjunction with the ſun; then all the places above the ſolar horizon are thoſe to which the eclipſe will be viſible. 7. *To find the ſame in a lunar eclipſe.* Proceed as in the laſt problem; only inſtead of the moon's being in conjunction, ſhe muſt now be in oppoſition; and inſtead of viewing all the countries on that ſide of the horizon towards the ſun, you muſt ſurvey thoſe on the oppoſite ſide; for they are the countries to which the lunar eclipſe will be viſible. 8. *To exhibit the phaſes of Mercury and Venus.* Set them to any given ſtation within the enlightened hemiſphere of the celeſtial globe; and it may be obſerved, that their different phaſes in thoſe ſeveral ſtations will be in all reſpects analogous to thoſe of our moon. 9. *To demonſtrate, that in a certain latitude, the inhabitants may obſerve the ſun, moon, Mercury, and Venus, all riſing together on a particular day; and yet, on the ſame day, may ſee the moon ſet twelve hours before the ſun, Mercury fourteen hours after the moon, and Venus ſix hours after all three.* Rectify the globe to the latitude of 66 ½; let the moon riſe near the tropic of Capricorn, the ſun at the beginning of Aries, Mercury about fifteen degrees in Aries, and Venus about eighteen degrees in Taurus, with five or ſix degrees of north latitude; then turn the globe about, and you will find by the index the difference of time ſought for. 10. *To find the height of the diurnal arch of the luminaries and planets aforeſaid, on any given day.* The globe being rectified, ſcrew the quadrant of altitude to the zenith of the place, which bring to the meridian; then turn about the globe to the given day, and the degree of the quadrant, each reſpectively paſs over, is the height of their arches ſought. 10. *To ſhew why neither Mercury nor Venus can be ſeen on the meridian of London at midnight, as all the other planets at certain times are.* Set theſe two planets to their greateſt elongation or diſtance from the ſun; and by turning the globe about the impoſſibility of the thing will be evident.

GLOBULAR, in general, an appellation given to things of a roundiſh figure, like that of a globe.

GLOBULAR *Projection.* See MAP.

GLOBULE, a diminutive of globe, frequently uſed by phyſicians in ſpeaking of the red ſpherical particles of the blood. See BLOOD.

GLORIA PATRI, among eccleſiaſtical writers. See DOXOLOGY.

GLORIOSA, ſuperb lilly, in botany, a genus of plants, the flower of which conſiſts of ſix oblongo-lanceolated, undulated, and very long petals, reflex nearly to the baſe; the fruit is an oval pellucid capſule, containing three cells, and numerous globoſe ſeeds, diſpoſed in a double ſeries.

GLOSS, in matters of literature, denotes an expoſition or explication of the text of any author, whether in the ſame language, or any other; in which ſenſe it differs little from commentary. See COMMENTARY.

GLOSS, among artificers, the luſtre or brightneſs ſet upon cloth, ſilk, and the like. See CLOTH, SILK, &c.

GLOSSARY, *Gloſſarium*, a ſort of dictionary, explaining the obſcure and antiquated terms in ſome old author; ſuch are Du Cange's Latin and Greek Gloſſaries, Spelman's Gloſſary, and Kennet's Gloſſary at the end of his Parochial Antiquities.

GLOSSOCOMON, in ſurgery, an inſtrument, or ſort of caſe, contrived by the ancient ſurgeons, for containing a fractured leg or thigh.

GLOSSOCOMON, in mechanics, the name by which Hiero calls a machine, compoſed of ſeveral dented wheels with pinions, and uſed for raiſing great weights.

GLOSSOPETRA, in natural hiſtory, a genus of extraneous foſſils, ſo called from their having been ſuppoſed the tongues of ſerpents turned to ſtone, though they are really the teeth of ſharks, and are daily found in the mouths of thoſe fiſhes, wherever taken.

GLOTTIS, in anatomy, the mouth or aperture of the larynx, through which the air aſcends and deſcends in reſpiring. It is of an elliptic figure, and furniſhed with cartilages and muſcles, by means of which it is occaſionally dilated or ſtraitened, ſo as to give that wonderful variety of notes, of which the voice is capable, in ſpeaking and ſinging. See the article LARYNX.

GLOW-WORM, the Engliſh name of an inſect, called by zoologiſts cicindela. See the article CICINDELA.

GLUE, among artificers, a tenacious viſcid matter, which ſerves as a cement to bind or connect things together.

Glues are of different kinds, according to the various uſes they are deſigned for, as the common glue, glove-glue, and parchment glue; whereof the two laſt are more properly called ſize. See SIZE.

The common or ſtrong glue is chiefly uſed by carpenters, joiners, cabinet-makers, &c. and the beſt kind is that made in England, in ſquare pieces of a ruddy brown colour; and, next to this, the Flanders glue. It is made of the ſkins of animals, as oxen, cows, calves, ſheep, &c. and the older the creature is, the better is the glue made of its hide. Indeed, whole ſkins are but rarely uſed for this purpoſe, but only the ſhavings, parings, or ſcraps of them; or the feet, ſinews, &c. That made of whole ſkins, however, is undoubtedly the beſt; as that made of ſinews is the very worſt.

The Method of making GLUE. In making glue of parings, they firſt ſteep them two or three days in water; then waſhing them well out, they boil them to the conſiſtence of a thick jelly; which they paſs, while hot, through ozier-baſkets, to ſeparate the impurities from it, and then let ſtand ſome time, to purify it further: when all the filth and ordures are ſettled to the bottom of the veſſel, they melt and boil it a ſecond time. They next pour it into flat frames or moulds, whence it is taken out pretty hard and ſolid, and cut into ſquare pieces or cakes. They afterwards dry it, in the wind, in a ſort of coarſe net; and at laſt ſtring it, to finiſh its drying. The glue made of ſinews, feet, &c. is managed after the ſame manner; only with this difference, that they bone and ſcour the feet, and do not lay them to ſteep.

The beſt glue is that which is oldeſt; and the ſureſt way to try its goodneſs, is to lay a piece to ſteep three or four days, and if it ſwell conſiderably without melting, and when taken out reſumes its former drineſs, it is excellent.

A glue that will hold againſt fire or water, may be made thus: mix a handful of quick-lime with four ounces of linſeed-oil; boil them to a good thickneſs, then ſpread it on tin-plates in the ſhade, and it will become exceeding hard, but may be eaſily diſſolved over a fire, as glue, and will effect the buſineſs to admiration.

Method of preparing and uſing GLUE. Set a quart of water on the fire, then put in about half a pound of good glue, and boil them gently together till the glue be entirely diſſolved and of a due conſiſtence. When glue is to be uſed, it muſt be made thoroughly hot; after which, with a bruſh dipped in it, beſmear the faces of the joints as quick as poſſible; then clapping them together, ſlide or rub them lengthwiſe one upon another, two or three times, to ſettle them cloſe; and ſo let them ſtand till they are dry and firm.

Fiſh-GLUE, a name ſometimes given to ichthyocolla. See ICHTHYOCOLLA.

GLUME, *Gluma*, among botaniſts, a kind of cup, conſiſting of two or three membranous valves, which are often pellucid at their edges. This ſort of cup belongs to the graſſes.

GLUTÆUS, in anatomy, the name of three muſcles, which form the buttocks, and from their ſize are called maximus, medius, and minimus. They all ariſe in the external ſurface of the ilium, iſchium, and os ſacrum: the termination of the firſt, or greateſt, is about four fingers-breadth from the great trochanter, and the terminations of the two others are in this trochanter.

GLYCINE, ſcarlet-pea, in botany, a genus of plants, with a papilionaceous flower, and an oblong bilo-

cular pod, containing a number of kidney ſhaped ſeeds, of a ſcarlet colour, ſpotted with black.

GLYCONIAN VERSE, in ancient poetry, conſiſts of three feet, whereof the firſt is a ſpondee, the ſecond a choriambus, and the laſt a pyrrhichius; or the firſt may be a ſpondee, and the other two dactyls.

GLYCYRRHIZA, liquorice, in botany, a genus of plants, with a papilionaceous flower, conſiſting of four petals; the fruit is an oblong, compreſſed, and uniloçular pod, containing a few kidney-ſhaped ſeeds.

GLYPH, in ſculpture and architecture, denotes any canal or cavity, uſed as an ornament.

GLYSTER, or CLYSTER, among phyſicians. See CLYSTER.

GNAPHALIUM, cudweed, in botany, a genus of plants, with numerous hermaphrodite flowers on its diſc, and a few female ones on the verge; there is no pericarpium; the ſeeds, which are oblong, ſingle, and crowned with down, being contained in the cup.

GNAT, in zoology, an inſect of the fly-kind, called by authors culex. See CULEX.

GNOME is often uſed in a ſynonymous ſenſe with apophthegm. See APOPHTHEGM.

GNOMES, *Gnomi*, certain inviſible people, who, according to the Cabbaliſts, inhabit the inner parts of the earth. They are ſuppoſed ſmall in ſtature, and the guardians of quarries, mines, &c. See the article CABBALISTS.

GNOMON, in dialling, is the ſtyle or pin of a dial, whoſe ſhadow ſerves to point out the hour.

The word is Greek, and derived from γνωμων, which imports ſomewhat that makes known; becauſe the ſtyle indicates the hour.

The gnomon of every dial is ſuppoſed to repreſent the axis of the world, and therefore the two ends, or extremities thereof, muſt anſwer to the north and ſouth poles.

GNOMON, in geometry. If a parallelogram be divided into four leſſer ones by two right lines drawn reſpectively parallel to the ſides thereof, and one of theſe parallelograms be retrenched, or taken away; the remaining three will form a gnomon.

GNOMON, in aſtronomy, a pillar, &c. erected to find meridian altitudes of the ſun and ſtars by its ſhadow.

The method of finding the ſun's meridian altitude by the help of a gnomon was much uſed by the ancients. It muſt be obſerved, that the greater the height of the ſun is, the ſhorter is the ſhadow of a gnomon, and the contrary. In making obſervations for determining the meridian altitudes of the ſun and ſtars, it was uſual to ſet down what proportion the length of the ſhadow bore to the height of the pillar; that is, the height of the pillar being divided into a certain number of equal parts, to ſay how many of theſe parts the length of the ſhadow amounted to at the equinoxes or ſolſtices. The moſt ancient obſervation of this kind, that we meet with, is that made by Pytheas, in the time of Alexander the Great, at Marſeilles, where he found the height of the gnomon was to the meridian ſhadow, at the ſummer ſolſtice, as $213\frac{1}{3}$ to 600; the ſame as Gaſſendus found it to be, by an obſervation made at the ſame place, almoſt 2000 years after, in the year 1636.

A very exact method whereby to obſerve the meridian altitude of the ſun is as follows.—Make a circular perforation in a braſs plate, to tranſmit enough of the ſun's rays to exhibit his image on the floor: fix this plate parallel to the horizon in a high place proper for obſervation: then let fall a plumb-line, whereby to meaſure the height of the perforation above the floor. Take care the floor be perfectly level, and exactly horizontal; and let it be whitened over, to exhibit the ſun more diſtinctly: draw a meridian line thereon, paſſing through the foot of the gnomon, that is, through the point where the center of the plumb-line marks the floor: note the extreme points of the ſun's diameter on the meridian line K and I (plate LXXI. *fig.* 6.) and from each ſubtract a right-line equal to the ſemi-diameter of the aperture, viz. K H on one ſide, and I L on the other: then will H L be the image of the ſun's diameter, which, biſected in B, gives the point on which the rays fall from the center of the ſun.

Now having given the right-line A B, and the altitude of the gnomon, with the angle A, which is right; the angle A B G, or the apparent altitude of the ſun's center, is eaſily found: for aſſuming one of the given ſides A B for radius; A G will be the tangent of the oppoſite angle B. Then ſay, as one leg A B: is to the other A G:: ſo is the whole ſine: to the tangent of the angle B.

GNOMONICS, *Gnomonica*, the art of dialling, or of drawing ſun and moon dials, on any given plane. See the article DIAL.

GNOSTICS, in church-hiſtory, chriſtian heretics ſo called, it being a name which almoſt all the ancient heretics affected to take, to expreſs that new knowledge and extraordinary light to which they made pretenſions; the word gnoſtic ſignifying a learned, or enlightened perſon.

St. Epiphanius aſcribes the origin of the Gnoſtics to Simon Magus, and ſays that they acknowledged two principles, a good and a bad. They ſuppoſed there were eight different heavens, each of which was governed by its particular prince: the prince of the ſeventh heaven, whom they named Sabaoth, created the heavens and the earth, the ſix heavens below him, and a great number of angels. In the eighth heaven they placed their Barbelo, or Barbero, whom they ſometimes called the father and ſometimes the mother of the univerſe. All the Gnoſtics diſtinguiſhed the creator of the univerſe from God, who made himſelf known to men by his Son, whom they acknowledged to be the Chriſt. They denied that the Word was made fleſh; and aſſerted that Jeſus Chriſt was not born of the Virgin Mary, that he had a body only in appearance, and that he did not ſuffer in reality. They neither believed a reſurrection, nor a judgment to come; but imagined that thoſe who had not been inſtructed in their maxims, would return into the world, and paſs into the bodies of hogs and other of the like animals. They had ſeveral apocryphal books, as the Goſpel of St. Philip, the Revelations of Adam, the Goſpel of Perfection, &c.

GOAT, *Capra*, in zoology, a quadruped of the order of the pecora. See the article CAPRA.

GOAT's BEARD, *Tragopogon*, in botany. See the article TRAGOPOGON.

GOAT's EYE, *Ægias*, among ancient phyſicians. See ÆGIAS.

GOAT-SUCKER, *Caprimulgus*, in ornithology, a ſpecies of hirundo. See HIRUNDO.

GOAT's-THORN, the ſame with tragacanth.

GOBELINS, a celebrated manufactory for tapeſtry, eſtabliſhed by Mr. Colbert, at Paris, in 1667. See TAPESTRY.

GOBONE, or GOBONY, in heraldry, the ſame with componed. See COMPONED.

GOD, *Deus*, the Supreme Being, the firſt cauſe or creator of the univerſe, and the only true object of religious worſhip.

The Hebrews called him Jehovah; which name they never pronounced, but uſed inſtead of it the words Adonai, or Elohim. See the articles ADONAI, ELOHIM, and JEHOVAH.

God, ſays Sir Iſaac Newton, is a relative term, and has reſpect to ſervants. It denotes, indeed, an eternal, infinite, abſolutely perfect being: but ſuch a being without dominion, would not be God. The word God frequently ſignifies lord, but every lord is not God. The dominion of a ſpiritual being, or lord, conſtitutes God; true dominion, true God; the ſupreme, ſupreme; pretended, pretended. From ſuch true dominion it follows that the true God is living, intelligent, and powerful; and from his other perfections, that he is ſupreme, or ſupremely perfect. He is eternal and infinite, omnipotent and omniſcient; that is, he endures from eternity to eternity, and is preſent from infinity to infinity. He governs all things that exiſt, and knows all things that are to be known. He is not eternity or infinity, but eternal and infinite. He is not duration and ſpace, but he endures and is preſent: he endures always, and is preſent every where; and by exiſting always and every where, conſtitutes the very things we call duration and ſpace, eternity and infinity. He is omnipreſent, not only virtually, but ſub-

ſubſtantially; for power without ſubſtance cannot ſubſiſt. All things are contained and move in him, but without any mutual paſſion, that is, he ſuffers nothing from the motions of bodies, nor do they undergo any reſiſtance from his omnipreſence.

It is confeſſed, that God exiſts neceſſarily; and by the ſame neceſſity he exiſts always and every where. Hence alſo he muſt be perfectly ſimilar; all eye, all ear, all brain, all arm, all perfection, intelligence, and action; but after a manner not at all corporeal, not at all like men; after a manner altogether unknown to us. He is deſtitute of all body, and bodily ſhape, and therefore cannot be ſeen, heard, or touched; nor ought to be worſhipped under the repreſentation of any thing corporeal. We know him only by his properties, or attributes, by the moſt wiſe and excellent ſtructure of things, and by final cauſes: but we adore and worſhip him only on account of his dominion: for God, ſetting aſide dominion, providence, and final cauſes, is nothing elſe but fate and nature.

The plain argument, ſays Mr. Maclaurin, for the exiſtence of the Deity, obvious to all, and carrying irreſiſtible conviction with it, is from the evident contrivance and fitneſs of things for one another, which we meet with throughout all parts of the univerſe. There is no need of nice or ſubtile reaſonings in this matter; a manifeſt contrivance immediately ſuggeſts a contriver. It ſtrikes us like a ſenſation; and artful reaſonings againſt it may puzzle us, but it is without ſhaking our belief. No perſon, for example, that knows the principles of optics and the ſtructure of the eye, can believe that it was formed without ſkill in that ſcience; or that the ear was formed without the knowledge of ſounds; or that the male and female in animals were not formed for each other, and for continuing the ſpecies. All our accounts of nature are full of inſtances of this kind. The admirable and beautiful ſtructure of things for final cauſes, exalt our idea of the contriver: the unity of deſign ſhews him to be one. The great motions in the ſyſtem, performed with the ſame facility as the leaſt, ſuggeſt his Almighty power, which gave motion to the earth and the celeſtial bodies with equal eaſe as to the minuteſt particles. The ſubtilty of the motions and actions in the internal parts of bodies, ſhews that his influence penetrates the inmoſt receſſes of things, and that he is equally active and preſent every where. The ſimplicity of the laws that prevail in the world, the excellent diſpoſition of things, in order to obtain the beſt ends, and the beauty which adorns the works of nature, far ſuperior to any thing in art, ſuggeſt his conſummate wiſdom. The uſefulneſs of the whole ſcheme, ſo well contrived for the intelligent beings that enjoy it, with the internal diſpoſition and moral ſtructure of thoſe beings themſelves, ſhew his unbounded goodneſs. Theſe are the arguments which are ſufficiently open to the views and capacities of the unlearned; while, at the ſame time, they acquire new ſtrength and luſtre from the diſcoveries of the learned. The Deity's acting and interpoſing in the univerſe, ſhew that he governs, as well as formed it; and the depth of his counſels, even in conducting the material univerſe, of which a great part ſurpaſſes our knowledge, keep up an inward veneration and awe of this great Being, and diſpoſe us to receive what may be otherwiſe revealed to us, concerning him. It has been juſtly obſerved that ſome of the laws of nature now known to us, muſt have eſcaped us, if we had wanted the ſenſe of ſeeing. It may be in his power to beſtow upon us other ſenſes, of which we have at preſent no idea; without which it may be impoſſible for us to know all his works, or to have more adequate ideas of himſelf. In our preſent ſtate, we know enough to be ſatisfied of our dependency upon him, and of the duty we owe to him, the Lord and diſpoſer of all things. He is not the object of ſenſe; his eſſence, and indeed that of all other ſubſtances, is beyond the reach of all our diſcoveries; but his attributes clearly appear in his admirable works. We know, that the higheſt conceptions we are able to form of them, are ſtill beneath his real perfections; but his power and dominion over us, and our duty towards him, are manifeſt.

With reſpect to Chriſtians it will be ſufficient to mention, that they were very early divided in opinion, with regard to the nature and eſſence of the Supreme Being; a great part worſhipping three perſons in the unity of the godhead, while others abſolutely rejected a trinity of perſons, and aſſerted the unity of the Divine nature, both with reſpect to perſon and ſubſtance. See ARIAN and TRINITARIAN.

GODDESS, a heathen deity of the female ſex.

GOD-FATHERS and GOD-MOTHERS, perſons who undertake to anſwer for the future conduct of infants at their baptiſm.

This cuſtom is of great antiquity in the Chriſtian church, and was, in all probability, inſtituted to prevent children from being brought up in idolatry, in caſe their parents ſhould die before they arrived at years of diſcretion.

GOLD, *Aurum*, the ſol and rex metallorum of the chemiſts, is a yellow metal ſcarce at all elaſtic or ſonorous, very ſoft and flexible, the moſt ductile of all metallic bodies. Dr. Halley took one grain of gilt ſilver, of which only one forty-eighth part was gold: this grain was drawn into a wire two ells in length, which examined by a microſcope, appeared every where covered with the gold: a piece of the wire being put into aqua-fortis, the ſilver was eaten out, and a tube of gold remained, which notwithſtanding its extreme thinneſs, was ſtill opake.

Gold is of all natural bodies the moſt ponderous: hence it ſinks into quickſilver, whilſt all other ſubſtances, platina excepted, ſwim on the ſurface. It is upwards of nineteen times heavier than an equal bulk of water: a Paris cubic foot is reckoned to weigh 1368 pounds. From its greater denſity it becomes ſenſibly hotter than other bodies when laid along with them in hot water.

Gold melts in a red heat, much ſooner than copper or iron; though much later than lead or tin. It is of all metals the moſt fixed, or permanent in the fire: an ounce has been kept for two months together, in a glaſs-houſe furnace, which of all furnaces gives the moſt vehement heat, without ſuffering the leaſt diminution of its weight. Homberg relates, that in the focus of Tſchirnhaus's large burning-glaſs, it loſt its fixity; that it ſmoked, diminiſhed in volume, changed into a red earth, and at laſt even vitrified: but as the gold had been placed on a piece of charcoal, the vitreous matter probably proceeded from the aſhes of the coal. Mr. Geoffroy often aſſured me, whilſt we were making experiments together with the ſame burning lens, that no ſuch vitrification had been obſerved, when any thing beſides charcoal was uſed for the ſupport.

Gold diſſolves in a mixture of the nitrous and marine acids, called, from its action on this rex metallorum, aqua-regia: either of theſe acids ſingly have no effect upon it; nor is it acted on by the vitriolic. Boerhaave ſays that ſea-ſalt or ſal-gem are the only menſtrua of gold; and that both theſe ſalts diſſolve it, whether applied in the form of a lixivium or ſpirit: experience affords no foundation for this aſſertion. The ſolution in aqua-regis is of a gold yellow colour, and ſtains the ſkin, wherever it touches, of a fine purpliſh red, which is not eaſily got off.

Singular and unalterable as the properties of gold appear to be, they are eaſily maſtered by chemiſtry. A ſingle grain of tin will deſtroy the ductility of a thouſand grains of gold; rendering the moſt malleable gold not only incapable of being extended, but of bearing the hammer at all. In Kunckel's *Laboratorium Chymicum*, there are proceſſes by which gold may be ſublimed and diſtilled over the helm; and ſurely what ſublimes or diſtils has loſt its fixity. Mercury-ſublimate and ſal-ammoniac volatilize. There is a certain common and well known ſubject, plentifully made uſe of by every body, which robs gold of its luſtre, its colour, and its malleability, and renders it white and brittle: but this ſubſtance, as it might give riſe to abuſes, I forbear to name. Gold melted repeatedly with borax becomes paler and paler on every fuſion; and there are ſundry other ſubſtances, as butter of antimony, zinc, and the ſmoky ſpirit of tin, from which it ſuffers notable alterations. After all theſe changes, however, it is ſtill reducible to its original ſtate; the brittle, the white, the ſublimed, the diſtilled gold, may all be reſtored to the purity

purity and properties of the gold at firſt. The chemiſts have long laboured in the deſtruction of this metal, and allow it to be eaſier to make gold than to deſtroy it; tho' it does not appear that either of theſe problems is entirely beyond the reach of art: for a little gold has in divers experiments been produced; and gold was deſtroyed in the preſence of Mr. Boyle.

Aqua-regia, the proper menſtruum of gold, is commonly prepared by diſſolving one part of ſal-ammoniac in four of aqua-fortis or ſpirit of nitre. Kunckel directs a commodious method of obtaining the exact proportions neceſſary for the ſolution. The gold, either in form of leaves, or granulated, or flatted into thin plates, then made red-hot and cut in ſmall pieces, is to be put into a ſuitable quantity of aqua-fortis, a gentle heat applied, and ſome powdered ſal-ammoniac added gradually, by little and little at a time, till the whole of the gold is diſſolved.

The largeſt quantities of gold are met with in the Spaniſh Weſt-Indies: there are mines of it alſo in ſome parts of Europe, particularly in Hungary and Tranſylvania. It is either imbedded in flinty or other ſtones, or intermingled among the looſe earth; always in its metallic form, though the particles are commonly very ſmall and often indiſtinguiſhable. It is never found in the ſtate of a true ore, unleſs when blended with a large proportion of other metals: the gold ore of Rammelſberg, in Goſlar, holds only a few grains on an hundred weight. Some gold is alſo met with in ſundry rivers, as the Tagus, the Ganges, the Rhine, the Saale, the Niger, the Danube, and many others, commonly in fine duſt, often in flat moleculæ, ſometimes ſuſpended by the water in inviſible atoms, which ſettle upon ſtanding, and are diſtinguiſhed by the name of river or waſh-gold: theſe golden particles doubtleſs proceed from ſome mines or veins of gold; from which the metal has been waſhed out, and carried down by the ſtream. Some have pretended to find perfect gold in vegetables, particularly in the vine-tree; but on examining thoſe gold-like ſpecks or granules, by fire, by quickſilver, or other trials, they ſoon diſcover themſelves to be no gold.

Gold coins and utenſils are not made of pure gold, but have always an alloy of ſilver, or copper, or both together, by which the gold is rendered firmer, harder, and more ſonorous. When gold is perfectly pure, it is called gold of twenty-four carats; the meaning of which is, that in an ounce of the metal all the twenty-four ſcruples are pure gold. If only twenty-three ſcruples are fine gold, and the other ſcruple a baſer metal, it is called gold of twenty-three carats; and in general, the number of carats by which the fineneſs is expreſſed, denotes the number of ſcruples of fine gold in an ounce or twenty-four ſcruples of the mixed. The ancients ſuppoſed the gold of different countries to differ in quality; the Armenian to be the beſt, the Hungarian next to it, and the Rheniſh the worſt. But gold, when perfectly pure, is always one and the ſame, wherever it is to be found; no other differences being obſerved in it than what proceed from an admixture of ſome other metal.

There are different methods of ſeparating gold from admixtures of other metals. If only a baſe metal is mixed with gold, they may be ſeparated by teſting or cupellation with lead; the baſe metal vitrifying with the lead, whilſt the gold remains unhurt.

Silver, which reſiſts the deſtructive power of lead equally with gold itſelf, is ſeparated by acid menſtrua. For this purpoſe, we muſt firſt examine, whether the mixture contains moſt gold, or moſt ſilver: if the gold is found to prevail, the metal is to be flatted into plates, or granulated, and put into a proportionable quantity of aqua-regis, which diſſolves the gold, and leaves the ſilver in the form of powder at the bottom: the ſilver, waſhed and dried, may be melted into a maſs, with the addition of a little tallow, and ſome nitre or borax; and the gold may be recovered from the liquor by precipitation. If on the other hand, the quantity of ſilver is much greater than that of the gold, aqua-fortis is made uſe of, which diſſolves the ſilver, and leaves the gold behind, in form of a black maſs or powder to be waſhed and melted with borax. If the proportions of the two metals are nearly equal, the mixture is melted with ſo much freſh ſilver as will make the whole quantity of ſilver at leaſt three times greater than that of the gold: if the quantity of ſilver is much leſs than this, the beſt aqua-fortis will not be able to extract it from the gold: if much greater, the ſolution or extraction will go on the faſter, but the gold will remain in form of powder, ſome particles of which may be in danger of being loſt: if it is juſt thrice the weight of the gold, the gold retains the form of the original plates: from the gold making one fourth of the compound, the proceſs is commonly called quartation. This method of parting the two metals is more commodious and effectual than that by aqua-regis; aqua-fortis diſſolving the ſilver much ſooner than aqua-regis does the gold; and the former taking up none of the gold along with the ſilver, whereas the latter almoſt always diſſolves a part of the ſilver along with the gold, eſpecially if the aqua-regis is made with an under-proportion of marine acid.

Gold is likewiſe purified from ſilver by acids applied in the form of vapour free from phlegm. Thus applied, they extract ſmall proportions of ſilver as well as large ones; the gold being unable to defend that metal againſt the fumes, as it does againſt the acid in its liquid ſtate. The marine vapours alſo, in this method of application, corrode the ſilver as effectually as the nitrous: the only difference is, that when corroded by the nitrous, ſuch part as may remain in the pores of the gold is eaſily diſſolved and waſhed out by water, whereas with the marine, it forms a concrete not diſſoluble in water.—The method of performing the proceſs is this. Nitre, or common ſalt, (not both at once, for the vapour ariſing from the mixture would diſſolve the gold as well as the ſilver) is mixed with an equal quantity of calcined vitriol, by which its acid is extricated in the fire; and twice its weight of powdered bricks, to prevent the matter from melting and adhering to the ſurface of the metal. The gold impregnated with ſilver, is flatted into plates; cleanſed by ignition from any external unctuoſity that might impede the action of the acid; then ſtratified and every where ſurrounded with the mixture in a crucible or cementing-pot; the veſſel cloſely covered and luted; the fire gradually raiſed to a ſlight red heat, and kept up for twelve, ſixteen, or twenty hours. It is often neceſſary to repeat the cementation; a part of the ſilver being apt to eſcape the action of the fumes, eſpecially when the plates are of conſiderable thickneſs: the metal, after one cementation, muſt be melted and laminated afreſh, before it is committed to another. Theſe kinds of operations were formerly often practiſed; but have now in great meaſure given place to more advantageous and effectual methods of ſeparation. The mixture with ſea-ſalt is commonly called the regal cement, gold being the only metallic body, platina excepted, that is capable of reſiſting it.

The reſiſtance of gold to aqua-fortis affords a ready method of diſtinguiſhing that metal from compoſitions reſembling it in colour. If a line be drawn with the maſs upon any ſmooth ſtone that does not diſſolve in acids, a drop of aqua-fortis will take off the mark left by any of the baſe metals, whilſt that made by gold remains untouched.

If gold contains copper, lead, or other imperfect metallic bodies, along with ſilver, it is purified firſt from the baſe metal by the teſt or cupel, and then ſeparated from the ſilver by quartation.—It is purified alſo from all the metals by fuſion with antimony, which abſorbs or ſcorifies all but gold. Tin is moſt commodiouſly ſeparated by injecting corroſive ſublimate upon the gold in fuſion. Mercury is diſſipated from it by bare ignition.

Gold is cleanſed, from external impurities, by heating it red-hot, and waſhing it with weak aqua-fortis, brine of ſea-ſalt, with tartar, &c. When pale, the colour is heightened, by melting it with copper, and afterwards ſeparating the copper; or by a mixture of verdigriſe and ſal-ammoniac with vitriol or nitre. Some boil the pale gold in a ſolution of theſe ſalts made in vinegar; others moiſten the ſalts with vinegar into the conſiſtence of a paſte, which is ſpread upon the gold, and the metal laid upon burning coals till the mixture is burnt off. The ſprinkling of the ſalts in powder upon the moiſtened gold, practiſed by ſome, does not anſwer ſo well. It is ſaid that a mixture of gold with one third, or even with half its weight of ſilver, acquires, on cementation with verdigriſe,

digriſe, the colour of pure gold. The ſilver however is eaſily diſcovered on the touchſtone, by means of aqua-fortis: if a line be drawn with the compound metal, a little aqua-fortis, applied upon the part, will eat out the ſilver; and the remaining gold will appear ſpecked and diſunited. *Neumann's Chemiſtry.*

GOLD-WIRE, a cylindrical ingot of ſilver, ſuperficially gilt, or covered with gold at the fire, and afterwards drawn ſucceſſively through a great number of little, round holes, of a wire-drawing iron, each leſs than the other, till it be ſometimes no bigger than a hair of the head. See the article WIRE.

It may be obſerved, that before the wire be reduced to this exceſſive fineneſs, it is drawn through above an hundred and forty different holes, and that each time they draw it, it is rubbed afreſh over with new wax, both to facilitate its paſſage, and to prevent the ſilver's appearing through it.

GOLD-WIRE *flatted*, is the former wire flatted between two rollers of poliſhed ſteel, to fit it to be ſpun on a ſtick, or to be uſed flat, as it is without ſpinning, in certain ſtuffs, laces, embroideries, &c. See the article STUFF, &c.

GOLD-THREAD, or SPUN GOLD, is a flatted gold, wrapped or laid over a thread of ſilk, by twiſting it with a wheel and iron bobins.

Manner of forming GOLD-WIRE *and* GOLD THREAD, *both round and flat.* Firſt, an ingot of ſilver, of twenty-four pounds, is forged into a cylinder, of about an inch in diameter: then it is drawn through eight or ten holes, of a large, coarſe wire-drawing iron, both to finiſh the roundneſs and to reduce it to about three-fourths of its former diameter. This done, they file it carefully all over to take off any filth remaining on the forge; then they cut it in the middle; and thus make two equal ingots thereof, each about twenty-ſix inches long, which they draw through ſeveral new holes, to take off any inequalities the file may have left, and to render it as ſmooth and equable as poſſible.

The ingot thus far prepared, they heat it in a charcoal fire; then taking ſome gold leaves, each about four inches ſquare, and weighing twelve grains, they join four, eight, twelve, or ſixteen of theſe, as the wire is intended to be more or leſs gilt; and when they are ſo joined, as only to form a ſingle leaf, they rub the ingots reeking hot with a burniſher. Theſe leaves being thus prepared, they apply over the whole ſurface of the ingot, to the number of ſix, over each other, burniſhing or rubbing them well down with the blood-ſtone, to cloſe and ſmoothe them. When gilt, the ingots are laid anew in a coal fire; and when raiſed to a certain degree of heat, they go over them a ſecond time with the blood-ſtone, both to ſolder the gold more perfectly, and to finiſh the poliſhing. The gilding finiſhed, it remains to draw the ingot into wire.

In order to this, they paſs it through twenty holes of a moderate drawing iron, by which it is brought to the thickneſs of the tag of a lace: from this time the ingot loſes its name, and commences gold wire. Twenty holes more of a leſſer iron leaves it ſmall enough for the leaſt iron; the fineſt holes of which laſt ſcarce exceeding the hair of the head, finiſh the work.

To diſpoſe the wire to be ſpun on ſilk, they paſs it between two rollers of a little mill: theſe rollers are of nicely poliſhed ſteel, and about three inches in diameter. They are ſet very cloſe to each other, and turned by means of a handle faſtened to one of them, which gives motion to the other. The gold wire in paſſing between the two, is rendered quite flat, but without loſing any thing of its gilding, it is rendered ſo exceedingly thin and flexible, that it is eaſily ſpun on ſilk thread, by means of a hand wheel, and ſo wound on a ſpool or bobin.

GOLD-LEAF, or BEATEN GOLD, is gold beaten with a hammer into exceeding thin leaves, ſo that it is computed, that an ounce may be beaten into ſixteen hundred leaves, each three inches ſquare, in which ſtate it takes up more than 159052 times its former ſurface.

This gold they beat on a block of black marble, about a foot ſquare, and uſually raiſed three feet high: they make uſe of three ſorts of hammers, formed like mallets, of poliſhed iron: the firſt, which weighs three or four pounds, ſerves to chaſe, or drive: the ſecond, of eleven or twelve pounds, to cloſe; and the third, which weighs fourteen or fifteen pounds, to ſtretch and finiſh. They alſo make uſe of four moulds of different ſizes, viz. two of vellom, the ſmalleſt whereof conſiſts of forty or fifty leaves, and the larger of two hundred: the other two, conſiſting each of five hundred leaves, are made of bullocks guts well ſcoured, and prepared.

Method of preparing and beating GOLD. They firſt melt a quantity of pure gold, and form it into an ingot: this they reduce, by forging, into a plate about the thickneſs of a ſheet of paper; which done, they cut the plate into little pieces about an inch ſquare, and lay them in the firſt or ſmalleſt mould to begin to ſtretch them: after they have been hammered here a while with the ſmalleſt hammer, they cut each of them into four; and put them into the ſecond mould, to be extended further.

Upon taking them hence, they cut them again into four, and put them into the third mould, out of which they are taken, divided into four, as before, and laid in the laſt, or finiſhing mould, where they are beaten to the degree of thinneſs required.

The leaves thus finiſhed, they take them out of the mould, and diſpoſe them into little paper books, prepared with a little red bole for the gold to ſtick to; each book ordinarily contains twenty-five gold leaves. There are two ſizes of theſe books; twenty-five leaves of the ſmalleſt only weigh five or ſix grains, and the ſame number of the largeſt, nine or ten grains.

It muſt be obſerved, that gold is beaten more or leſs, according to the kind or quality of the work it is intended for; that for the gold wire-drawers to gild their ingots, is left much thicker than that for gilding the frames of pictures, &c. withal. See GILDING.

GOLD-FINCH, in ornithology, the Engliſh name of a ſpecies of fringilla, with the wings variegated with black, yellow, and white.

GOLD-SIZE. See the article SIZE.

GOLD-SMITH, or as ſome chooſe to expreſs it, ſilver-ſmith, an artiſt who makes veſſels, utenſils, and ornaments in gold and ſilver.

Shell-GOLD, that uſed by the illuminers, and wherewithal we write gold letters. It is made of the pareings of leaf-gold; and even of the leaves themſelves, reduced into an impalpable powder, by grinding on a marble with honey. After leaving it to infuſe ſome time in aqua-fortis, they put it in ſhells, where it ſticks. To uſe it they dilute it with gum-water, or ſoap-water.

GOLDEN, ſomething that has a relation to gold, or conſiſts of gold, is valuable, or the like; as,

GOLDEN-BULL. See the article BULL.

GOLDEN-CALF, in Jewiſh antiquity, a figure which the Iſraelites caſt in gold, and ſet up in the wilderneſs to worſhip during Moſes's abſence in the mount, and which that legiſlator, at his return, burnt, ground to powder, and mixed with the water the people were to drink of; as in Exod. xxxii.

GOLDEN-FLEECE, in the ancient mythology, the ſkin, or fleece, of the ram upon which Phryxus and Hella are ſuppoſed to have ſwam over the ſea to Colchis; which being ſacrificed to Jupiter, its fleece was hung upon a tree in the grove of Mars, guarded by two brazen-hoofed bulls, and a monſtrous dragon that never ſlept; but was at laſt taken and carried away by Jaſon, and the Argonauts.

GOLDEN-NUMBER, in chronology, a number ſhewing what year of the moon's cycle any given year is. See CYCLE *of the Moon.*

GOLDEN-RULE, in arithmetic, is alſo called the rule of three, and the rule of proportion. See PROPORTION and RULE OF THREE.

GOLPS, in heraldry, are roundles of a purple tincture, called by the French *torteaux*, adding their peculiar colours.

GOMPHOSIS, γόμφωσις, in anatomy, a ſpecies of articulation, wherein one bone is ſet in the other, like a nail or peg; as the teeth within the jaws.

GOMPHRENA, the purple everlaſting flower, in botany, a genus of plants, the flower of which is divided into five parts, and erect: the petals are ſubulated and permanent: the fruit is a thin, roundiſh cruſt, with one

cell, in which are contained a ſingle, large, roundiſh ſeed, with an oblique end. It is a native of both Eaſt and Weſt-Indies; and the flower is uſually of a beautiful purple colour.

GONDOLA, a ſort of barge curiouſly ornamented, and navigated on the canals of Venice. See the article BARGE.

GONORRHOEA, in medicine, an involuntary efflux of the ſeminal juices, and ſome other recrementitious matter.

Authors take notice of three ſpecies of gonorrhœas; the firſt is a ſimple gonorrhœa, or perpetual efflux of the ſeminal juices, without any virulence: the ſecond is a venereal, or virulent gonorrhœa, ſo called, though improperly, from its ſimilitude to the preceding: the third is an involuntary efflux of a viſcid white, or whitiſh fluid from the urethra, in conſequence of a venereal gonorrhœa ill cured, or too frequently repeated.

The firſt ſpecies of this diſorder ariſes from a want of a due tone in the ſolid parts, and by a preternatural relaxation of the veſſels containing the ſeed, and of the parts adjacent to them. See GLEET.

This gonorrhœa is either mild or benign, or of a malignant kind. The latter conſiſts in a diſcharge of matter of various colours, accompanied with heat and exulceration; and in ſcorbutic, or cacochymic patients, as alſo thoſe afflicted with the ſtone, this diſorder is generally attended with a pain in diſcharging the urine, which in ſuch patients is of an acrimonious quality; but in a gonorrhœa of a mild or a benign kind, a whitiſh liquor all of one colour, is diſcharged without pain, heat, or exulceration; and frequently proceeds from a redundance of the ſeminal fluid, ariſing from high living in an unmarried ſtate, or its acrimony in cacochymic, ſcorbutic, or arthritic patients, as well as from the weakneſs of, and want of due tone in, the ſeminal veſſels.

The cure of a benign gonorrhœa is highly difficult; nor can any other reaſon be aſſigned for this diſorder, than that there is a preternatural efflux of impure humours from all parts of the body to thoſe parts infected, which are already too much weakened, and have their tone deſtroyed. Beſides, the parts ſubſervient to generation, which are in this diſorder affected, conſiſt entirely of nerves and nervous coats; and it is not without the greateſt difficulty that the energy of medicines penetrates to them. In the cure, the following intentions are to be purſued. Firſt, the redundance of impure ſerum, if there are any ſuch in the body, is, by means of proper laxatives, to be evacuated and derived from the parts affected. Then the too much relaxed and flaccid parts are to be ſtrengthened by proper corroborating medicines, both of the external and internal kind. The former of theſe intentions is anſwered by ſuch laxatives as operate in a double manner, ſuch as the pilulæ balſamicæ of Becher, which are not only purgative, but highly corroborating. To anſwer the other intention, the following powder muſt be uſed. Take of cuttle-bone, one ounce; of red coral, amber, the ſpecies of hyacinth, and the bark of Caſcarilla, each two drams; make into a powder, one dram of which is to be taken every morning and evening in a decoction of barley, prepared with ſome almonds. At the ſame time the following epithem may be applied to the region of the pubes and perinæum, eſpecially during the night-time. Take of herbs, baum, mint, and baſil; of the leaves of red roſes, and balauſtins, each one handful; of pomegranate-bark, cloves, nutmegs, cardamoms, and maſtich, each half an ounce; mix together, and put into a ſmall bag to be boiled in red French wine. Theſe meaſures are to be ſeconded by an accurate regimen, being chiefly ſuch as is preſcribed below for the virulent gonorrhœa. In the cure of a malignant gonorrhœa, regard is to be had to the conſtitution of the patient: when he is hot, and of a delicate conſtitution, he ought, eſpecially in the beginning of the diſtemper, to abſtain from hot ſubſtances, purgatives, ſudorifics, diuretics, &c. The following preparation may be frequently exhibited in this diſorder. Take of mint, three handfuls; of Venice turpentine, one ounce; of Peruvian balſam, half an ounce: diſtil with three pints of Rheniſh wine. The doſe is from one to two ounces: and the following may be uſed as a ſucceſdaneum. Take of roſe-water, and rectified ſpirit of wine, each half a pint; and of the balſam of life, fifty drops. Mix all together.

A virulent gonorrhœa, or clap, being the ſecond ſpecies of this diſorder, proceeds from impure coition with an infected perſon.

This diſtemper begins, and makes its progreſs, in the following manner.

The patient, ſooner or later, according as the perſon with whom he has had converſation, was more or leſs infected, and according to his conſtitution, by which he may be more or leſs diſpoſed to receive the infection, is firſt ſeized with an unuſual pain in the genitals; and a kind of ſenſation like a rotation of his teſticles. Afterwards, if the prepuce conſtantly covers his glands, there appears an eruption, or puſtule, which, by its ſize, colour, and figure, reſembles a ſpot of the meaſles. Preſently after appears a weeping matter like ſemen, which daily changes colour, and becomes more purulent, and more yellow, till at length, if the diſorder be highly virulent, it aſſumes a greeniſh hue, or appears like a thin ſanious matter, mixed with blood. The puſtule at length becomes an ulcer, called a ſhanker. See SHANKER.

Thoſe whoſe glans is uncovered, ſeldom have ſuch a puſtule, and are leſs liable to imbibe the infection. The running brings on a heat, or ſmarting in making water, which is moſt violent when it is over, for then it ſeems to burn the whole duct of the urethra.

Another ſymptom is the cordee, or contraction of the frænum, by which the penis is bent downwards. There is likewiſe, when the penis is erected, great pain, as if compreſſed tranſverſely with a ſtrong hand. This chiefly happens in the night, when the patient is warm in bed: ſometimes the urethra being eaten, and excoriated with long running of acrimonious pus, nature breeds a ſoft ſpungy fleſh, to ſupply the defect, which daily increaſing, forms caruncles, or carnoſities ſo far as to plug up the urinary paſſage, and ſtop up the urine. However, the little adjoining ulcers continue to pour forth a kind of an ichor. It alſo happens, through ſome violent motion, or the ill-timed uſe of aſtringents, that the ſanies, which ſhould be carried off by the gonorrhœa, is tranſlated to the ſcrotum, and cauſes one or both of the teſticles to ſwell, and inflame with intolerable pain: the running at the ſame time decreaſing, while the ſcalding of the urine is as great as ever.

To theſe ſymptoms may be added the phimoſis, and the paraphimoſis. There are alſo ſometimes watery bladders, called cryſtallines, and at length buboes of the glands in the groin. See PHIMOSIS, PARAPHIMOSIS, BUBO, and POX.

Women are not ſo ſubject to ſuch a variety of ſymptoms as men; their chief complaint being a difficulty of urine, and a running; however, they are liable to ſhankers and venereal warts, as well within as on the outward parts of the labia pudendi; as alſo to buboes in the groin: as for the coarctation of the ſphincter vaginæ, paſſing as it were the external orifice, this is not a phimoſis, though by ſome improperly ſo called.

This diſorder proceeding from an infection of a malignant gonorrhœa, or the lues venerea, is firſt conveyed to the genitals, and afterwards through the pores to the lymph, or ſeminal liquor; the due craſis and natural mixture of which it deſtroys, by inducing partly a cauſtic and corroding, and partly a putrid ſtate thereof; hence ariſe the pains, the heats, the tumours, the inflammations, and the exulcerations of the genitals: for at firſt the glans only is infected whilſt in coition, the poiſon inſinuating itſelf into the pores; after which, it ſoon proceeds to the glands of the urethra, then to the proſtate, and afterwards to the veſiculæ ſeminales. The regimen, during the time of the cure, according to Boerhaave, requires the patient to abſtain from all oily food; and he muſt alſo avoid every thing, which by its acrimonious quality ſtimulates to venery; ſuch as ſpices, bulbous roots, fleſh, eggs, fiſh, and fermented liquors: for as the inflation of the penis retards the cure, it is of the utmoſt conſequence to be avoided; as are alſo every thing elſe that inflames the fancy, or provokes to venery, as amorous dalliance with women, &c. Water and whey are the beſt drinks; and ſeeds and ſummer fruits the beſt aliment. All poſſible care muſt be taken that cold never reach

reach the penis, and that it be kept always moiſt, leſt the pores contracting repel the flux of matter. An emollient and ſomewhat antiſeptic cataplaſm will be beneficial. In the cure, Sydenham's method of purging the patient till the ſymptoms were abated is now juſtly laid aſide. Turner's laſt method, which he made uſe of himſelf, is as follows: Take two drachms of quickſilver; one drachm of gum guaiacum; and beat them, together with a little ſpirit of lemon, till the globules of the mercury diſappear: afterwards add half a drachm of the pills of colocynth with aloes: beat it into a maſs; of which make up twenty-four pills. Two of theſe pills containing half a ſcruple of the mercury, may be taken night and morning; or according to the operation, one only for a week or ten days, unleſs the patient complains of his gums, or a ſore mouth; for then the mercury muſt be left out.

If the cordee does not remit, a ſcruple of ſal prunella may be taken, with as much fine ſugar between whiles, in a draught of the following apozem: Take of mercurial water two pounds; of the ſolution of gum arabic, and ſyrup of marſh-mallows, of each one ounce; make it into an apozem, or decoction. The mercurial water is common river-water, in two quarts of which four ounces of quickſilver have been boiled to a quart. The patient may drink of the apozem through the whole courſe.

And now, as there is occaſion, the pills are continued for a week, or ten days more, but at night only; and in the morning is given the quantity of a nutmeg of the following electuary: Take virgin-honey, an ounce and a half; balſam of capivi, ſix drachms; powder of the root of jalap, and ſal prunella, of each one drachm, which make into an electuary. The patient muſt drink a draught of the apozem as well after the electuary as after the pill.

There is no danger of the running being ſtopt while his body is kept open by theſe means; but when the quantity grows leſs, and the colour whiter, and feels more tenacious, the pill is laid aſide, and the electuary kept to ſome days longer, night and morning. If it purges too much, the jalap is left out, and the rhubarb ſubſtituted inſtead thereof. When it proves tedious, boiled turpentine is given by way of farther agglutinating, and drying the gleet.

When the cordee and dyſury are very ſtubborn, or the running more virulent than ordinary, the genitals are to be ſmeared every night quite up to the groin, with the weaker blue ointment, and the pill without the quickſilver is given early in the morning in a large doſe, or a draught of the infuſion of ſenna. This method will ſucceed in three weeks, or a month's time, if the patient is governable.

In the place of mercurials given internally, Aſtruc directs the uſe of crude quickſilver, as in the common unction, to be rubbed upon the parts, as about the body of the penis, eſpecially under the urethra, to the perinæum, and ſo up to the pubes and teſticles, by which the mercury, inſinuating itſelf through the pores into the lymphatic veſſels, is inſtantly conveyed into the glandules, and ſubdues the poiſon lodged therein, taking away all the ſymptoms without any diſturbance to the primæ viæ, the ſtomach and guts.

If there is no diſcharge from the penis of any virulent matter, it is called the gonorrhœa ſicca, or dry clap; the ſymptoms of which are a dyſury, or difficulty of making water, and after, from the increaſe of the inflammation and tumefaction, an iſchury, or total ſuppreſſion of urine.

In the cure of the dry clap, Aſtruc adviſes plentiful bleeding in the beginning, to take off the tenſion, and to abate the inflammation; as alſo emollient decoctions of mallows, linſeed, &c. in milk, to foment the parts: but perhaps it might be better to make a poultice of theſe ingredients, after Boerhaave's method, to lay to the parts affected; or, which is beſt of all, to uſe them one after the other.

Aſtruc adviſes alſo lenient clyſters, cooling emulſions, and ptiſans, with ſal prunella and anodynes, between whiles. During the continuance of the inflammation, no mercurials muſt be uſed, and if the ſymptoms increaſe, threatening an abſceſs in the perinæum, it is to be forwarded as much as poſſible, by ſuppurative poultices, and the matter diſcharged.

When the gonorrhœa has continued a long while, or long enough for the poiſonous matter to make its way into the blood; or by aſtringents given unſeaſonably it cannot make its exit; then the patient is infected with the pox.

The third ſpecies of this diſorder requires the very ſame treatment with the ſimple and virulent: but here the leaſt time muſt not be loſt; the affected part muſt be kept in a conſtant ſtate of laxity, by the moſt emollient applications; and the contagious matter muſt with all poſſible expedition be drawn out: for the whole cure depends upon the total diſcharge of the infectious matter, together with the pus, which it has introduced; and if this taſk is not performed, a pox is greatly to be apprehended. Wherefore, if this diſeaſe continues but for a little time, recourſe muſt be had to all the ſeverities of a ſalivation. For though ſalivating does not at all cure either of the two former kinds of gonorrhœa, this ſpecies of the diſeaſe, having its ſeat in the glandulæ Cowperianæ of the urethra, ſo that the pus diſcharges itſelf by their excretory duct into the urinary duct, is much more ſuſceptible of the power of mercury.

GOOD, in general, whatever is apt to cauſe or increaſe pleaſure, or diminiſh pain in us; or, which amounts to the ſame, whatever is able to procure, or preſerve to us the poſſeſſion of agreeable ſenſations, and remove thoſe of an oppoſite nature.

Metaphyſical GOOD, the ſame with perfection. See PERFECTION.

Moral GOOD denotes the right conduct of the ſeveral ſenſes and paſſions, or their juſt proportion and accommodation to their reſpective objects and relations.

GOOD BEHAVIOUR, in law, an exact carriage and behaviour to the king and his people.

GOOGINGS, in ſhip-building, certain plates of iron bolted to the ſtern-poſt of a ſhip, to receive and keep ſteady the rudder.

There are four or five of them on the ſtern-poſt, having a large hole in each, into which certain ſpindles, called pintles, are introduced, upon which the rudder reſts, and turns as upon an axis. See the article RUDDER.

GOOSE, *Anſer*, in ornithology, a well-known bird of the anas-kind, with the back of a greyiſh brown colour, the belly and edges of the wing-feathers white.

Geeſe are fowls of great profit, both for food, for their feathers, and for their greaſe. For the gathering of their feathers, ſome authors adviſe their being pulled twice a year, viz. in March and Auguſt; yet this is certainly an unprofitable as well as a cruel practice; for the gooſe on being incapable of flight, eaſily falls a prey to the fox, and other ravenous creatures, and by uncloathing her, you occaſion her getting cold, which ſuddenly kills her. 'Tis therefore, moſt adviſeable to ſtay till moulting time, or till you kill her, and then all her feathers may be made uſe of at pleaſure.

GOOSE-BERRY, *Groſſularia*, or *Ribes*, in botany. See the article RIBES.

The beſt way of raiſing theſe uſeful buſhes is by cuttings, obſerving always to take the handſomeſt ſhoots, and that from branches that bear moſt fruit. Theſe are to be planted in February.

There are a great many ſorts of gooſe-berry, among which the white Holland kind is the faireſt, and beſt bearer of all others; the berries being large, tranſparent, and well taſted. The Engliſh yellow gooſe-berry is known every where, and fitteſt for culinary uſes while green. The hedge-hog gooſe-berry is large, well-taſted, and extremely hairy. There is alſo a ſort of green gooſe-berry, that is a very pleaſant fruit.

Gooſe-berries taken in ſeaſon, produce a delicious wine, very proper for ſummer repaſts. Alſo, if thoroughly preſſed, with an addition of water, and well fermented, they yield in diſtillation the beſt brandy of any of our fruits, and little inferior to French brandy.

GOOSE-NECK, among ſailors, a ſort of hook fixed in the inner end of a boom, or pole, to extend the bottom of ſome of the ſails of a ſhip, particularly the main boom of a brig or ſloop, and the lower-ſtudding-ſail booms of ſhips and larger veſſels. See the article BOOM.

The

The gooſe neck is hooked in a ring or eye-bolt of iron, and may be occaſionally unhooked at pleaſure.

GOOSE-WINGS *of a Sail*, the clues, or lower corners, of a ſhip's main-ſail or fore ſail, when the middle part is tied up or furled to the yard.

The gooſe-wings are only uſed in a great ſtorm to ſcud under, when the ſail at large, or even reefed, would be too much for the ſhip to carry at ſuch a time.

GOR-COCK, a bird, otherwiſe called a moor-cock. See MOOR-COCK.

GORDIAN KNOT, in antiquity, a knot made in the leathers or harneſs of the chariot of Gordias, king of Phrygia, ſo very intricate, that there was no finding where it began or ended.

The inhabitants had a tradition, that the oracle had declared, that he who untied this knot, ſhould be maſter of Aſia. Alexander having undertaken it, was unable to accompliſh it, when fearing leſt his not untying it ſhould be deemed an ill augury, and prove a check in the way of his conqueſts, he cut it aſunder with his ſword, and thus either accompliſhed or eluded the oracle.

GORE, in heraldry, one of the abatements, which, according to Guillim, denotes a coward. It is a figure conſiſting of two arch lines drawn one from the ſiniſter chief, and the other from the ſiniſter baſe, both meeting in an acute angle in the middle of the feſs point.

GORE, in law, ſignifies a narrow ſlip of ground.

GORGE, *Gula*, in architecture, the narroweſt part of the Tuſcan and Doric capitals, lying between the aſtragal, above the ſhaft of the pillar and the annulets. See TUSCAN and DORIC.

It is alſo uſed for a concave moulding, larger, but not ſo deep as a ſcotia, which ſerves for compartments, &c. See the article COMPARTMENT.

GORGE, in fortification, the entrance of the platform of any work.

In all the out-works, the gorge is the interval betwixt the wings on the ſide of the great ditch, as the gorge of a ravelin, half-moon, &c. Theſe, it is to be obſerved, are all deſtitute of parapets; becauſe, if there were any, the beſiegers, having taken poſſeſſion of the work, might uſe it to defend themſelves from the ſhot of the place; which is the reaſon that they are only fortified with paliſadoes, to prevent a ſurprize.

The gorge of a baſtion is nothing elſe but the prolongation of the curtins from their angle with the flanks, to the center of the baſtion where they meet. When the baſtion is flat, the gorge is a right line, which terminates the diſtance between the two flanks. See the articles BASTION and FORTIFICATION.

GORGED, in heraldry, the bearing of a crown, coronet, or the like, about the neck of a lion, a ſwan, &c. and in that caſe it is ſaid, the lion or cygnet is gorged with a ducal coronet, &c.

Gorged is alſo uſed when the gorge, or neck of a peacock, ſwan, or the like bird, is of a different colour or metal from the reſt.

GORGED, among farriers, &c. ſignifies the ſame as ſwelled; in which ſenſe they ſay, the legs of a horſe are gorged; the paſtern joint is gorged; you muſt walk him out to diſgorge his ſhoulder.

GORGERIN, in architecture, the ſame with gorge. See the article GORGE.

GORGONS, in antiquity, a warlike female nation of Lybia, in Africa, who had frequent quarrels with another nation of the ſame ſex, called Amazons.

GOSHAWK, the Engliſh name of the yellow-legged falcon, with a brown back, and a white variegated breaſt.

GOSPEL, the hiſtory of the life, actions, death, reſurrection, aſcenſion, and doctrine of Jeſus Chriſt.

The word is Saxon, and of the ſame import with the Latin term *evangelium*, or the Greek ευαγγελιον, which ſignifies glad tidings, or good news; the hiſtory of our bleſſed Saviour being the beſt news ever publiſhed to mankind.

This hiſtory is contained in the writings of St. Matthew, St. Mark, St. Luke, and St. John; who from thence are called evangeliſts. The Chriſtian church never acknowledged any more than theſe four goſpels as canonical; notwithſtanding which, ſeveral apocryphal goſpels are handed down to us, and others are entirely loſt.

The ancient fathers endeavoured to find out divers myſteries in there being but four genuine canonical goſpels. St. Jerom, in particular, ſays, that as there are four parts of the world, and four principal winds, it was alſo proper there ſhould be four goſpels in the church, as four columns to ſupport it, and four breathings of life to render it immortal. They thought they found the figure of the four evangeliſts in the beginning of the prophecy of Ezekiel, and in the ninth chapter of the Revelations, where mention is made of four living creatures, the firſt having the face of a man; the ſecond of a lion; the third of an ox; and the fourth of an eagle; and for this reaſon the evangeliſts are uſually painted with theſe ſymbols.

GOSSYPIUM, cotton, in botany. See the article COTTON.

GOTHIC, in general, whatever has any relation to the Goths: thus, we ſay, Gothic cuſtoms, Gothic architecture, &c. See the article ARCHITECTURE.

Gothic architecture is far removed from the manner and proportions of the antique; having its ornaments wild and chimerical, and its profiles incorrect: however, it is frequently found very ſtrong, and appears very rich and pompous, as may be ſeen in ſeveral of our Engliſh cathedrals. This manner of building was, originally, very heavy and coarſe; but is ſince run into the oppoſite extreme, being ſlender, rich, and delicate to a fault. In the Gothic architecture we ſee high vaults raiſed on ſlender pillars; and every thing crowded with windows, roſes, croſſes, figures, &c.

GOVERNMENT, in general, is the polity of a ſtate, or an orderly power conſtituted for the public good.

GOVERNMENT is alſo a poſt or office which gives a perſon the power or right to govern or rule over a place, a city or province, either ſupremely or by deputation.

GOVERNMENT is alſo uſed for the city, country, or place to which the power of governing is extended.

GOVERNMENT, in grammar, a part of conſtruction uſually called regimen.

GOUGE, an inſtrument or tool uſed by divers artificers; being a ſort of round hollow chiſſel, for cutting holes, channels, grooves, &c. either in wood or ſtone. See the article JOINERY.

GOURD, *Cucurbita*, in botany. See the article CUCURBITA.

GOUT, *Arthritis*, in medicine, as defined by Boerhaave, a very painful diſeaſe, whoſe ſeat is in the joints and ligaments of the feet, and whoſe principal times of invaſion are the ſpring and autumn.

The curative intention, according to Wintringham, requires, firſt, that the primæ viæ be ſet free from a load of indigeſted crudities, and the viſcera be reſtored to their priſtine vigour; ſecondly, that the fluid ſtagnating in and ſtuffing up the ſmaller veſſels, may be expelled the body, and a free paſſage through the contracted veſſels be reſtored.

The firſt intention may be anſwered by vomits and gentle cathartics repeated as occaſion requires; by bitters, aromatics, antiſcorbutic medicines; by alkaline fixed ſalts, taken in ſmall quantities for a long time; by aliments and drinks that are nouriſhing, light, eaſy of digeſtion, quickly aſſimilated, and taken in due quantity; by powerful exerciſe often repeated, and long continued; and eſpecially by riding in a dry, ſerene, pure air; by frictions; by motion of the affected parts; by going to ſleep at early hours.

The ſecond intention may be anſwered partly by the preceding, as well as by procuring gentle ſweats; by bathing in natural and artificial baths; by ſweating in a bagnio; or by the uſe of volatile ſalts, and copious drinking of attenuating liquors, actually hot, in the morning while in bed, in order to procure a ſweat; as alſo by mercurial purges, taking a large quantity of diluents after them; by frictions of the whole body, eſpecially the parts affected, with hot, dry linen-cloths, till a redneſs appear; by cold baths; and the like.

To abate the exceſſive pain in the part affected, Boerhaave ſays, that if there be an abſolute neceſſity, opiates may

may be given internally, and the patient may drink plentifully of hot whey, or any other liquor of the like nature. Externally emollients and anodynes may be uſed, laid on pretty hot; or the part affected may be beat with nettles; or it may be anointed with terebinthinated balſam of ſulphur; or tow may be burnt thereon.

GOUT-WORT, in botany, a term ſometimes uſed for angelica. See ANGELICA.

GOUTY-LAND, among farmers, denotes a mooriſh, cold, and black ſoil, abounding with ſprings.

In Staffordſhire this ſort of land is ordered much in the ſame manner as heathy land, only that it is uſually burnt deeper. It bears little but oats, white oats upon the gouty, and black oats upon the black cold land.

The turf of theſe grounds burnt, and carried upon rye or barley-lands, is eſteemed a better improvement than dung. See the article HEATHY LAND.

GRACE, *Gratia*, among divines, ſignifies any unmerited gift which God beſtows on mankind.

Divines diſtinguiſh grace into habitual and actual: the firſt reſides ſtatedly in us, is fixed in the ſoul, and remains till it is expunged by ſome grievous wilful ſin. This is alſo called juſtifying grace, as it makes us appear innocent and righteous in the ſight of God; and ſanctifying grace, as it makes us holy and devoted to God. Actual grace is that which God gives us for the ſpecial performance of ſome particular good thing, as to convert us, to enable us to reſiſt a particular temptation, &c.

Grace is alſo divided into natural and ſupernatural: the natural including the gifts of being, life, of rational faculties, and immortal ſoul, &c. and the ſupernatural is conſidered as a gift conferred on intelligent beings in order to their ſalvation.

Act of GRACE, an act of parliament for a general and free pardon, and for ſetting at liberty inſolvent debtors.

Days of GRACE, in commerce. See DAY.

GRACES, in heathen mythology, three goddeſſes, whoſe names were Aglia, Thalia, and Euphroſyne; that is, ſhining, flouriſhing, and gay; or according to ſome authors, Paſithea, Euphroſyne, and Ægiale. Some make them the daughters of Jupiter and Eurynome, or Eunomia, the daughter of Oceanus; but the moſt common opinion is, that they were the daughters of Bacchus and Venus.

They are ſometimes repreſented dreſſed, but more frequently naked, to ſhew, perhaps, that whatever is truly graceful, is ſo in itſelf, without the aid of exterior ornaments. They preſided over mutual kindneſs and acknowledgment; beſtowed liberality, eloquence, and wiſdom, together with a good grace, gaiety of diſpoſition, and eaſineſs of manners.

GRACILIS, in anatomy, a muſcle of the leg, ſo called from its ſlenderneſs: it ariſes from the ſynchondroſis of the os pubis.

GRADATION, in general, the aſcending ſtep by ſtep, or in a regular and uniform manner.

GRADATION, in architecture, a flight of ſteps, particularly aſcending from the cloiſter to the choir in churches.

It alſo denotes an artful diſpoſition of ſeveral parts, as were by ſteps and degrees, after the manner of an amphitheatre; ſo that thoſe placed before, are rather ſerviceable than the contrary, to thoſe behind.

GRADATION, in painting, a gradual and inſenſible change of colour, by the diminution of the teints and ſhades.

GRADATION, in rhetoric, the ſame with climax. See the article CLIMAX.

GRAFT, or GRAFF, in gardening, a cion or ſhoot of a tree inſerted into another, ſo as to make it yield fruit of the ſame nature with that of the tree from whence the graft was taken.

In the choice of grafts, the following directions ſhould be carefully obſerved: 1ſt. That they are ſhoots of the former year. 2dly. That they are taken from healthy fruitful trees. And, 3dly. That you prefer thoſe grafts which are taken from the lateral or horizontal branches, to thoſe taken from the perpendicular ſhoots. Theſe grafts ſhould be cut off from the trees before the buds begin to ſwell, which is generally three weeks or a month before the ſeaſon for grafting; therefore when they are cut off, they ſhould be laid in the ground with the cut downwards, burying them half their length, and covering their tops with dry litter, to prevent their drying: if a ſmall joint of the former year's wood be cut off with the cion, it will preſerve it the better; and when it is grafted, this may be cut off; for the grafts muſt be cut to a proper length before they are inſerted into the ſtocks; but till then, the ſhoots ſhould remain their full length, as they were taken from the tree, which will preſerve them better from ſtriking. If theſe grafts are to be carried to a conſiderable diſtance, it will be proper to put their cut ends into a lump of clay, and to wrap them up in moſs, which will preſerve them freſh for a month or longer: but theſe ſhould be cut off earlier from the trees, than thoſe which are to be grafted near the place where the trees are growing. For the choice of ſtocks for grafting, ſee the article STOCK.

GRAFTING, or ENGRAFTING, is the taking a ſhoot from one tree, and inſerting it into another, in ſuch a manner that both may unite and form one tree.

The reaſon for grafting is, that as all good fruits have been accidentally obtained from ſeeds, ſo theſe when ſown will often degenerate, and produce ſuch fruit as are not worth cultivating: but when the ſhoots, cions, or grafts, are taken from ſuch trees as yield good fruit, theſe will never vary from their kind, whatever be the ſtock, or tree, on which they are grafted.

The moſt proper ſeaſon for grafting is in the ſpring, juſt before the riſing of the ſap, or at leaſt before it riſes in any great quantity: but the weather muſt be neither froſty nor wet; nor ſhould the wind blow very bleak or ſtrong when this operation is performed: for on theſe circumſtances, and upon the exact joining of the inner bark of the cion with the inner bark of the ſtock, ſo that the ſap which flows between the bark and the wood may be communicated from the one to the other, the ſucceſs of grafting chiefly depends.

The implements neceſſary for grafting are, a fine ſmall hand-ſaw to cut off the heads of large ſtocks; a good ſtrong knife with a thick back to make cleſts in the ſtocks; a ſharp pen-knife to cut the grafts; a grafting chiſſel, and a ſmall mallet to pare away the wood; baſs, or woollen yarn to tie the grafts with; and a quantity of clay, or cement, properly prepared, to lay over the inciſions, in order to prevent their bleeding, and keep out the air.

The method of preparing the clay intended for this purpoſe, is to mix thoroughly together a quantity of ſtrong, fat loom, ſome new ſtone-horſe dung broken into ſmall bits, a little tanners hair, or ſtraw, cut very ſmall, with a little ſalt, and as much water as will make the whole of the conſiſtence of pretty ſtiff mortar.

The cement or compoſition which ſome have of late uſed, and which has been found to anſwer the deſign of keeping out the air better than the above clay, is made of turpentine, bees wax, and roſin, melted together. This compoſition, when of a proper conſiſtence, is laid about a quarter of an inch thick, upon the cut part of the ſtock round the graft; and has this farther advantage over the clay, that there is no danger of its being hurt by froſt; for cold hardens it; and when the heat of ſummer comes on, by which time it is no longer wanted on the tree, it will melt and fall off without any trouble.

Among the ſeveral methods of grafting hitherto known, the following are moſt approved, and generally practiſed.

Cleft-GRAFTING, called alſo STOCK, or SLIT-GRAFTING.—This is uſed chiefly for middle ſized ſtocks, from one to two inches in diameter. The ſeaſon for it is in the months of February and March; and the method, as now practiſed, is thus.

The head of the ſtock being ſawn, or cut off, with a ſlope, ſmooth and clean; a perpendicular cleft is made therein, about two inches deep, with a ſtrong knife, or chiſſel, from the top of the ſlope, as near to the pith as may be without touching it. In this cleft, the grafting chiſſel, or a wedge, is put to keep it open. The graft, or cion, is prepared by cutting it aſlope, in form of a wedge, to ſuit the cleft; only leaving a ſmall ſhoulder on each ſide; and when cut, it is to be placed exactly in the cleft, ſo as that the inner bark of the cion may aptly, and cloſely, join to the inner part of the bark, or rind of the

ſtock; in the dextrous performance of which, the chief part of the art of grafting conſiſts. That ſide of the cion, which is to be placed outward, at the part where it is cut wedge-wiſe and inſerted into the cleft of the ſtock, ſhould be much thicker than the other ſide, the better to facilitate the exact joining of its rind to that of the ſtock; for if theſe two do not unite, the graft will not ſucceed. The rind of the ſtock choſen for this way of grafting ſhould therefore not be too thick; becauſe it will then be the leſs manageable. If the cleft pinch too tight, a ſmall wedge may be left in it to bear the ſtreſs. As ſoon as the graft is properly fixed, the cleft ſhould be cloſely covered over with clay, or, which ſome think better, with moſs, or the freſh bark of a tree bound on with ozier.

When this method, which is the moſt ancient, and moſt common, manner of grafting, is uſed to ſtocks that are not ſtrong, a ligature of baſs ſhould be made around the ſtock, to prevent the opening of its ſlit; and the whole ſhould then be clayed over, or covered with the cement before deſcribed, to hinder the air from penetrating into the ſlit, ſo as to deſtroy the graft, only two eyes of which ſhould here be left above the clay, for ſhooting.

The ſtraighteſt and ſmootheſt part of the ſtock ſhould always be preferred for grafting, in whatever way this operation is performed.

GRAFTING *in the Rind*, or SHOULDER-GRAFTING, likewiſe called *ſlicing* and *packing*, to diſtinguiſh it from *grafting in the bark*, which will next be ſpoken of, is performed in the following manner, about the latter end of March, or the beginning of April, on more ſlender ſtocks than thoſe which are commonly uſed for cleft-grafting.

The top of the ſtock is cut off in a ſmooth, ſtraight place: then the cion, or graft, is prepared by cutting it on one ſide from the joint, or ſeam, down ſlope-wiſe, making the ſlope about an inch, or an inch and an half long; and obſerving it is bent, ſo that the cion may ſtand nearly upright when it is fixed to the ſtock. At the top of the ſlope, a ſhoulder is made, whereby it is to reſt on the crown of the ſtock. The whole ſlope muſt be plain and ſmooth, that it may lie even to the ſide of the ſtock. The length of the cion uſed here may be about four inches from the ſhoulder, for a ſtandard tree; but for a dwarf, or wall tree, it may be ſix inches. When the cion is prepared, the outſide of its ſloped end, from the ſhoulder downward, is applied to the weſt, or ſouth-weſt ſide of the ſtock, and its length and breadth meaſured thereon; which done, the bark of the ſtock (but not any of its wood) is cut away to thoſe dimenſions, that the cut part of the cion may be fitted in as exactly as poſſible. In doing this, regard muſt be had to the bigneſs of the ſtock, and the thickneſs of its bark, in order to proportion thereto the length and breadth of the cut part of the cion; otherwiſe the paſſages of the ſap in the ſtock and cion will not meet, and the cion will then of courſe periſh. When the cut part of the cion is exactly fitted to, and laid on that of the ſtock, they are bound together with woollen yarn, and covered with clay an inch above, and as far below, the head of the ſtock; working it round the cion, till it become ſharp at top, that the rain may run down it.

This method has ſeveral advantages over the former. Among theſe are, that the wound heals up ſooner, and that, in the mean time, it is in leſs danger from the weather; that it does leſs injury to the ſtocks and grafts, by avoiding all ſevere ſplittings and pinchings; that the bark is more eaſily placed in the paſſage of the ſap here, than in the cleft; that the graft thrives and ſhoots with greater vigour, and bears ſooner in this way than in that; and that it is practicable on ſmaller ſtocks than the other, which muſt have a good body, and conſiſtence, before they can bear cleaving.

GRAFTING *in the Bark* is performed thus. Prepare the ſtock and cion as for grafting in the rind, both as to time and manner; but, inſtead of cutting out the bark of the ſtock, ſlit it down, on the ſouth-weſt ſide, from the top, almoſt as long as the ſloped part of the cion, and at the top of the ſlit looſen the bark, with the point of your knife. Then thruſt an inſtrument, made of very hard wood, ivory, ſilver, or the like, and formed at the end like the ſlope-end of the cion, but much leſs, down, between the bark and wood, to make room for the cion; which being put in, the bark is to be ſo managed, as that it may cloſe exactly to the ſtock and edges of the cion, and the whole is then to be bound up, and covered as before.

Whip-GRAFTING, or *Tongue*-GRAFTING, is proper for ſmall ſtocks, from an inch diameter to a quarter of an inch, or even leſs. Mr. Worlidge, Mr. London, Mr. Miller, and others, ſpeak of it as the moſt effectual way of any, and that which is moſt in uſe, becauſe the cion covers the ſtock much ſooner in this method than in any other; for here the cion and the ſtock muſt always be of the ſame thickneſs. There are three ways of performing it, and all of them may be practiſed ſomewhat later than either of the foregoing.

The firſt is, to ſlope the cion off a full inch, or more; then to do the ſame to the ſtock; and afterwards to tie the one to the other, with baſs or yarn, ſo as to join them cloſely at every part, but particularly at the rind; and then to cover the joint carefully with well tempered clay. The baſs uſed for this, or for any other binding, ſhould be taken from a ſound mat, and be ſoaked in water for ſome hours, to increaſe its ſtrength, and render it the more pliable.

The ſecond way is, to make a ſhoulder in the graft, and, the head of the ſtock being cut off and ſmoothed, to join it as in grafting in the rind.

The third method, which is an improvement of the laſt, is properly named tipping or tonguing. This is done by cutting the ſtock off ſlanting, as before, and leaving at its upper ſide a thin piece, or tongue, as it is called, of the wood, pared away like the lower end of a cion. The cion is then ſloped, and tongued, in the ſame manner as the ſtock, and a ſlit is made in each of them, downward in the ſtock, and upward in the graft, on the ſide oppoſite to the tongue, ſo that each may receive the tongue of the other. The cion is then joined to the ſtock, as cloſely as can be, particularly at the bark; a ligature is made round them with baſs or woollen yarn, and the engrafted part is well covered with clay or cement.

Side-GRAFTING. In this, the cion is prepared as in whip-grafting; but the head of the ſtock is not cut off at the time of performing the operation. Inſtead of that, ſo much of the bark as the cion will cover is pared off from the weſt-ſide of the ſtock; then both the cion and the ſtock are ſlit in the laſt mentioned manner of whip-grafting, and they are bound together, and cloſed up with clay. At the year's end, the top of the ſtock is cut off at the grafted place, ſlopewiſe; and the wound is covered with clay or cement.

Scutcheon-GRAFTING is another method of grafting in the rind, by ſlitting the bark of the ſtock in form of the capital letter T, looſening it with the point of a knife, and inſerting a cion prepared as above. This is practiſed in June, July, and Auguſt; eſpecially if bark does not part eaſily from the ſtock; and in caſe of failure, it is properly ſupplied by cleft-grafting, in the enſuing month of February or March.

Crown-GRAFTING is only practiſed in the larger trees, which are capable of receiving a number of grafts, and are too big to be cloven: for theſe, the head or main branches, being cut off horizontally, four or more grafts are placed round the ſtock, between the bark and the rind, ſomewhat in the manner of a crown. The moſt proper time for performing this is about the latter end of March, or the beginning of April. After the intended number of cions are inſerted, which is done exactly in the ſame manner as that already delivered for grafting in the rind, the whole crown of the ſtock is well clayed over, and only two eyes of each cion are left uncovered; theſe being ſufficient for their ſhooting.

This method of grafting was more practiſed formerly than it is at preſent; many people having been diſcouraged by the ill ſucceſs that has frequently attended the cions, which have been blown out of the ſtock, by ſtrong winds, after they had made large ſhoots, and even after they had grown there five or ſix years. But this accident

may be prevented, by tying the cions to ſtakes faſtened to the tree, till they are ſo firmly fixed, as to have almoſt covered the ſtock.

Root-GRAFTING is a modern invention, the deſign of which is ſomewhat different from that of any of the former methods; this being for the propagation, or multiplication, of plants already fitted to produce their fruit.

To perform this, take a graft, or ſprig, of a young tree, which you intend to propagate, and a ſmall piece of the root of another tree of the ſame kind, or of a like genus, and whip-graft them together; obſerving that the but-ends of the graft and root be well united, and that the rind of the root join cloſely to that of the graft. Theſe may, afterwards, be planted out at pleaſure, and the piece of root will collect the nutritive juices, and feed the graft, as the ſtock does the other way.

This method of propagation is very eaſy and expeditious; roots being more plentiful than ſtocks: by this means the pieces of roots of one crab-ſtock, for example, or of one apple-ſtock, will ſerve for twenty or thirty apple grafts; and the like of other trees. It is alſo an excellent way for raiſing of tender trees, which will hardly bear being grafted in the ſtock. Add, that trees thus graſted bear ſooner, and are more eaſily dwarfed, than thoſe done any other way.

The only objection againſt this method is, that the young tree grows but ſlowly at firſt, which is occaſioned by the ſmallneſs of the root that feeds the graft; for in all trees the head muſt follow the increaſe of the roots, from whence it hath its nouriſhment.

Reiterated GRAFTING, or GRAFTING *by a double*, or *triple Inciſion*, is another method mentioned by Agricola, whoſe work, though chimerical enough in many reſpects, contains, notwithſtanding, ſeveral good things. To perform this, firſt graft a good cion on a ſtock, and cut it away to one half, or a third part; then fix to that remaining part of the cion, another graft, of a better kind; and to that a third; for the oftener the tree is grafted, the finer fruit it produces.

By this method, the author above-mentioned aſſures us, that he produced muſcat pears, which were admirable; making, at firſt, uſe of a ſtock grafted with a pound-pear, on which he grafted a ſummer bon-chretien; and when the branch of this laſt had ſhot, he grafted on it a cion of a bergamo, which he alſo cut, and grafted on it a cion of a muſcat pear.

GRAFTING *of Branches* is alſo commended by Agricola, as a very certain and profitable operation: beſt practiſed on large, full-grown, and even old trees.

To do this, half or more of the branches muſt be lopped off, and grafts of three or four years old be applied to them; taking care to have ſtakes, or other things, to ſupport them againſt the wind, &c.

He adds, that by this method, you will have, perhaps the ſame year, or at leaſt the ſecond or third, ſuch a quantity of fruit, as the youngeſt and ſoundeſt tree would hardly produce.

GRAFTING *by Approach*, called alſo *Inarching*, and *Ablactation*, is uſed only when the tree intended to be grafted, and that from which the graft is to be taken, ſtand ſo near, or can be brought ſo near to each other, that they may be joined together. The method of performing it is thus: The branch to be inarched is fitted to that part of the ſtock where it is to be joined; the rind, and part of the wood, of one ſide of that branch, is then pared away, very ſmooth and even for the length of three inches; and afterwards the other branch, which is to ſerve for the ſtock to which the graft is to be united, is ſerved in the ſame manner, ſo that the two may join cloſely and equally together, that the ſap veſſels may meet. A little tongue is then cut upwards in the graft, and a ſlit is made in the ſtock, to receive it; ſo that when they are joined, the tongue prevents their ſlipping, and the graft is the more cloſely united to the ſtock. When they are thus placed exactly together, they muſt be tied with baſs, worſted, or ſome other ſoft thing; and the place of junction muſt be well covered over with grafting clay, to prevent the air from drying the wound, and the wet from rotting the ſtock. A ſtake muſt alſo be fixed in the ground, and both the ſtock and the graft muſt be tied thereto to prevent their being diſplaced by the wind. When they have remained in this ſtate four months, they will be ſufficiently united, and the graft may then be cut off from the mother tree; obſerving to ſlope it cloſe to the ſtock. It is of great ſervice to the graft then to lay a freſh coat of clay all round the grafted or joined part. This operation ſhould be performed in April or May, that the graft may be perfectly united to the ſtock, before the enſuing winter. It is chiefly practiſed upon oranges, mirtles, jaſmines, firs, pines, and ſome other trees, which do not ſucceed well in the common way of grafting or budding. But, though orange-trees are here mentioned among the reſt, this practice is not to be adviſed for them, or for any other trees, if they are intended to grow large; for that they hardly ever do in this method; and accordingly it is ſeldom uſed but for the curioſity of having a young plant with fruit upon it, in a year or two from its having been raiſed from the ſeed. This is, indeed, effected by inarching a bearing branch into a young ſtock; but the plant ſo treated ſeldom lives long.

The walnut, fig, and mulberry, will alſo take by this method of grafting, though neither of them will ſucceed in any other way: but ſtill, they, like all other trees that are thus managed, will remain weak, and ſtinted in their growth, beſides the ſhortening of their otherwiſe uſual time of duration.

All grafts, particularly of young cions, are ſubject to be injured by birds; but that may be prevented by binding ſome ſmall buſhes about the tops of the ſtocks.

The binding of the grafts, whether it be of baſs or yarn, ſhould be looſened at leaſt, if it be not entirely taken off, at Midſummer, or thereabouts; leſt its then too great tightneſs (as the ſtock will have increaſed in bulk, and the binding perhaps have been ſwelled, and conſequently ſhrunk, by the weather) ſhould injure the plant.

Eſcutcheon GRAFTING. See INOCULATION.

GRAIN, a general name for all ſorts of corn, as wheat, barley, &c.

GRAIN is alſo the name of a ſmall weight, the twentieth part of a ſcruple in apothecaries weight, and the twenty-fourth of a penny-weight troy. See the article WEIGHT.

GRAIN alſo denotes the component particles of ſtones and metals, the veins of wood, &c. Hence croſs-grained, or againſt the grain, is contrary to the fibres of wood, &c.

GRAINING-BOARD, among curriers, an inſtrument called alſo a pummel, uſed to give a grain to their leather. See the article CURRYING.

GRAMEN, graſs, in botany. See the article GRASS.

GRAMEN JUNCEUM, a name uſed by Moriſon for a ſpecies of plantain.

GRAMINEOUS CROWN, in antiquity, the ſame with the obſidional one. See the article CROWN.

GRAMMAR, γραμματικη, the art of ſpeaking and writing any language with propriety.

GRAMMAR is alſo uſed for a book containing the rules of this art, methodically digeſted; of which there are multitudes indeed, but few good ones.

GRAMMARIAN, one that is ſkilled in, or teaches grammar.

GRAMMATICAL, in general, ſomething belonging to grammar. See the article GRAMMAR.

GRANADIER, a ſoldier armed with a ſword, a firelock, a bayonet, and a pouch full of hand-granadoes. They wear high caps, are generally the talleſt and briſkeſt fellows, and are always the firſt upon all attacks.

Every battalion of foot has generally a company of granadiers belonging to it, or elſe four or five granadiers belong to each company of the battalion; which, on occaſion, are drawn out, and form a company of themſelves. Theſe always take the right of the battalion.

Horſe-GRANADIERS, called by the French *grenadiers volans*, or flying-grenadiers, are ſuch as are mounted on horſeback, and fight on foot: their exerciſe is the ſame with the other granadiers.

GRANADILLA, paſſion-flower, a plant called by Linnæus paſſiflora. See the article PASSIFLORA.

GRANADO, a hollow ball or ſhell, of iron or other metal, about two inches and a half in diameter; which being filled with fine powder, is ſet on fire by means of a ſmall fuſee faſtened to the touch-hole, made of the ſame compoſition as that of a bomb: as ſoon as the fire enters the ſhell, it burſts into many pieces, much to the damage of all that ſtand near. See the article BOMB.

Thuanus obſerves, that the firſt time granadoes were uſed, was at the ſiege of Wachtendonck, a town near Gueldres; and that the inventor was an inhabitant of Venlo, who, in making an experiment thereof, occaſioned two-thirds of that city to be burnt, the fire being kindled by the fall of a granado.

GRANARY, a building to lay or ſtore corn in, eſpecially that deſigned to be kept a conſiderable time.

Experimental philoſophy has proved that the air is the great ſource of corruption; keep out that, and all is kept out; and the moſt corruptible ſubſtances, ſuch as meal, butter, milk, and the like, have been preſerved freſh four months in the exhauſted receiver of an air-pump.

They have, near Grand Cairo, a magazine or granary, defended with good walls, and called Joſeph's granaries. It is not probable that they are quite ſo old as the days of that patriarch, but they abundantly prove the utility of ſuch ſtore-houſes, by the vaſt quantities of grain annually preſerved in them.

Many parts of Africa abound with granaries of this kind.

They are ſo many deep pits made in the ſolid rock; the deſcent into them is but juſt large enough for a man to go down into them by, but they grow larger as ſoon as the perſon is in, and are uſually ſquare, from thirty to forty feet in diameter. In theſe the great men of the country preſerve their corn; they firſt ſtrew over the floor with ſtraw, then they lay on the corn; ſtill, as the heap riſes, placing a thin bed of ſtraw between the corn and the ſides, as they did at the bottom. In this manner they proceed till the whole cavity is filled: when this is done, they cover the mouth of the entrance with a ſort of hurdle of green boughs of trees, interwoven one with another. This they cover with about two feet thickneſs of ſand, and over this raiſe a ridge of earth, well beat together, in order to throw off the rain both ways, that none may ſettle on the place and ſoak into the magazine.

The corn thus ſtored up always keeps three, four, or more years very good; and, not unfrequently, the proprietor being taken off by the ſeverity of the eaſtern governments, under which they live, the magazine is forgotten, and ſome accident diſcovering it many years afterwards, the corn is almoſt always found perfectly good in it. All the care they take, in regard to the corn, is to expoſe it two or three days to the ſun's heat, to dry it thoroughly, before they carry it into the magazine.

In the dutchy of Lithuania and in the Ukraine, the people always preſerve their corn in the ſame manner in wells or pits made in dry places; but in theſe countries great care is to be taken in the opening theſe ſtore-rooms; for if people deſcend into them before they have had ſufficient communication with the freſh air, they are often killed by the damps; this, however, is eaſily guarded againſt. By theſe, and numerous other inſtances of the practice of other countries, it appears evident, that the advantage of theſe ſubterranean granaries over all others is very great.

Though theſe are to be recommended before all others, yet the common granaries may, with proper care, be rendered greatly more uſeful than they are at preſent. The grand caution neceſſary to this purpoſe is to guard againſt the too great humidity, which there always is in places where there is a great number of doors and windows. A too free acceſs of the external air is alſo to be carefully guarded againſt; for this brings in with it the eggs of a vaſt number of different inſects, which prey upon and deſtroy the corn. A third caution is, when the corn is the produce of the country, where it is preſerved, not to fill the place with the crop of one place only, but to mix the harveſts of two as different provinces as may be, the one dry, the other moiſt, or otherwiſe differing as much as may be; thus the contrary qualities of the one will prevent the deſtruction of the other. Theſe are the three great rules to prevent the corrupting of corn; but when the miſchief is once begun, it will prove very difficult to ſtop it: all the care that can be employed, ſhould therefore be taken in regard to theſe.

The two great cautions to be obſerved in the erecting of granaries are to make them ſufficiently ſtrong, and to expoſe them to the moſt drying winds. The ordering of the corn in many parts of England is thus: to ſeparate it from duſt and other impurities after it is threſhed, they toſs it with ſhovels from one end to the other of a long and large room; the lighter ſubſtances fall down in the middle of the room, and the corn only is carried from ſide to ſide, or end to end of it. After this, they ſcreen the corn, and, then bringing it into the granaries, it is ſpread about half a foot thick, and turned from time to time about twice in a week; once a week they alſo repeat the ſcreening it. This ſort of management they continue about two months, and after that they lay it a foot thick for two months more, and in this time they turn it once a week, or twice, if the ſeaſon be damp, and now and then ſcreen it again. After about five or ſix months, they raiſe it to five or ſix feet thickneſs in the heaps, and then they turn it once or twice in a month, and ſcreen it now and then. When it has lain two years, or more, they turn it once in two months, and ſcreen it once a quarter, and, how long ſoever it is kept, the oftener the turning and ſcreening is repeated, the better the grain will be found to keep.

It is proper to leave an area of a yard wide on every ſide the heap of corn, and other empty ſpaces, into which they turn and toſs the corn, as often as they find occaſion. In Kent they make two ſquare holes at each end of the floor, and one round in the middle, by means of which they throw the corn out of the upper into the lower rooms, and ſo up again, to turn and air it the better. Their ſcreens are made with two partitions, to ſeparate the duſt from the corn which falls into a bag; and when ſufficiently full, this is thrown away, the pure and good corn remaining behind.

Corn has by theſe means been kept in our granaries thirty years; and it is obſerved, that the longer it is kept, the more flour it yields in proportion to the corn, and the purer and whiter the bread is, the ſuperfluous humidity only evaporating in the keeping. At Zurich, in Switzerland, they keep corn eighty years or longer, by the ſame ſorts of methods.

The public granaries at Dantzick are ſeven, eight, or nine ſtories high, having a funnel in the midſt of every floor to let down the corn from one to another. They are built ſo ſecurely, that though every way ſurrounded with water, the corn contracts no damp, and the veſſels have the convenience of coming up to the walls for their lading. The Ruſſians preſerve their corn in ſubterranean granaries of the figure of a ſugar-loaf, wide below, and narrow at top: the ſides are well plaiſtered, and the top covered with ſtones. They are very careful to have the corn well dried before it is laid into theſe ſtore-houſes, and often dry it by means of ovens; the ſummer dry weather being too ſhort to effect it ſufficiently.

GRAND, a term borrowed from the French, implying the ſame with great.

GRAND-JURY, the jury who find bills of indictment at the ſeſſions, &c. of the peace.

GRANGE, a houſe or farm furniſhed with granaries and barns for holding corn, ſtables for horſes, ſtalls for cattle, &c.

GRANIFEROUS *Pods*, among botaniſts, are ſuch as contain ſmall ſeeds reſembling grain.

The word is compounded of the Latin, *granum*, grain, and *fero*, to bear.

GRANITE, *Granita*, in natural hiſtory, a diſtinct genus of ſtones, compoſed of ſeparate and very large concretions, rudely compacted together, of great hardneſs, and capable of receiving a very beautiful poliſh.

GRANIVOROUS, in natural hiſtory, an epithet given to animals that feed on corn or ſeed.

The word is compounded of the Latin, *granum*, grain, and *vora*, to devour.

GRANULATION, in metallurgy, the action of reducing

ducing metals to ſmall particles in order to promote their fuſion and mixture with other bodies.

GRAPES, the fruit of the vine. See the article VINE.

GRAPHOMETER, among ſurveyors, an inſtrument for taking angles, and generally called a ſemi-circle. See SEMI-CIRCLE.

GRAPPLING, in the ſea language, a ſort of ſmall anchor with four or five flukes or arms, commonly uſed to ride a boat. See the article ANCHOR.

Fire-GRAPPLING, an inſtrument nearly reſembling the above, only that it is fitted with ſtrong barbs in the room of flukes; and is fixed at the yard-arms of a fire-ſhip to grapple her adverſary, and ſet her on fire.

GRASS, *Gramen*, in botany, a general name for moſt of the herbaceous plants uſed in feeding cattle.

The beſt ſeaſon for ſowing graſs ſeed is the latter end of Auguſt, and the beginning of September, that the graſs may be well rooted before the froſt ſet in, which is apt to turn the plants out of the ground, when they are not well rooted. This ſeed ſhould be ſown in moiſt weather, or when there is a proſpect of ſhowers, which will ſoon bring the graſs up; for, the earth being at that ſeaſon warm, the moiſture will cauſe the ſeed to vegetate in a few days: but, where this cannot be performed in autumn, the ſeeds may be ſown in the ſpring; towards the middle of March will be a good time, if the ſeaſon proves favourable.

The land on which graſs ſeed is intended to be ſown, ſhould be well plowed, and cleared from the roots of noxious weeds, ſuch as couch graſs, fern, ruſhes, heath, gorſe, broom, reſt-harrow, &c. which, if left in the ground, will ſoon get the better of the graſs, and over-run the land. Therefore, in ſuch places where either of theſe weeds abound, it will be a good method to plow up the ſurface in April, and let it lie ſome time to dry; then lay it in ſmall heaps, and burn it. The aſhes ſo produced, when ſpread on the land, will be a good manure for it. The method of burning the land is particularly uſeful; eſpecially, if it is a cold ſtiff ſoil; but where couch graſs, fern, or reſt-harrow, is in plenty, whoſe roots run far under ground, the land muſt be plowed two or three times pretty deep in dry weather, and the roots carefully harrowed off each plowing; which is the moſt ſure method to deſtroy them. Where the land is very low, and of a ſtiff clayey nature, which holds water in winter, it will be of ſingular ſervice to make ſome underground drains to carry off the wet; which, if detained too long on the ground, will render the graſs ſour. The method of making theſe drains is preſcribed under the article LAND, which ſee.

Before the ſeed is ſown, the ſurface of the ground ſhould be made level and fine, otherwiſe the ſeed will be buried unequal. The quantity of graſs-ſeed for an acre of land is uſually three buſhels, if the ſeed is clean, otherwiſe there muſt be a much greater quantity allowed; when the ſeed is ſown, it muſt be gently harrowed in, and the ground rolled with a wooden roller; which will make the ſurface even, and prevent the ſeeds being blown in patches. When the graſs comes up, if there ſhould be any bare ſpots, where the ſeed has not grown, they may be ſown again, and the ground rolled, which will fix the ſeeds; and the firſt kindly ſhowers will bring up the graſs, and make it very thick.

Some people mix clover and rye graſs together, allowing ten pounds of clover, and one buſhel of rye graſs, to an acre: but this is only to be done where the land is deſigned to remain but three or four years in paſture, becauſe neither of theſe kinds are of long duration; ſo that, where the land is deſigned to be laid down for many years, it will be proper to ſow with the graſs-ſeed ſome white trefoil, or Dutch clover; which is an abiding plant, and ſpreads cloſe on the ſurface of the ground, ſending forth roots at every joint; and makes the cloſeſt ſward of any, and is the ſweeteſt feed for cattle: ſo that, whenever land is laid down to paſture, there ſhould always be ſix or eight pounds of this ſeed ſown upon each acre.

The following ſpring, if there ſhould be any thiſtles, ragwort, or ſuch other troubleſome weeds, come up among the graſs, they ſhould carefully be cut up with a ſpaddle before they grow large; and this ſhould be repeated two or three times in the ſummer, which will effectually deſtroy them; for, if theſe plants are ſuffered to ripen their ſeeds, they will be blown all over the ground; their ſeeds having down adhering to them, which aſſiſts their tranſportation; ſo that they are often carried by the wind to a great diſtance, and thereby become very troubleſome weeds to the graſs. For want of this care, how many paſtures may be ſeen almoſt over-run with theſe weeds, eſpecially the ragwort; when a ſmall expence, if applied in time, would have intirely extirpated them! for a man may go over ſeveral acres of land in one day with a ſpaddle, and cut up the weeds juſt below the ſurface of the ground, turning their roots upwards; which if done in dry weather, they will ſoon decay; but this muſt always be performed before the plants come to have their ſeeds formed; becauſe after that many ſorts will live long enough to nouriſh their ſeeds after they are cut, ſo as to ripen them: and there will be a ſupply of weeds for ſome years after, which cannot be extirpated without a much greater expence.

The proper management of paſture land is the leaſt underſtood of any part of agriculture: the farmers never have attended to this, being more inclined to the plough; though the profit attending that has not of late years been ſo great as to encourage them in that part of huſbandry: but theſe people never think of laying down land for paſture, to continue longer than three years; at the end of which time they plow it up again, to ſow it with grain.

Their uſual method is to ſow rye graſs and trefoil with barley, when they intend to lay down the ground; or ſometimes ſow only clover with the barley; nor is it poſſible to convince theſe people of their error in ſowing corn with this graſs; which they affirm to be uſeful in ſhading the graſs; not conſidering how much the corn draws away the nouriſhment from the graſs: but it is in vain to write to theſe people, who are not to be convinced, either by argument or experiment; ſo much are they led by cuſtom, as not to be led or driven out of their own methods; but, as their practice of huſbandry has greatly leſſened the circumſtances of the farmers, ſo that the lands are daily falling into the hands of the owners, therefore, this part of huſbandry ſhould by them be principally attended to, as it may be carried on with a much leſs expence: for paſture land requires but few hands to manage; whereas the ſowing of corn is attended with great expence, and the profit is very precarious: but, when this is attended with ſucceſs, and the grain at a moderate price, if the whole labour is to be paid for, there will be little coming to the owner for rent, when the balance is fairly ſtated; but in this moſt gentlemen deceive themſelves, and often ſuppoſe they gain by farming, when, perhaps, the whole rent of the land is loſt: therefore, to avoid the trouble which attends this ſort of huſbandry, it will be the beſt method to turn as much of their land into paſture, as they can; which, by grazing and feeding of ſheep, will be attended with little expence, and a ſure profit.

As to graſs plats and green walks, they are made, for the moſt part, not by ſowing graſs-ſeed, but by laying turfs: and indeed the turfs from a fine common or down, are much preferable to ſown graſs: but if walks or plats are to be made by ſowing, the beſt way is to procure the ſeed from thoſe paſtures where the graſs is naturally fine and clear, or elſe the trouble of keeping it from ſpiry or benty graſs will be very great, and it will ſcarce ever look handſome.

In order to ſow graſs-walks, the ground muſt be firſt dug; and when it has been firſt dreſſed and laid even, it muſt be very carefully raked over, and all the clods and ſtones taken off, and then covered over an inch thick with good mould. This being done, the ſeed is to be ſown pretty thick, that it may come up cloſe and ſhort; it muſt then be raked over again, to cover the ſeed, that if the weather ſhould happen to be windy, it may not be blown away. It ought alſo to be obſerved, that where graſs is ſown in gardens, either for lawns or walks, there ſhould always be a good quantity of the white trefoil or Dutch clover ſown with it; for this will make a fine turf much ſooner than any other ſown graſs, and will continue a better verdure than any other of the graſs-tribe.

In order to keep graſs-plats or walks handſome, and in good order, you may ſow in autumn freſh ſeed over any places that are not well filled, or where the graſs is dead: but nothing improves graſs ſo much, as mowing and conſtant rolling.

When turf is laid in gardens, it is a general practice to cover the ſurface of the ground under the turf, either with ſand or very poor earth: the deſign of this is to keep the graſs fine, by preventing its growing too rank. This is proper enough for very rich ground, but it is not ſo for ſuch land as is but middling, or poor; for when this is practiſed in ſuch places, the graſs will ſoon wear out and decay in patches.

When turf is taken from a common or down, ſuch ought to be choſen as is free from weeds: and when it is deſigned to remain for years without renewing, a dreſſing ſhould be laid upon it every other year, either of very rotten dung, aſhes, or where it can be eaſily procured, very rotten tan; but theſe dreſſings ſhould be laid on early in the winter, that the rain may waſh them into the ground, otherwiſe they will occaſion the graſs to burn, when the warmth of the ſummer begins. Where graſs is ſo dreſſed, and kept well rolled and mowed, it may be kept very beautiful for many years: but where it is not dreſſed, or fed with ſheep, it will rarely continue handſome more than eight or ten years.

GRASSHOPPER, in zoology, a ſpecies of the gryllus, frequent in paſtures. See GRYLLUS.

GRATINGS, in ſhip-building, certain hatches or covers laid over the hatchways of a ſhip, and croſſed with battens of wood, ſo as to let the light down between the decks of a ſhip. See HATCHES.

GRAVE, in muſic, is applied to a ſound of a low or deep tone.

GRAVE *Accent*, in grammar, is a mark placed in this manner [`] over ſome vowel, and implies that the voice ſhould be lowered in pronouncing that ſyllable.

GRAVEL, in natural hiſtory, is a congeries of ſmall pebbles, which being mixed with a ſtiff loam, makes laſting and elegant walks in our gardens.

Opinions with regard to the choice of gravel, are various; ſome are for having it as white as poſſible, and in order to render it the more ſo cauſe the walks to be often rolled with ſtone rollers, which add a whiteneſs to the ſurface. But this renders them very troubleſome to the eyes, by reflecting too ſtrongly the rays of light: ſuch gravel therefore as will lie ſmooth and reflect the leaſt, ſhould be preferred. Again, ſome ſcreen the gravel too fine, but this is an error; for if it be caſt into a round heap, and the great ſtones only are raked off, it will be the better. There are many kinds of gravel which do not bind, and by this means cauſe a continual trouble of rolling, to little or no purpoſe; as for ſuch, if the gravel be looſe or ſandy, you ſhould take one load of ſtrong loam and two of gravel, and ſo caſt them well together.

The month of March is the propereſt time for laying gravel; for it is not prudent to do it ſooner, or to lay walks in any of the winter-months before that time. In making theſe walks, great regard muſt be had to the level of the ground, ſo as to lay the walks with eaſy deſcents toward the low parts of the ground, that the wet may be eaſily drained off: but when the ground is level, it will be proper to have ſink-ſtones laid by the ſides of the walk, and at convenient diſtances, to let off the wet; and when the ground is naturally dry, the drains from the ſink-ſtones may be contrived ſo as to convey the water into ſeſſpools, from which the water will ſoak away in a ſhort time: but in wet lands there ſhould be underground drains, to convey the water off, either into ponds, ditches, or the neareſt place proper to receive it.

Some are apt to lay gravel walks too round; but this is an error, becauſe they are not ſo good to walk upon; and beſides, it makes them look narrow; one inch is enough in a crown of five feet; and it will be ſufficient, if a walk be ten feet wide, that it lies two inches higher in the middle than it does on each ſide: if fifteen feet, three inches; if twenty feet, four inches; and ſo in proportion.

For the depth of gravel-walks, ſix or eight inches may do well enough; and a foot in thickneſs will be ſufficient for any; but then there ſhould always be a depth of rubbiſh laid under the gravel, eſpecially if the ground be wet.

Some turn up gravel walks into ridges in December, in order to kill the weeds: but this is very wrong, ſince it never anſwers the end, and therefore if conſtantly rolling them after rain and froſt will not effectually kill the weeds and moſs, you ſhould turn the walks in March, and lay them down at the ſame time.

In order to deſtroy worms that ſpoil the beauty of gravel or graſs walks, ſome recommend the watering them with water made very bitter by ſteeping walnut-tree leaves in it; but if in the firſt laying of the walks there be a good bed of lime rubbiſh laid at the bottom, it will prove the moſt effectual method to keep out the worms, for they never harbour near lime.

GRAVEL, in medicine, a very painful diſtemper ariſing from a gritty matter concreting into ſmall ſtones in the kidnies and bladder. See the article STONE.

GRAVELLING, an accident that often happens to a horſe in travelling, occaſioned by ſmall gravel-ſtones getting between the hoof and the ſhoe, where they feſter and fret the part.

It is cured by taking off the ſhoe, picking out all the gravel, waſhing the part affected, and then pouring hot upon it a compoſition of ſheep's tallow and bay ſalt melted together.

GRAVELLY *Land*, that which abounds with gravel and ſand.

The beſt manure of theſe lands is marl, or any ſtiff clay that will diſſolve with the froſt, cow dung, chalk, mud, and half rotten ſtraw from the dung-hill.

GRAVER, the name of a tool by which all the lines, ſcratches, and ſhades, are engraved on copper, &c.

There are three ſorts of gravers, round-pointed, ſquare-pointed, and lozenge-pointed. The round are beſt for ſcratching; the ſquare pointed for cutting the larger ſtrokes; and the lozenge pointed for the moſt delicate ſtrokes: but a graver of a middle form between the ſquare and lozenge-pointed will make the ſtrokes or hatches appear with more life and vigour. See ENGRAVING.

GRAVING, among ſeamen, the act of cleaning a ſhip's bottom. See CAREEN and DOCK, where this operation is particularly explained.

GRAVITATION, in philoſophy, the preſſure which one body exerts upon another by reaſon of its gravity. See the article ATTRACTION.

GRAVITY, the natural tendency which all bodies have towards a center. See ATTRACTION.

GRAVITY, in mechanics, the tendency of bodies towards the center of the earth. Gravity is of two kinds, abſolute and relative, or ſpecific.

Abſolute GRAVITY is the whole force with which a body tends downwards, or towards the center of the earth, and is always equal to the quantity of matter the body contains, without any regard to its bulk; ſo that the abſolute gravity of a pound of wood is equal to that of a pound of iron.

Relative or *Specific* GRAVITY is the exceſs of gravity in one body above that of another of equal dimenſions, and is always proportionable to the quantity of matter under that dimenſion. Thus a cubic inch of iron is heavier than a cubic inch of wood; for the iron being more denſe than the wood, contains a greater quantity of matter under the ſame bulk.

For the method of finding the ſpecific gravities of bodies, ſee the article *Hydroſtatical* BALANCE.

GRAVITY *of the Air*. See AIR and ATMOSPHERE.

GRAY, or GREY, in horſemanſhip. See the article GREY.

GREASE, in farriery, a ſwelling and gourdineſs of the legs of a horſe.

This diſeaſe is generally the effects of a faulty blood, and happens moſtly to horſes of a groſs conſtitution; ſometimes it is owing to careleſſneſs in the perſons that look after them, for want of keeping their limbs clean and dry; but for the moſt part horſes that run late in the winter at graſs are the moſt ſubject to it; their blood by that means growing poor and dropſical, expoſes them firſt to ſwell in their limbs, and then to eruptions, which diſcharge a fœtid ſtinking matter reſembling melted glue, and when it turns ſharp and corroſive, it becomes very trou-

troubleſome. Sometimes the greaſe breaks out only behind, ſometimes before; and when the conſtitution is very bad, it will break out in all the four limbs at the ſame time.

When the heels are very much ſwelled and full of hard ſcabs, it is neceſſary to begin the cure with poultices, which may be made with either turneps or rye-flower, turpentine, and hogs lard, mixed with ſpirit of wine or red wine-lees; and when the horſe comes to move his limbs with leſs ſtiffneſs, it will be proper to purge him, which, in ſome caſes, muſt be repeated five or ſix times before you can obtain the deſired effect. Where there are pretty large ſwellings in the limbs, diuretics that work powerfully by urine, often ſucceed better than purges.

Molten GREASE, a diſtemper incident to very fat horſes from over-riding, or any violent exerciſe.

It is known by the horſe's voiding a greaſy matter with his dung; though this ſymptom ſometimes attends fat horſes that ſtand much in the ſtable, and have but very little exerciſe, on their catching the leaſt cold. But when a horſe's greaſe is really melted, it is always accompanied with a fever, heat, reſtleſſneſs, ſtarting tremors or tremblings, great inward ſickneſs, ſhortneſs of breath, and ſometimes with the ſymptoms of a pleuriſy.

In order to cure this diſeaſe, it is neceſſary to bleed plentifully in order to empty the veſſels; and ſeveral rowels or iſſues ſhould be cut in different parts of his body. Glyſters are alſo of great ſervice, and ought to be rather of the emollient kind, than purgative, as they are principally intended to cool the inteſtines; all the other internals ought likewiſe to be cleanſing, attenuating, and opening.

GREAT, a term of compariſon, applied to things of large or extraordinary dimenſions, &c.

GREAT *Circles of the Sphere*, are ſuch as divide the ſphere into two equal parts or hemiſpheres, in contradiſtinction to the leſſer circles, which cut the ſphere into unequal parts. See SPHERE.

GREAT *Circle Sailing*. See the article SAILING.

GREECE, the preſent Rumelia, and the ancient Hellas, one of the moſt famous republics of antiquity, is ſituated between 36 and 44 degrees of north latitude; and between 20 and 26 degrees of eaſt longitude. It is in general a very healthy and fruitful country, extending from the Adriatic ſea to the Archipelago.

GREEK, or GRECIAN, ſomething relating to ancient Greece.

GREEK *Bible*. See the article BIBLE.

GREEK *Church*, that part of the Chriſtian church eſtabliſhed in Greece and other parts of Turkey.

GREEK *Language*, the language ſpoken by the ancient Greeks, and ſtill preſerved in the writings of Plato, Ariſtotle, Demoſthenes, Thucydides, Xenophon, Homer, Heſiod, &c.

The Greek language was that of a people who had a taſte for the arts and ſciences, which they happily cultivated; and hence it abounds with very ſignificative terms, which are often borrowed by the moderns, and applied to any new diſcovery, inſtrument, machine, &c.

GREEK *Orders*, in architecture, are the Doric, Ionic, and Corinthian; the other two, namely, the Tuſcan and Compoſite, being called the Latin orders.

GREEN, one of the original colours of the rays of light. See the article COLOUR.

GREEN, among painters and dyers, is a colour produced by a mixture of yellow and blue, which will be either deeper or lighter in proportion to the quantity of yellow uſed in the compoſition.

GREEN-CLOTH, a board or court of juſtice, held in the compting-houſe of the king's houſhold, compoſed of the lord-ſteward, and the officers under him, who ſit daily, and take cognizance of matters of juſtice within the verge of the court, which extends about two hundred yards every way from the laſt gate of the palace where his majeſty reſides.

GREEN-FINCH, in ornithology, the Engliſh name of the greeniſh fringilla, having its wings and tail variegated with yellow. It is a very common bird with us, and ſomething larger than the chaffinch.

GREENHOUSE, a conſervatory, or houſe erected in a garden, for preſerving ſuch tender and exotic plants as cannot bear the cold of our winters, if expoſed to the open air.

The following deſcription of a green-houſe is taken from Mr. Miller's Gardener's Dictionary, as the conſervatory given by that ingenious gardener is very well adapted to this climate.

The length of theſe houſes muſt be proportioned to the number of plants they are intended to contain; but their depth ſhould never be greater than their height in the clear; which, in ſmall or middling houſes, may be ſixteen or eighteen feet, and in large ones from twenty to twenty four. The windows in front ſhould extend from about one foot and a half above the pavement, to within the ſame diſtance of the ceiling, which will admit of a corniche round the building, over the heads of the windows. In a ſmall green-houſe the ſaſhes ſhould not be leſs than four or five feet broad; and in a large one, they ought not to exceed ſeven and a half; the ſhutters of which ought to fall back cloſe to the piers on the inſide, that, when open, they may not prevent any of the rays of light from reaching the plants. The piers between theſe windows, ſupporting the building, ſhould be as narrow as poſſible; for which reaſon they ſhould be either of ſtone or well-burnt brick. If they are of ſtone, they ought not to exceed two feet and a half in front, and ſhould be ſloped off backward to about eighteen inches broad; by which means the rays of the ſun will not be obſtructed by the corners of the piers, as they would be if they were ſquare: but if they are built of brick, it will be proper to make them near three feet in front, otherwiſe they will be too weak to ſupport the building: theſe I would alſo adviſe to be ſloped off in the manner directed for the ſtone.

At the back of the green-houſe, there may be erected an houſe for tools, and many other purpoſes; which will be extremely uſeful, and alſo prevent froſt from entering the houſe that way; ſo that the wall between theſe need not be more than two bricks and an half in thickneſs; whereas, were it quite expoſed behind, it ſhould be at leaſt three bricks in thickneſs; and by this contrivance, if you are willing to make an handſome building, and to have a noble room over the green-houſe, you may make the room over the tool-houſe, and carry up the ſtair-caſe in the back, ſo as not to be ſeen in the green-houſe; and hereby you may have a room twenty-five or thirty feet in width, and of a proportionable length: and, under this ſtair caſe, there ſhould be a private door into the green-houſe, at which the gardener may enter in hard froſty weather, when it will not be ſafe to open any of the glaſſes in the front. The floor of the green-houſe, which ſhould be laid either with marble, ſtone, or broad tiles, according to the fancy of the owner, muſt be raiſed two feet above the ſurface of the ground whereon the houſe is placed; which, in dry ground, will be ſufficient: but if the ſituation be moiſt and ſpongy, and thereby ſubject to damps, it ſhould be raiſed at leaſt three feet above the ſurface: and if the whole is arched with low brick arches under the floor, it will be of great ſervice in preventing the damps riſing in winter, which are often very hurtful to the plants, eſpecially in great thaws, when the air is often too cold to be admitted into the houſe, to take off the damps. Under the floor, about two feet from the front, I would adviſe a flue of about ten inches in width, and two feet deep, to be carried the whole length of the houſe, which may be returned along the back part, and be carried up in proper funnels adjoining to the tool-houſe, by which the ſmoke may paſs off. The fire-place may be contrived at one end of the houſe, and the door at which the fuel is put in, as alſo the aſh-grate, may be contrived to open into the tool-houſe, ſo that it may be quite hid from the ſight, and be in the dry; and the fuel be laid in the ſame place, whereby it will always be ready for uſe.

I ſuppoſe many people will be ſurpriſed to ſee me direct the making flues under a green-houſe, which has been diſuſed ſo long, and by moſt people thought of ill conſequence; as indeed they have often proved, when under the direction of unſkilful managers, who have thought it neceſſary, whenever the weather was cold, to make fires therein. But however injurious flues have been under ſuch management, yet, when ſkilfully managed,

naged, they are of very great ſervice: for, though perhaps it may happen that there will be no neceſſity to make any fires in them for two or three years together, as, when the winters prove mild, there will not, yet, in very hard winters, they will be extremely uſeful to keep out the froſt; which cannot be effected any other way, but with great trouble and difficulty.

Withinſide of the windows, in front of the green-houſe, you ſhould have good ſtrong ſhutters, which ſhould be made with hinges, to fold back, that they may fall back quite cloſe to the piers, that the rays of the ſun may not be obſtructed thereby. Theſe ſhutters need not to be above an inch and an half thick, or little more; which, if made to join cloſe, will be ſufficient to keep out our common froſt: and, when the weather is ſo cold as to endanger the freezing in the houſe, it is but making a fire in your flue, which will effectually prevent it: and without this conveniency it will be very troubleſome, as I have often ſeen, where perſons have been obliged to nail mats before their windows, or to ſtuff the hollow ſpace between the ſhutters and the glaſs with ſtraw; which, when done, is commonly ſuffered to remain till the froſt goes away; which, if it ſhould continue very long, the keeping the green-houſe cloſely ſhut up will prove very injurious to the plants: and as it frequently happens, that we have an hour or two of ſunſhine in the middle of the day, in continued froſts, which is of great ſervice to plants, when they can enjoy the rays thereof through the glaſſes; ſo, when there is nothing more to do than to open the ſhutters, which may be performed in a very ſhort time, and as ſoon ſhut again when the ſun is clouded, the plants may have the benefit thereof, whenever it appears; whereas, where there is ſo much trouble to uncover, and as much to cover again, it would take up the whole time in uncovering and ſhutting them up, and thereby the advantage of the ſun's influence be loſt. Beſides, where there is ſo much trouble required to keep out the froſt, it will be a great chance if it be not neglected by the gardener: for, if he be not as fond of preſerving his plants, and as much in love with them, as his maſter, this labour will be thought too great by him; and, if he takes the pains to cover the glaſſes up with mats, &c. he will not care to take them away again, until the weather alters; ſo that the plants will be ſhut up cloſe during the whole continuance of the froſt.

There are ſome people who commonly make uſe of pots filled with charcoal to ſet in their green-houſe in very ſevere froſts; but this is very dangerous to the perſons who attend theſe fires; and I have often known they have been almoſt ſuffocated therewith; and at the ſame time they are very injurious to the plants: nor is the trouble of tending upon theſe ſmall; and the many hazards, to which the uſe of theſe fires is liable, have juſtly brought them into diſuſe with all ſkilful perſons; and as the contrivance of flues, and of the fires, are but ſmall charges, they are much to be preferred to any other method for warming the air of the houſe.

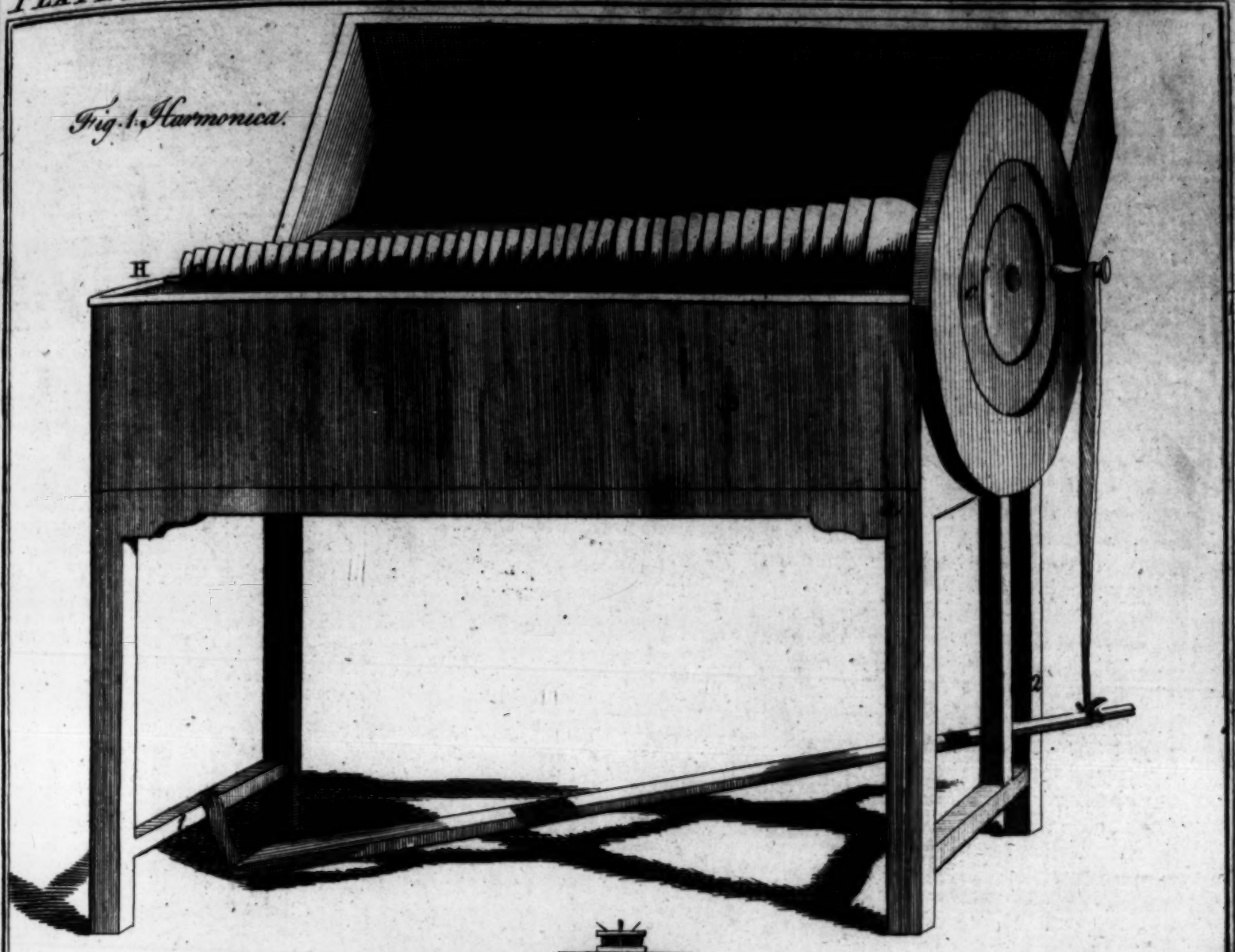
The back part of the houſe ſhould be either laid over with ſtucco, or plaſtered with mortar, and white-waſhed; for otherwiſe the air in ſevere froſt will penetrate through the walls, eſpecially when the froſt is attended with a ſtrong wind; which is often the caſe in the moſt ſevere winters. There are ſome perſons who are at the expence of wainſcoting their green-houſes; but, when this is done, it is proper to plaſter with lime and hair behind the wainſcot, to keep out the cold; and, when they are lined with wainſcot, they ſhould be painted white, as ſhould the ceiling, and every part withinſide of the houſe: for this reflects the rays of light in much greater quantity than any other colour, and is of ſignal ſervice to plants, eſpecially in the winter, when the houſe is pretty much cloſed, and but a ſmall ſhare of light is admitted through the windows: for, at ſuch times, I have obſerved, that in ſome green-houſes which have been painted black, or of a dark colour, the plants have caſt moſt of their leaves.

Where green-houſes are built in ſuch places as will not admit of rooms over them, or the perſon is unwilling to be at the expence of ſuch building, there muſt be care taken to keep out the froſt from entering through the roof. To prevent which, it will be very proper to have a thickneſs of reeds, heath, or furz, laid between the ceiling and the tiles: in the doing of which, there muſt be care taken in framing the joiſts, ſo as to ſupport theſe, that their weight may not lie upon the ceiling, which might endanger it: for theſe ſhould be laid a foot thick at leaſt, and as ſmooth as poſſible, and faſtened down well with laths, to prevent their riſing; and then cover it over with a coat of lime and hair, which will keep out the air, and alſo prevent mice, and other vermin, from harbouring in them; which, if left uncovered, they would certainly do. For want of this precaution, there are many green-houſes built, which will not keep out the froſt in hard winters; and this is many times attributed to the glaſſes in front admitting the cold, when the fault is in the roof: for where there is only the covering, either of tiles or ſlates, and the ceiling, every ſevere froſt will penetrate through them.

In this green-houſe you ſhould have treſſels, which may be moved out and into the houſe; upon which you ſhould fix rows of planks, ſo as to place the pots or tubs of plants in regular rows one above another, whereby the heads of the plants will be ſo ſituated as not to interfere with each other. The loweſt row of plants, which ſhould be the forwardeſt towards the windows, ſhould be placed about four feet therefrom, that there may be a convenient breadth left next the glaſſes to walk in front: and the rows of plants ſhould riſe gradually from the firſt, in ſuch a manner, that the heads of the ſecond rows ſhould be entirely advanced above the firſt, the ſtems only being hid thereby; and, at the backſide of the houſe, there ſhould be allowed a ſpace of at leaſt five feet, for the conveniency of watering the plants; as alſo to admit of a current of air round them, that the damps, occaſioned by the perſpiration of the plants, may be the better diſſipated, which, by being pent in too cloſely, often occaſions a mouldineſs upon the tender ſhoots and leaves; and when the houſe is cloſe ſhut up, this ſtagnating rancid vapour is often very deſtructive to the plants: for which reaſon alſo you ſhould never croud them too cloſe to each other, nor ſhould you ever place ſedums, euphorbiums, torch thiſtles, and other tender ſucculent plants, amongſt oranges, myrtles, and other ever-green-trees; for, by an experiment which I made anno 1729, I found that a ſedum, placed in a green-houſe among ſuch trees, almoſt daily increaſed its weight, although there was no water given to it the whole time; which increaſe of weight was owing to the moiſture imbibed from the air, which, being replete with the rancid vapours perſpired from the other plants, occaſioned the leaves to grow pale, and in a ſhort time they decayed, and dropped off; which I have often obſerved has been the caſe with many other ſucculent plants, when placed in thoſe houſes which were filled with many ſorts of ever-green trees, that required to be frequently watered.

Therefore, to avoid the inconvenience which attends the placing of plants of very different natures in the ſame houſe, it will be very proper to have two wings added to the main green-houſe; which, if placed in the manner expreſſed in the annexed plan, will greatly add to the beauty of the building, and alſo collect a greater ſhare of heat. In this plan, the green-houſe is placed exactly fronting the ſouth; and one of the wings faces the ſouth-eaſt, and the other the ſouth-weſt; ſo that, from the time of the ſun's firſt appearance upon any part of the building, until it goes off at night, it is conſtantly reflected from one part to the other; and the cold winds are alſo kept off from the front of the main green-houſe hereby: and, in the area of this place, you may contrive to place many of the moſt tender exotic plants, which will bear to be expoſed in the ſummer ſeaſon: and in the ſpring, before the weather will permit you to ſet out the plants, the beds and borders of this area may be full of anemonies, ranunculus's, early tulips, &c. which will be paſt flowering, and the roots fit to take out of the ground, by the time you carry out the plants; which will render this place very agreeable during the ſpring ſeaſon that the flowers are blown; and here you may walk and divert yourſelf in a fine day, when, perhaps, the air in moſt other parts of the garden will be too cold for perſons not much uſed thereto, to take pleaſure in being out of the houſe.

Fig. 1. Harmonica.



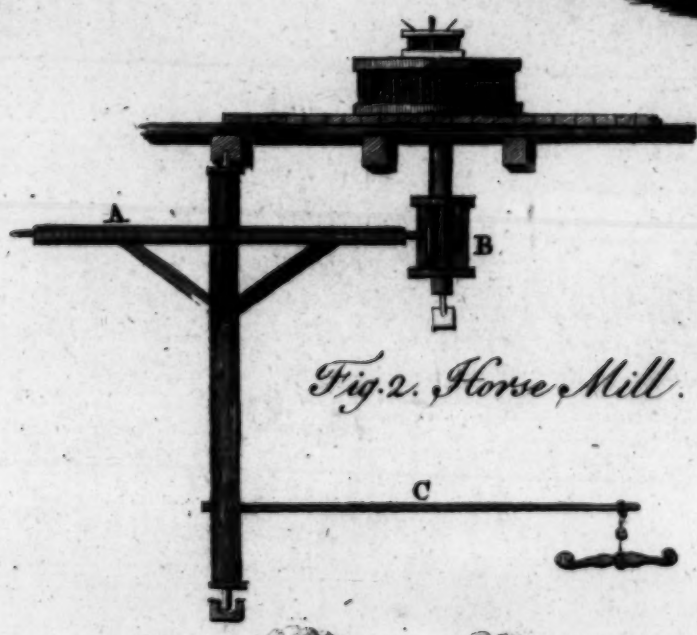


Fig. 2. Horse Mill.

Fig. 3. Green-house.

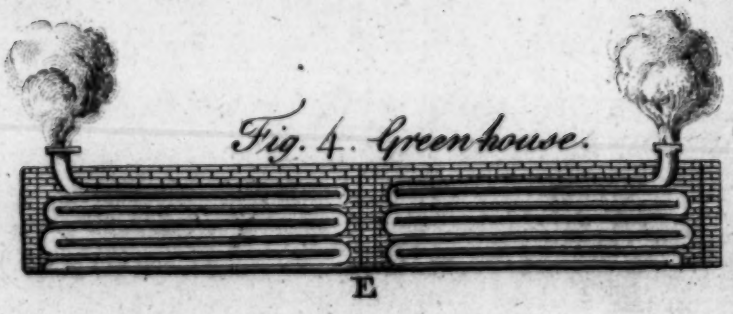


Fig. 4. Green-house.

Fig. 5. Green-house.

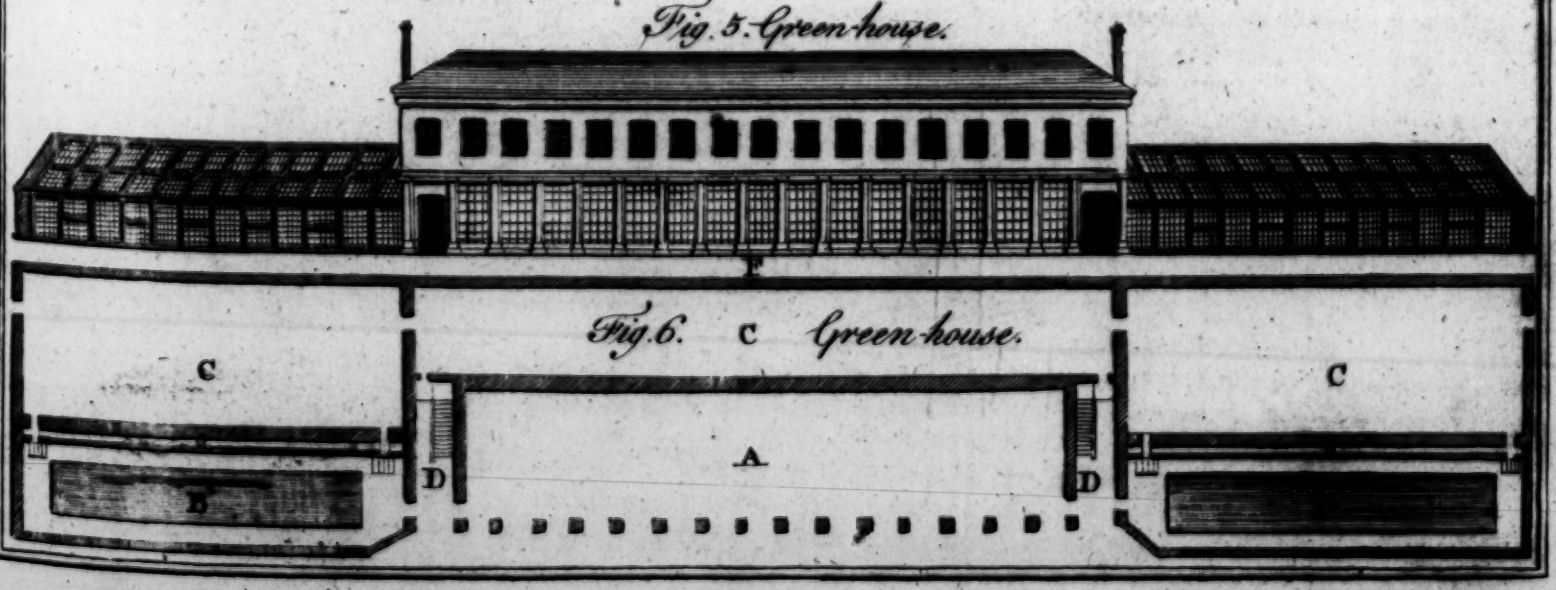


Fig. 6. C Green-house.

5 JA 59

In the center of this area may be contrived a ſmall baſon for water, which will be very convenient for watering of plants, and add much to the beauty of the place: beſides, the water, being thus ſituated, will be ſoftened by the heat, which will be reflected from the glaſſes upon it; whereby it will be rendered much better than raw cold water for theſe tender plants.

The two wings of the building ſhould be contrived ſo as to maintain plants of different degrees of hardneſs; which muſt be effected by the ſituation and the extent of the fire-place, and the manner of conducting the flues; a particular account of which will be exhibited under the article STOVES. But I would here obſerve, that the wing facing the ſouth-eaſt ſhould always be preferred for the warmeſt ſtove; its ſituation being ſuch, as that the ſun, upon its firſt appearance in the morning, ſhines directly upon the glaſſes; which is of great ſervice in warming the air of the houſe, and adding life to the plants, after having been ſhut up during the long nights in the winter ſeaſon. Theſe wings being, in the draught annexed, allowed ſixty feet in length, may be divided in the middle by partitions of glaſs, with glaſs doors to paſs from one to the other. To each of theſe there ſhould be a fire-place, with flues carried up againſt the back wall, thro' which the ſmoke ſhould be made to paſs, as many times the length of the houſe, as the height will admit of the number of flues; for the longer the ſmoke is in paſſing, the more heat will be given to the houſe, with a leſs quantity of fuel; which is an article worth conſideration, eſpecially where fuel is dear. By this contrivance, you may keep ſuch plants as require the ſame degree of heat in one part of the houſe, and theſe will thrive in a much leſs warmth in the other part; but this will be more fully explained under the article STOVES.

The other wing of the houſe, facing the ſouth-weſt, may alſo be divided in the ſame manner, and flues carried through both parts, which may be uſed according to the ſeaſons, or the particular ſorts of plants which are placed therein; ſo that here will be four diviſions in the wings, each of which may be kept up to a different degree of warmth: which, together with the green-houſe, will be ſufficient to maintain plants from all the ſeveral countries of the world; and, without having theſe ſeveral degrees of warmth, it will be impoſſible to preſerve the various kinds of plants from the ſeveral parts of Africa and America, which are annually introduced into the Engliſh gardens; for when plants from very different countries are placed in the ſame houſe, ſome are deſtroyed for want of heat, while others are forced and ſpoiled by too much of it; and this is often the caſe in many places, where there are large collections of plants.

In the building theſe wings, if there are not ſheds running behind them their whole length, the walls ſhould not be leſs than two bricks thick; and if they are more, it will be better; becauſe, where the walls are thin, and expoſed to the open air, the cold will penetrate them; and when the fires are made, the heat will come out thro' the walls; ſo that it will require a larger quantity of fuel to maintain a proper temperature of warmth in the houſe. The back part of theſe houſes, having ſloping roofs, which are covered either with tiles or ſlates, ſhould alſo be lined with reeds, &c. under the covering, as is before directed for the green-houſe; which will keep out the cold air, and ſave a great expence of fuel; for the cloſer and better theſe houſes are built, and the glaſſes of the ſlope, as alſo in front, well guarded by ſhutters or reeds in a hard froſt, the leſs fuel will be required to warm the houſes; ſo that the firſt expence of building theſe houſes properly will be the cheapeſt, when the after expence of fires is taken into conſideration.

The ſloping glaſſes of theſe houſes ſhould be made to ſlide, and take off; ſo that they may be drawn down more or leſs, in warm weather, to admit air to the plants; and the upright glaſſes in front may be ſo contrived, as that every other may open as doors upon hinges; and the alternate glaſſes may be divided into two: the upper part of each ſhould be contrived ſo as to be drawn down like ſaſhes; ſo that either of theſe may be uſed to admit air, in a greater or leſs quantity, according as there may be occaſion.

But, beſides the conſervatories here mentioned, it will be proper to have a deep hot bed frame, ſuch as is commonly uſed to raiſe large annuals in the ſpring; into which may be ſet pots of ſuch plants as come from Carolina, Virginia, &c. while the plants are too ſmall to plant in the open air; as alſo may other ſorts from Spain, &c. which require only to be ſcreened from the violence of the froſts, and ſhould have as much free air as poſſible in mild weather; which can be no better effected than in one of theſe frames, where the glaſſes may be taken off every day when the weather will permit, and put on every night; and in hard froſts, the glaſs may be covered with mats, ſtraw, peaſe haulm, or the like, ſo as to prevent the froſt from entering the pots to freeze the roots of the plants, which is what will, many times, utterly deſtroy them; though a ſlight froſt pinching the leaves or ſhoots very ſeldom does them much harm: if theſe are ſunk a foot or more below the ſurface of the ground, they will be the better, provided the ground is dry; otherwiſe they muſt be wholly above ground: the ſides of this frame ſhould be built with brick, with a curb of wood laid round on the top of the wall, into which the gutters, on which the glaſſes ſlide, may be laid: the back wall of this frame may be four feet high, and the front one foot and an half; the width about ſix feet, and the length in proportion to the number of plants.

Explanation of plate LXXII. *fig.* 3, 4, 5, 6, repreſenting a plan, elevation, &c. of a green-houſe.

A; *fig.* 6, the ground plan of a green-houſe.

B B, the ground plan of the two ſtoves.

C C C, the ſheds behind the green-houſe.

D D, the paſſage of communication between the green-houſe and ſtoves, where the ſtairs are placed which lead to the rooms over the green houſe.

E E, *fig.* 3, 4, ſection of the flues in the back of the ſtoves.

F, *fig.* 5, the elevation of the green-houſe.

GREGARIOUS, an epithet applied to ſuch animals as live together in flocks or herds.

GREGORIAN *Calendar*. See the article CALENDAR.

GREGORIAN *Year*. See YEAR.

GREWT, among miners, implies earth of a different colour from the reſt, found on the banks of rivers as they are ſearching for mines.

GREY, or GRAY, a mixed colour compounded of black and white. See COLOUR.

GRIFFON, in heraldry, an imaginary animal, ſuppoſed by the ancients to be half eagle and half lion.

GRINDING, *Trituratio*, the reducing hard ſubſtances to fine powders, by means of mills, rubbing them in a mortar, or with a muller on a marble.

GRIPE, in huſbandry, a ſmall ditch cut acroſs a meadow or ploughed land, in order to drain it.

GRIPES, among ſailors, certain ropes hooked to the decks of a ſhip, and drawn tight over the boats, to ſecure and prevent them from being ſhaken by the agitation of a ſhip at ſea.

GRIPING, in the ſea language, the inclination of a ſhip to run to the windward of her courſe, when ſhe ſteers with a wind on either quarter.

This is partly occaſioned by the ſhock of the waves which ſtrike her on the weather-quarter, but chiefly by the arrangement of the ſails, which diſpoſe her at ſuch a time to edge continually to windward. See the article QUARTER.

GRIST, in country affairs, implies corn already ground or ready for grinding.

GROAT, an Engliſh money of account, equal to four-pence.

GROGRAM, among manufacturers, a kind of ſtuff compoſed of ſilk and mohair.

GROIN, *Pubes*, in anatomy; ſee PUBES.

GROOM, a name applied to ſeveral ſuperior officers belonging to the king's houſhold.

GROOM is more particularly uſed for a ſervant appointed to attend horſes in the ſtable.

GROMMET, among ſailors, a ſort of wreath or ring of rope to faſten a ſail to any ſtay, upon which it is drawn along at the time of hoiſting and lowering it, by

the help of theſe grommets, as a curtain is extended or drawn together along its rod by the aſſiſtance of rings.

GROOVE, among miners, the ſhaft or pit ſunk into the earth, whether in the vein or not.

GROOVE, among joiners, implies the channel made by their plough in the edge of a moulding, &c.

GROSS-WEIGHT, among merchants, ſignifies the whole weight of any commodity, including the duſt, droſs, and bag, cheſt, &c. in which it is contained.

GROSSULARIA, the gooſeberry and currant-buſhes. See RIBES and GOOSEBERRY.

GROTESQUE, ſomething whimſical, extravagant, and monſtrous.

GROTTO, in natural hiſtory, a large deep cavern in ſome rock or mountain.

GROTTO is alſo uſed for a ſmall artificial edifice made in a garden, in imitation of a natural grotto.

The outſides of theſe grottos are uſually adorned with ruſtic architecture, and their inſide with ſhell-work, coral, &c. and alſo furniſhed with various fountains, and other ornaments.

The following is recommended as a good cement for grotto-work. Take two parts of white roſin, melt it clear, add to it four parts of bees-wax; when melted together, add ſome flower of the ſtone you deſign to cement, two or three parts, or ſo much as will give the cement the colour of the ſtone; to this add one part of the flower of ſulphur: firſt incorporate all together over a gentle fire, and afterwards knead it with your hands in warm water. With this faſten the ſtones, ſhells, &c. after they are well dried, and warmed before the fire.

Artificial and red corals, for the embelliſhment of grottos, may be made in the following manner: Take two drams of the fineſt vermilion; and when you have ſtirred them well together, and choſen your twigs and branches, which muſt be peeled and dried, take a pencil and paint the branches all over, whilſt the compoſition is warm; afterwards ſhape them in imitation of natural coral. This done, hold the branches over a gentle coal fire, till all is ſmooth and even, as if poliſhed.

In the ſame manner white coral may be prepared with white lead, and black coral with lamp-black.

A grotto may be built with a little expence of glaſs, cinders, pebbles, pieces of large flints, ſhells, moſs, ſtones, counterfeit coral, pieces of chalk, &c. all bound or cemented together with the above deſcribed cement.

GROVE, in gardening, a ſmall wood impervious to the rays of the ſun.

Groves are the greateſt ornaments to a garden; nor can a garden be complete which has not one or more of theſe. In ſmall gardens there is ſcarce room to admit of groves of any extent; yet, in theſe, there ſhould be at leaſt one contrived, which ſhould be as large as the ground will allow it: and, where theſe are ſmall, there is more ſkill required in the diſpoſition, to give them the appearance of being larger than they really are.

Groves are of two ſorts, viz. open and cloſe groves; open groves are ſuch as have large ſhady trees, which ſtand at ſuch diſtances, as that their branches may approach ſo near each other, as to prevent the rays of the ſun from penetrating through them: but as ſuch trees are a long time in growing to a proper ſize for affording a ſhade; ſo, where new groves are placed, the trees muſt be placed cloſer together, in order to have ſhade as ſoon as poſſible; but, in planting of theſe groves, it is much the beſt way to diſpoſe all the trees irregularly, which will give them a greater magnificence, and alſo form a ſhade ſooner, than when the trees are planted in lines; for, when the ſun ſhines between the rows of trees, as it muſt do ſome part of the day in ſummer, the walks between them will be expoſed to the heat, at ſuch times, until the branches of theſe trees meet; whereas, in the irregular plantations, the trees intervene, and obſtruct the direct rays of the ſun.

When a perſon, who is to lay out a garden, is ſo happy as to meet with large full grown trees upon the ſpot, they ſhould remain inviolate, if poſſible; for it will be better to put up with many inconveniencies, than to deſtroy theſe, which will require an age to retrieve; ſo that nothing but that of offending the habitation, by being ſo near as to occaſion great damps, ſhould tempt the cutting of them down.

Moſt of the groves which have been planted either in England, or thoſe celebrated gardens in France, are only a few regular lines of trees; many of which join to the habitation, or lead to ſome building, or other object: but theſe do not appear ſo grand, as thoſe which have been made in woods, where the trees have grown accidentally, and at irregular diſtances; where the trees have large ſpreading heads, and are left at ſuch diſtance as to permit the graſs to grow under them, then they afford the greateſt pleaſure; for nothing is more noble, than fine ſpreading trees, with large ſtems, growing through graſs, eſpecially if the graſs is well kept, and has a good verdure; beſide, moſt of theſe planted groves have generally a gravel walk, made in a ſtraight line between them; which greatly offends the ſight of perſons who have a true taſte: therefore, whenever a gravel walk is abſolutely neceſſary to be carried through theſe groves, it will be much better to twiſt it about, according as the trees naturally ſtand, than to attempt regularity: but dry walks under large trees are not ſo uſeful, as in open places; becauſe the dropping of the trees will render theſe walks uſeleſs, after rain, for a conſiderable time.

Cloſe groves have frequently large trees ſtanding in them; but the ground is filled under theſe with ſhrubs, or under-wood; ſo that the walks which are made in them are private, and ſcreened from winds; whereby they are rendered agreeable for walking, at ſuch times when the air is too violent or cold for walking in the more expoſed parts of the garden.

Theſe are often contrived ſo as to bound the open groves, and frequently to hide the walls, or other incloſures, of the garden: and when they are properly laid out, with dry walks winding through them, and on the ſides of theſe ſweet-ſmelling ſhrubs and flowers irregularly planted, they have a charming effect: for here a perſon may walk in private, ſheltered from the inclemency of cold or violent winds, and enjoy the greateſt ſweets of the vegetable kingdom: therefore, where it can be admitted, if they are continued round the whole incloſure of the garden, there will be a much greater extent of walk: and theſe ſhrubs will appear the beſt boundary where there are not fine proſpects to be gained.

Theſe cloſe groves are by the French termed boſquets, from the Italian word boſquetto, which ſignifies a little wood: and in moſt of the French gardens there are many of them planted; but theſe are reduced to regular figures, as ovals, triangles, ſquares, and ſtars: but theſe have neither the beauty or uſe which thoſe have that are made irregularly, and whoſe walks are not ſhut on each ſide by hedges, which prevents the eye from ſeeing the quarters; and theſe want the fragrancy of the ſhrubs and flowers, which are the great delight of theſe private walks; add to this, the keeping of the hedges in good order is attended with a great expence; which is a capital thing to be conſidered in the making of gardens. *Miller's Gard. Dict.*

GROUND, in agriculture; ſee EARTH and SOIL.

GROUND, in painting, the ſurface upon which the figures and other objects are repreſented.

The ground is properly underſtood of ſuch parts of the piece as have nothing painted on them, but retain the original colours upon which the other colours are applied to make the repreſentations.

A building is ſaid to ſerve as a ground to a figure, when the figure is painted on the building.

The ground behind a picture in miniature is commonly blue or crimſon, imitating a curtain of ſattin or velvet; if it be to be blue, it ſhould be laid on as follows: waſh bice till it is very pure and clear, and temper a quantity in a ſhell ſufficient for your ground, letting it be thoroughly moiſt and well bound with gum. Then with a ſmall pencil lay on the ſame colour about the pourfile, that is, the ambient ſuperficies of the picture; having done this, take a large pencil, and waſh over the whole ground you deſign to cover with a blue, ſomewhat thin and wateriſh, and then with a pretty large pencil, full of colour and flowing, lay over with a thick and ſubſtantial colour what you had before only waſhed over; in the doing

doing of this you muſt be very quick, keeping the colour you have laid on moiſt, and not ſuffering any part to dry till you have covered the whole.

If you would have your ground a crimſon like ſattin, then trace out where and in what places you will have thoſe ſtrong and hard lights and reflections to fall, which are ſeen in ſattin or velvet, with Indian lake; there lay your lights with a lake that is thin and wateriſh, and while it is yet wet, lay the deepening and hard ſtrong ſhadows with a ſtronger and darker colour of lake thick ground, cloſe by the other lights. The beſt way for imitation, is to have a piece of ſattin before you to imitate.

GROUND, in etching; ſee the article ETCHING.

GROUND-ANGLING, a method of angling without a float, only with a plumb of lead, or rather a bullet, becauſe it will roll on the ground.

GROUND-IVY, hedera terreſtris, in botany; ſee HEDERA TERRESTRIS.

GROUND-PINE, in botany; ſee CHAMEPITYS.

GROUND-TACKLE, among ſailors, all ſorts of ropes which belong to the anchors, or for mooring a ſhip, as cables, hawſers, tow-lines, warps, buoy ropes, &c.

GROUND-WORK, among builders; ſee FOUNDATION.

GROUNDING, in the ſea-language, a ſhip is ſaid to ground when ſhe ſtrikes and reſts upon the ground.

GROUNDSEL, in botany; ſee ERYERON.

GROUP, in painting and ſculpture, an aſſemblage of two or more figures, of men, beaſts, fruits, &c. which have ſome apparent reſemblance to one another.

It is neceſſary in a good piece of painting, that all the figures be divided into groups: this has ſomewhat in it of the nature of ſymphony or concert of voices; for as in the one the voices muſt ſuſtain each other, in order to fill the ear with an agreeable harmony from the whole; ſo in groups, if the parts or figures be not well diſpoſed, ſomething will be found diſagreeable.

There are two kinds of groups, or two manners of conſidering them, with reſpect to the deſign, and to the clair-obſcure. The firſt of theſe is common both to works of painting and ſculpture; but the latter is peculiar to painting.

Groups, with reſpect to the deſign, are combinations of ſeveral figures, which bear a relation to each other, either upon account of the action, or of their proximity, or of the effect they produce. Theſe we conceive as repreſenting ſo many different ſubjects, or at leaſt ſo many diſtinct parts or members of one great ſubject. Thus, in architecture, we ſay a group of columns, when we ſpeak of three or four columns ſtanding together on the ſame pedeſtal.

Groups, with reſpect to the clair-obſcure, are aſſemblages of figures, where the lights and ſhadows are diffuſed in ſuch a manner, that they ſtrike the eye together, and naturally lead it to conſider them in one view.

GROUSE, or GROWSE, the name of a very valuable bird, of the ſize of a full-grown fowl. Its head is large, and adorned with a very beautiful ſcarlet protuberance over the eyes, which are remarkably piercing. It is a native of England, though not very common, and lives on large mountainous heaths.

GROWAN, among the Corniſh miners, implies a coarſe gritty ſtone of a greyiſh colour, which they are often obliged to dig through, before they reach the tin ore.

GRUB, the Engliſh name of the hexapode worms, or maggots, hatched from the eggs of beetles.

Grubs are an excellent bait for many kinds of fiſh. In angling for the grayling, the aſh-grub is to be preferred to all others. This is plump, milk-white, but round from head to tail, and has a red head. There is alſo another grub, which is very common, and is longer and ſlenderer than the aſh-grub. It is yellower and tougher, and is known by having a red head, and two rows of legs along the belly. The trout and grayling uſually frequent the ſame places, and it is not uncommon to take the trout, while fiſhing for the other. Theſe grubs are to be kept in bran, in which they will grow tougher than they were at firſt; but the aſh-grub is always ſo tender, that it is difficult to make a good bait of it. The beſt method is to wrap it in a piece of ſtiff hair with the arming, leaving it ſtanding out above a ſtraw's breadth at the head of the hook, ſo as to keep the grub from totally ſlipping off, when baited. The horſe-hair that the hook is faſtened to ſhould be as white as poſſible, that it may reſemble the colour of the bait, and not be ſuſpected.

GRUBS, in medicine, certain unctuous pimples riſing on different parts of the face, particularly in the alæ of the noſe. They are cured by cooling phyſic, and ſuch medicines as have a tendency to cleanſe the blood.

GRUBBING, a term uſed by our farmers to ſignify the taking up the roots of trees.

Several occaſions offer for the doing this; as when trees are old and paſt growing to any uſe, the roots muſt be taken up, that young trees may be planted in their places. This is a chargeable operation in moſt places, but, in ſome countries, the farmers have deviſed a machine, which does a great part of the work in a much ſhorter time than in any other way can be done. It is a hook of iron, of about two feet and a half long, with a large iron ring faſtened to its ſtraight end or handle. The whole inſtrument may be made for about three or four ſhillings, and is to be uſed in this manner: the ground is firſt to be cleared away about the root, and any ſtraggling ſide roots found running horizontally are to be cut off. Then they faſten the point of the hook to ſome part of the ſtump or root, and, putting a long and ſtrong lever through the ring, two men at the end of it go round forcing it every way, till they tear the root out, twiſting the top roots off at ſome diſtance under ground; the digging down to which, in the common way, is one great article of the expence. It is very effectual in ſtubbing up the roots of the underwood, but, when large tree roots are to be taken up by it, it is beſt to cleave them firſt with wedges into ſeveral pieces, and then pull them out ſeparately. *Mortimer's Huſbandry.*

GRUME, *Grumus*, in medicine, implies a concreted clot of blood, milk, or other ſimilar ſubſtance.

GRUS, the crane, in ornithology, a bird of the heron kind. See CRANE.

GRYLLOTALPA, the mole cricket, in natural hiſtory, a creature approaching to the locuſt kind, and very properly called by this name by Moffet, as it has much of the form of the cricket, and makes a noiſe like it in the evening; and is, like the mole, continually employed in the digging the ground. It is an inſect of a very unpleaſant form. It is of the length and thickneſs of a man's little finger, and is of a brown colour; which is darker in the male than in the female. There are on each ſide of the anus two hairy proceſſes, reſembling the tails of mice; its belly is compoſed of eight joints, and is covered with as many ſcales, which are of a pale fleſh colour, and are covered with ſhort hair. The back is covered by a pair of pointed wings, along each of which there runs a black ſtreak or line. Theſe wings fold any way at the creature's pleaſure, and, when fully expanded, are very large. Over theſe lie the antennæ; theſe are variegated alſo with black, and reach about half the length of the wings. It has only four legs; the hinder pair are long and fit for hopping; the anterior pair are ſhort, and furniſhed with a ſort of hands for digging, in the manner of the mole. The breaſt is covered with a cruſtaceous ſubſtance which is blackiſh, and hairy on the outſide, and ſmooth and pale within. The eyes are very bright and black, and very hard; the mouth is wide, and has two tonſils, and teeth in both jaws. The creature lives under ground, and is principally found in damp and boggy places.

GRILLUS, in zoology, the name of the cricket and locuſt kind, which, together with the graſshopper, form one genus of inſects.

GUAIACUM, in the materia medica, the wood of two kinds of trees growing in America, called by Plukenet, the one *guaiacum Jamaicenſe*, &c. the Jamaica guaiacum-tree, with bright green roundiſh leaves like thoſe of the maple; the other *euonymo adfinis occidentalis*, &c. an occidental nut bearing tree, allied to the euonymus or ſpindle-tree, with winged leaves, like thoſe of butcher's broom, and a fungous bark at the joints. The wood comes over in large pieces, weighing four, five, and more hundred weight, from Jamaica, Mexico, Porto-rico, Boriquen,

riquen, St. Domingo, and other parts of the Weſt Indies: the tree has been raiſed alſo in Europe, but proved far inferior in quality to that produced in its native climate, and yielded nothing of the reſinous juice, which it plentifully bleeds there.

This wood is remarkably hard, compact, and ſo heavy as to ſink in water; of a brown, or yellowiſh-brown colour, often blackiſh, or marbled as it were with different colours. When the tree is ſtanding or newly felled, the bark adheres ſo firmly as not to be got off even with iron tools; after lying for ſome time it ſeparates eaſily. On account of its great hardneſs, ſolidity, and indiſpoſition to crack, it is employed by the turners and others for ſeveral of the more curious mechanic uſes. In Holland, at Hamburg, and other places of large commerce, it is raſped in workhouſes eſtabliſhed for that purpoſe, after the ſame manner as the colouring-woods; and from theſe the druggiſt and apothecary are ſupplied.

Guaiacum is a very reſinous wood: on expoſing it to a moderate heat, the reſin viſibly melts out. By digeſtion in highly rectified ſpirit of wine, I obtained three ounces and a half of reſinous extract from ſixteen ounces of the wood: ſuch as had been boiled in water till that menſtruum would take up no more, yielded ſtill, with rectified ſpirit, two ounces of reſin upon the pound. Water applied at firſt extracts an ounce and a half, and after ſpirit has performed its office half an ounce and two ſcruples of gummy matter. The indiſſoluble part, when the gum was extracted firſt, weighed twelve ounces and a half; when the reſin was firſt extracted, only twelve ounces and two drams. Theſe experiments were made with chips of a good reſinous kind of guaiacum. The raſped wood commonly ſold yields leſs of a reſinous and more of a gummy extract. From a pound of good raſpings I obtained by ſpirit two ounces and ſix drams, and afterwards by water one ounce: another pound of the ſame, treated with water at firſt, gave two ounces, and afterwards with ſpirit one ounce and ſix drams.

A ſtrong decoction of guaiacum is uſed as an alterative diet-drink in venereal, cancerous, and other diſorders from an impurity of the blood and juices. Hoffman recommends the ſpirituous extract (which is the moſt active preparation) as a high antidote againſt the venereal poiſon, provided it be uſed properly, according to the laws of medicine. He mentions alſo another reſinous preparation of this wood, under the title of "A ſingular reſin, "of a ſtimulating errhine quality, and poſſeſſing alſo a "corroborating power, highly friendly to the nervous "parts of the head." This, according to his account, is the reſin that precipitates in boiling down a watery decoction of the wood. *Neumann's Chemiſtry.*

Gum-GUAIACUM, ſo called, is a reſin exuding from the guaiacum-tree. It is of a brown colour, partly reddiſh, and often greeniſh, brittle, of a gloſſy ſurface when broke, of a pungent taſte; and when rubbed or heated, of a not diſagreeable ſmell: its ſmoke, in burning, has ſomewhat the ſmell of that of wood. Such ſhould be choſen as has pieces of the bark adhering, and eaſily parts from them by a few quick blows. The maſſes which have no bark, eſpecially the large ones, are often ſophiſticated. I received for gum-guaiacum, a whole box of an artificial compoſition of colophony and balſam of ſulphur: this abuſe was readily diſtinguiſhable by the ſmell of the compound when laid upon burning coals, and even by its appearance upon breaking.

Out of an ounce of gum-guaiacum, rectified ſpirit of wine diſſolves ſix drams and two ſcruples: of the remainder, water applied at firſt, extracts four ſcruples out of an ounce: of the reſiduum, ſpirit diſſolves four drams and two ſcruples. In diſtillation, it gives over a little both to water and to ſpirit, ſo little as to be altogether inconſiderable.

Its virtues are the ſame with thoſe of the wood. It is uſed pretty frequently in England, very rarely in Germany, the pure reſin artificially extracted from the wood by means of ſpirit of wine, advantageouſly and elegantly ſupplying its place. *Neumann's Chemiſtry.*

GUAJAVA, or GUAVA, in botany, the name by which Tournefort calls the pſidium of Linnæus. See PSIDIUM.

GUANABANUS, the cuſtard apple, in botany, a genus of plants whoſe characters are:

The empalement of the flower conſiſts of three ſmall pointed leaves: the flowers of ſome ſorts have only three, but in others ſix petals; in the latter, three are alternately leſs than the others: from the empalement ariſes the pointal, which afterwards becomes an oval or round fleſhy ſoft fruit, incloſing ſeveral oblong ſmooth hard ſeeds.

All theſe plants, which are natives of the warm parts of America, are too tender to live in this country, if they are not preſerved in warm ſtoves: they come up very eaſily from the ſeeds which are brought from America, if they are freſh: but the ſeeds muſt be ſown on a good hot bed, or in pots of light earth, and plunged into an hot bed of tanners bark. Theſe ſeeds ſhould be ſown as ſoon as poſſible when they ariſe, unleſs it is very late in the autumn, or in winter; in which caſe, they ſhould not be ſown till February; becauſe if the ſeeds receive much damp in the winter, they will rot; and if the plants ſhould come up at that ſeaſon, it will be very difficult to preſerve them till ſpring; ſo that, when theſe ſeeds come to England, pretty early in the ſpring, it is by much the beſt time; becauſe the plants come up early, and will have time to get ſtrength, before the cold comes on.

If theſe plants are kept in the bark ſtove, and carefully managed, they will make great progreſs; but in warm weather, they ſhould have plenty of freſh air admitted to them; for, when the air is excluded from them too much, they are apt to grow ſickly; when they will ſoon be attacked by vermin, which will multiply and ſpread over the whole ſurface of the leaves, and cauſe them to decay: but, if the plants are carefully managed, their leaves will continue green all the winter, and make a very good appearance in the ſtove at that ſeaſon.

There are ſome of theſe plants in England, which are upwards of twelve feet high, and have produced flowers; ſo that they may probably produce fruit here. As theſe plants advance in their growth, ſo they become more hardy, and ſhould have a greater ſhare of air admitted to them, eſpecially in the ſummer: but there ſhould be great care taken, not to let them remain in the bark bed too long unremoved; becauſe they are very apt to root thro' the holes of the pots into the tan; and then theſe roots will be torn off, whenever the pots are removed, and the plants ſeldom ſurvive this; and, when they do, it is generally a long time before they perfectly recover their former vigour. Theſe plants, when young, will require to be kept in the ſame degree of warmth with ananas; but as they get more ſtrength, ſo they will thrive with leſs warmth. *Miller's Gard. Dict.*

GUARANTY, in policy, the engagement of neutral kingdoms or ſtates, whereby they undertake that certain treaties ſhall be inviolably obſerved.

GUARD, in a general ſenſe, ſignifies the defence or preſervation of any thing; the act of obſerving what paſſes, in order to prevent ſurprize; or the care, precaution, and attention we make uſe of, to prevent any thing happening contrary to our intention or inclinations.

GUARD, in the military art, is a duty performed by a body of men, to ſecure an army or place from being ſurpriſed by an enemy.

In a garriſon the guards are relieved every day, and it comes to every ſoldier's turn once in three days; ſo that they have two nights in bed, and one upon guard.

To be upon guard, to mount the guard, to diſmount the guard, to relieve the guard, to change the guard, the officer of the guard, or the ſerjeant of the guard, are words often uſed, and well underſtood.

Advanced-GUARD is a party of either horſe or foot, that marches before a more conſiderable body, to give notice of any approaching danger.

When an army is upon the march, the grand-guards which ſhould mount that day, ſerve as an advanced-guard to the army: in ſmall parties, ſix or eight horſe are ſufficient, and theſe are not to go above four or five hundred yards before the party.

An advanced-guard is alſo a ſmall body of twelve or ſixteen horſe, under a corporal, or quarter-maſter, poſted before the grand-guard of a camp.

Artillery-GUARD is a detachment from the army to ſecure the artillery; their corps de garde is in the front, and

and their centries round the part. This is a forty-eight hours guard: and upon a march, they go in the front and rear of the artillery, and muſt be ſure to leave nothing behind; if a gun or waggon break down, the captain is to leave a part of his guard to aſſiſt the gunners and matroſſes in getting it up again.

Corps de GARDE, are ſoldiers entruſted with the guard of a poſt, under the command of one or more officers.

Counter-GUARD, in fortification. See the article COUNTER-GUARD.

Forrage-GUARD, a detachment ſent out to ſecure the forragers, which are poſted at all places, where either the enemy's party may come to diſturb the forragers; or where they may be ſpread too near the enemy, ſo as to be in danger of being taken. They conſiſt both of horſe and foot, and muſt ſtay at their poſts till the forragers all come off the ground.

Grand-GUARD, three or four ſquadrons of horſe, commanded by a field-officer, poſted at about a mile and a half from the camp, on the right and left wings, towards the enemy, for the ſecurity of the camp.

Main-GUARD, that from whence all the other guards are detached.

Thoſe who are to mount the guard, meet at their reſpective captain's quarters, and go from thence to the parade; where, after the whole guard is drawn up, the ſmall guards are detached for the poſts and magazines; and then the ſubaltern officers throw lots for their guards, and are commanded by the captain of the main-guard.

Picquet-GUARD, a good number of horſe and foot always in readineſs in caſe of an alarm: the horſe are all the time ſaddled, and the riders booted. The foot draw up at the head of the battalion, at the beating of the tattoo; but afterwards return to their tents, where they hold themſelves in readineſs to march, upon any ſudden alarm. This guard is to make reſiſtance, in caſe of an attack, till the army can get ready.

Quarter-GUARD, a ſmall guard, commanded by a ſubaltern officer, poſted by each battalion, about an hundred yards before the front of the regiment.

Rear-GUARD, that part of the army which brings up the rear, which is generally the old grand-guards of the camp. The rear-guard of a party is ſix or eight horſe, that march about four or five hundered paces behind the party. The advanced-guard of a party on its going out, make the rear-guard on its return.

Standard-GUARD, a ſmall guard, under a corporal, out of each regiment of horſe, and placed on foot, in the front of each regiment.

Van-GUARD, that part of the army which marches in the front.

GUARDS alſo imply the troops kept to guard the king's perſon.

Yeomen of the GUARDS. See YEOMEN.

GUARD, in fencing, implies a poſture proper to defend the body from the ſword of the antagoniſt.

GUARD-BOAT, in naval affairs, a boat commanded by a lieutenant, appointed to row around the ſhips in a harbour to ſee that the officers in each ſhip obſerve their watch, and call to the boat as ſhe paſſes, and do not ſuffer them to board without a watch-word.

GUARD-SHIP, a veſſel of war appointed to ſuperintend the marine affairs in a harbour or river, and ſee that the ſhips who are not commiſſioned have their proper watch kept duly every night alſo to receive and ſecure ſeamen who are impreſſed in the time of war.

GUARDIAN, in law, a perſon who has the charge or cuſtody of ſuch perſon or perſons as have not ſufficient diſcretion to take care of themſelves; as ideots, or children under age.

GUAZUMA, baſtard cedar-tree, in botany, a genus of trees whoſe characters are:

It hath a regular flower conſiſting of five leaves, which are hollowed like a ſpoon at their baſe; but at their tops are divided into two parts, like a fork; the flower cup conſiſts of three leaves, from whence ariſes the pointal, which afterward becomes a roundiſh warted fruit, which has five cells incloſing many ſeeds.

Theſe plants may be propagated by ſeed, which ſhould be ſown early in the ſpring, in ſmall pots filled with freſh light earth, and plunged into a hot-bed of tanners bark. When the plants appear above ground, they muſt be carefully cleared from weeds, and often refreſhed with water; and the glaſſes muſt be raiſed to admit freſh air to them, otherwiſe they will draw up too weak: and, when they are about three inches high, they muſt be ſhaken out of the pots filled with light freſh earth; and then plunge them into the hot-bed again, being careful to ſcreen them from the heat of the ſun, until they have taken new root. In this bed the plants may remain all the ſummer, being careful to keep them clear from weeds; and, when the plants have filled the ſmall pots with their roots, they ſhould be ſhaken out, and their roots trimmed, and then put into pots a ſize larger. About Michaelmas the plants muſt be removed into the ſtove, and plunged into the tan in a warm part of the ſtove. During the winter ſeaſon, they will not require ſo much water as in ſummer: if their leaves ſhould contract filth, it muſt be carefully waſhed off with a ſponge; for, if it is ſuffered to remain on them, it will greatly injure the plants. Theſe plants being very tender, they muſt conſtantly remain in the ſtoves, giving them a good ſhare of freſh air in the ſummer; but in winter, they muſt be kept very warm, otherwiſe they will not live in this country; but, if they are carefully managed, they will thrive very well, and afford an agreeable variety in the ſtove, amongſt other tender exotic plants of the ſame countries. *Miller's Gard. Dict.*

GUIDON, the name of a ſort of ſtandard carried by the king's life-guards; ſo called from its being broad at one extreme, and almoſt pointed at the other, and ſlit, or divided into two.

GUIDON alſo implies the officer who carries the guidon.

GUILD, or GILD, a Saxon word ſignifying a company, or fraternity.

GUILDHALL, the chief hall of a city or corporation where the courts are held.

GUINEA-PIG, in zoology, a quadruped of the rat kind, with a variegated body, reſembling in ſome meaſure that of a young pig, whence the name.

GUITAR, a muſical inſtrument of the ſtringed kind, uſed greatly in Spain, and at preſent in England.

GULA, in anatomy, the ſame with œſophagus. See OESOPHAGUS.

GULA, or GOLA, in architecture, the ſame with cymatium, or ogee. See CYMATIUM and OGEE.

GULES, in heraldry, the true ſcarlet colour, and expreſſed in engraving by lines falling perpendicular from the top of the eſcutcheon to the bottom.

GULPH, in geography, a part of the ſea almoſt ſurrounded by the land.

GUM, in pharmacy, a concreted vegetable juice, which tranſudes through the bark of certain trees, and hardens upon the ſurface.

The chemiſts allow only thoſe to be properly gums, which are diſſolvable in water; thoſe which are only diſſolvable in ſpirits, they call reſins; and thoſe of a middle nature, gum-reſins. Geoffroy ſays, that gums are ſomething between acid and oil; being an acid ſalt ſo fixed in earth, as that the greateſt part of it is changed to an alkali, the other into oil; ſo that the mixture ariſing from thence is an oily ſalt reſembling the ſaponaceous concretes of the chemiſts, made of oil of olives, and a lixivium of tartar; or the mucilaginous bodies formed of ſpirit of wine, and the volatile ſpirit of urine.

The reader will find an account of the various ſubſtances, many of which are improperly ſtiled gums, under ARABIC, SENECA, TRAGACANTH, AMMONIACUM, ANIME, GUAIACUM, LACCA.

GUM, among gardeners, a kind of gangrene incident to fruit-trees of the ſtone kind, ariſing from a corruption of the ſap, which, by its viſcidity, not being able to make its way through the fibres of the tree, is, by the protruſion of other juice, made to extravaſate and ouze out upon the bark.

When the diſtemper ſurrounds the branch, it admits of no remedy, but when only on one part of a bough, it ſhould be taken off to the quick, and ſome cow-dung clapped on the wound, covered over with a linnen-cloth, and tied down. M. Quintinie directs to cut off the morbid branch two or three inches below the part affected.

GUM-APPLES, in Languedoc, and ſome other parts of France. The juice of apples will ſometimes exſudate through their rind, and congeal all about them in form of a clear white gum, hard like ice, by reaſon of its being ſoon dried in the ſun into a thin cake. The people call ſuch an apple, pomme gelée, or a frozen apple. It is very common to ſee apples covered in part with this gum in ſeveral ſpecks; but it is more rare to meet with them wholly ſo. The gum is inſipid to the taſte.

We have one plant cultivated in ſome gardens, which yields, in the heat of ſummer, ſuch another white icy and taſteleſs gum. This is the common rhubarb, of the ſtalks of the leaves of which tarts are made. The ribs of the larger leaves of this plant, in June and July, are covered with large tranſparent drops of this gum, and an ounce of it may be ſometimes collected from a ſingle plant. *Phil. Tranſ.* N°. 224.

GUMS, *Gingivæ*, in anatomy; ſee GINGIVÆ.

GUM-BOILS, a morbid affection of the gums called by the writers of ſurgery parulides. Theſe are of different degrees, and uſually ariſe from pains in the teeth. They are to be treated by diſcutients or other inflammatory tumors, but if theſe fail, or the diſorder is neglected, it uſually terminates in an abſceſs or fiſtula. Sage, camomile, and elder flowers, boiled in milk and water, make a good gargariſm to be held in the mouth, and the remaining herbs may be ſewed up in a bag to be kept hot to the cheek. A half roaſted fig is a very good internal application, and, when the ſoftneſs of the tumor ſhews that the matter is ſuppurated, it ought immediately to be opened with the lancet, to prevent the matter's lodging there, and eroding the bone, and producing a fiſtula or caries. After it is opened, the matter ſhould be gently preſſed out with the fingers, and the mouth frequently waſhed with red wine mixed with a decoction of vulnerary herbs till it is well. When the ulcer has penetrated deep, it will be neceſſary to inject the ſame liquors with a ſyringe, and compreſs the part by a proper external bandage, to make the bottom part heal firſt; and, when it is already become fiſtulous, and has callous edges, it may then often be cured by injecting tincture of myrrh, and elixir proprietatis, continuing this for ſome time. If all theſe prove ineffectual, the fiſtula muſt be laid open by inciſion, and the caries removed by medicines, cauſtics, or the actual cautery. If this proceeds, as ſometimes it does, from a carious tooth, this is firſt to be drawn before any thing elſe can be done; and it is a good rule in theſe caſes always to be rather too ſoon than too late in laying them open. *Heiſter's Surg.*

GUN, a fire-arm, or weapon of offence, which forcibly diſcharges a ball, ſhot, or other offenſive matter, through a cylindrical barrel, by means of gun-powder. See the article GUN-POWDER.

Gun is a general name, under which are included divers or even moſt ſpecies of fire-arms, They may be divided into great and ſmall.

Great guns, called alſo by the general name cannons, make what we alſo call ordnance, or artillery; under which come the ſeveral ſorts of cannons, as cannon-royal, demi-cannon, &c. Culverins, demi-culverins, ſakers, minions, falcons, &c. See CANNON, CULVERIN, &c. as alſo ORDNANCE and ARTILLERY.

Small guns include muſquets, muſquetoons, carabines, blunderbuſſes, fowling-pieces, &c. See the article MUSQUET, &c.

Piſtols and mortars are almoſt the only ſort of regular weapons, charged with gun-powder, that are excepted from the denomination of guns. See the articles PISTOL and MORTAR.

GUN is alſo a name given by the miners to an inſtrument uſed in cleaving rocks with gun-powder. It is an iron cylinder of a inch and a quarter thick, and about ſix inches long, and having a flat ſide to receive the ſide of a wedge, and a hole drilled thro' it to communicate with the inſide of the hole in the rock. The hole is made of about eight inches deep, and in the bottom of it are put about two or three ounces of gun-powder; then this gun is driven forcibly in, ſo as to fill up the hole, and the wedge is driven in on its flat ſide to ſecure it. The priming at the hole is then fired by a train, and, the orifice being ſo well ſtopped by this gun, the force of the powder is determined to the circumjacent parts of the rock which it ſplits.

GUNNEL, in ſhip-building, the upper-part of a ſhip's ſide.

GUNNER, an officer appointed for the ſervice of the artillery; or a perſon ſkilled in the art of gunnery.

GUNNER *of a Ship of War*, an officer appointed to take charge of the artillery and ammunition aboard; and to teach the men the exerciſe of great guns.

GUNNERY, the art of determining the motion of bodies ſhot from mortars, cannon, &c. See the article PROJECTILE.

The late ingenious Mr. Robins having concluded, from the experiments related in his New Principles of Gunnery, that the force of fired gun-powder, at the inſtant of its exploſion, is the ſame with that of an elaſtic fluid of a thouſand times the denſity of common air, and that the elaſticity of this fluid, like that of air, is proportional to its denſity, propoſes the following problem:

The dimenſions of any piece of artillery, the weight of its ball, and the quantity of its charge, being given; to determine the velocity which the ball will acquire from the exploſion, ſuppoſing the elaſticity or force of the powder at the firſt inſtant of its firing to be given.

In the ſolution of this important problem, he aſſumes the two following principles: 1. That the action of the powder on the bullet ceaſes as ſoon as the bullet is got out of the piece. 2. That all the powder of the charge is fired, and converted into an elaſtic fluid, before the bullet is ſenſibly moved from its place.

Theſe aſſumptions, and the concluſions above-mentioned, make the action of fired gun-powder to be entirely ſimilar to that of air condenſed a thouſand times; and from thence it will not be difficult to determine the velocity of the ball ariſing from the exploſion: for the force of the fired powder diminiſhing in proportion to its expanſion, and ceaſing when it is got out of the piece; the total action of the powder may be repreſented by the area of a curve, the baſe of which repreſents the ſpace through which the ball is accelerated, while the ordinates repreſent the force of the powder at every point of that ſpace: and theſe ordinates being in reciprocal proportion to their diſtance from the breech of the gun, becauſe when the ſpaces occupied by the fired powder, are as 1, 2, 3, 4, &c. the ordinates repreſenting it, will be as 1, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, &c. it appears that the curve will be a common parabola, and that the area intercepted between it, its aſymptote, and the two ordinates repreſenting the force of the powder at the firſt exploſion, and at the muzzle of the piece, will repreſent the total action of the powder on the ball: but if the ball were urged through the ſame ſpace by an uniform force equal to its gravity, the total action of this force would be repreſented by a rectangle, the baſe of which would be the baſe of the curve or intercepted portion of the aſymptote above-mentioned, and the height of which would repreſent the uniform force of gravity. Hence the ſquare of the velocity of the ball reſulting from gravity is given, being the velocity it would acquire from a height equal to the ſpace through which the powder accelerates it; and the proportion between the hyperbola and the rectangle is given from the analogy between the hyperbolic ſpaces and logarithms; therefore the velocity of the ball ariſing from the action of the fired gunpowder will be given.

Mr. Robins has alſo given us an ingenious way of determining, by experiments, the velocity which any ball moves with at any diſtance of the piece it is diſcharged from.

This may be effected by means of a pendulum made of iron, having a broad part at bottom, covered with a thick piece of wood, which is faſtened to the iron by ſcrews: then having three poles joined together by their tops, and ſpreading at bottom, ſuch as are vulgarly uſed in weighing and lifting heavy bodies, and called by workmen triangles; on two of theſe poles, towards their tops, are ſcrewed on ſockets, on which the pendulum is hung by means of a croſs piece, which becomes its axis of ſuſpenſion, and on which it ought to vibrate with great freedom. Something lower than the bottom of the pendulum there ſhould be a brace, joining the two poles to which the pendulum is ſuſpended; and to this brace there

there is faſtened a contrivance made with two edges of ſteel, ſomething in the manner of a drawing-pen; the ſtrength with which theſe edges preſs on each other being diminiſhed or increaſed at pleaſure, by means of a ſcrew. To the bottom of the pendulum ſhould be faſtened a narrow ribbon, which, paſſing between the ſteel edges, may hang looſely down by means of an opening cut in the lower piece of ſteel.

The inſtrument being thus fitted, if the weight of the pendulum, the reſpective diſtances of its center of gravity, and of its center of oſcillation, from its axis of ſuſpenſion, be known, it may from thence be found, what motion will be communicated to this pendulum by the percuſſion of a body of a known weight moving with a known degree of velocity, and ſtriking it in a given point; that is, if the pendulum be ſuppoſed at reſt before the percuſſion, it will be known what vibration it ought to make in conſequence of ſuch a blow; and if the pendulum, being at reſt, is ſtruck by a body of a known weight, and the vibration which the pendulum makes after the blow is known, the velocity of the ſtriking body may from thence be determined.

Now the extent of the vibration, made by the pendulum, may be meaſured by the ribbon: for if the preſſure of the ſteel edges on the ribbon be regulated by the ſcrew, ſo as to be free and eaſy, though with ſome minute reſiſtance to hinder its ſlipping of itſelf: then, ſetting the pendulum at reſt, let the part of the ribbon between the pendulum and the ſteel edges be drawn ſtraight, but not ſtrained, and fixing a pin in the part of the ribbon contiguous to the edges, the pendulum, ſwinging back by the impulſe of the ball, will draw out the ribbon to the juſt extent of its vibration, which will be determined by the interval on the ribbon between the edges and the place of the pin.

The computation by which the velocity of the ball is determined from the vibration of the pendulum after the ſtroke, is founded on this principle of mechanics: that if a body in motion ſtrikes on another at reſt, and they are not ſeparated after the ſtroke, but move on with one common motion, then that common motion is equal to the motion with which the firſt body moved before the ſtroke: whence, if that common motion and the maſſes of the two bodies are known, the motion of the firſt body before the ſtroke is thence determined. On this principle it follows, that the velocity of a bullet may be diminiſhed in any given ratio, by its being made to impinge on a body of weight properly proportioned to it; and hereby the moſt violent motions, which would otherwiſe eſcape our examination, are eaſily determined by the retarded motions which have a given relation to them.

It is to be obſerved, that the length to which the ribbon is drawn, is always near the chord of the arch deſcribed by the aſcent; it being ſo placed, as to differ inſenſibly from thoſe chords which moſt frequently occur; and theſe chords are known to be in the proportion of the velocities of the pendulum acquired from the ſtroke. Hence it follows, that the proportion between the lengths of the ribbon, drawn out at different times, will be the ſame with that of the velocities of the impinging bullets.

Now, from the computations delivered by Mr. Robins, it appears, that the velocity of the bullet was 1641 feet in one ſecond of time, when the chord of the arch deſcribed by the aſcent of the pendulum, in conſequence of the blow, was 17 $\frac{1}{4}$ inches. Therefore, by the proportion of any other lengths of ribbon drawn out, by any percuſſion, to 17 $\frac{1}{4}$, the proportion of the velocity with which the bullets impinge, to the known velocity of 1641 feet in one ſecond, will be determined.

GUN-POWDER, a compoſition of ſalt-petre, ſulphur, and charcoal, well mixed together and granulated; which eaſily takes fire, and expands with amazing force.

The invention of this compoſition is aſcribed by Polydore Virgil to a chemiſt, who having accidentally put the ingredients above-mentioned into a mortar, and covered it over with a ſtone, it happened to take fire, and threw off the ſtone. Thevel ſays that this chemiſt was one Conſtantine Anelzen, a monk of Friburg; but Belleforet and others aſſert it to be Bertholdus Schwartz: at leaſt it is affirmed that he firſt taught the uſe of gun-powder to the Venetians, in the year 1380. Peter Mexia however contradicts this account, by ſhewing it to have been uſed by Alphonſus XI. king of Caſtile, in the year 1342. Ducange adds, that there is mention made of this powder in the regiſters of the chambers of accounts of France, ſo early as the year 1338; and our countryman, Friar Bacon, expreſsly mentions the compoſition, in his treatiſe *De nullitate Magiæ*, publiſhed at Oxford in the year 1216.

Method of making GUN-POWDER. The following recipe for making gun-powder is taken from Dr. Shaw's Chemical Lectures.

Take four ounces of refined ſalt-petre, an ounce of brimſtone, and ſix drams of charcoal; reduce theſe to a fine powder, and continue beating them for ſome time in a ſtone mortar, with a wooden peſtle, wetting the mixture between whiles with water, ſo as to form the whole into an uniform paſte, which is reduced to grains, by paſſing it through a white ſieve for the purpoſe; and in this form, being carefully dried, it becomes the common gun-powder.

For greater quantities, mills are uſually provided, by means of which more work may be performed in one day than a man can do in a hundred. See MILL.

The nitre or ſalt-petre is refined thus: diſſolve four pounds of rough nitre as it comes to us from the Indies, by boiling it in as much water as will commodiouſly ſuffice for that purpoſe; then let it ſhoot for two or three days in a covered veſſel of earth, with ſticks laid acroſs for the cryſtals to adhere to. Theſe cryſtals being taken out, are drained and dried in the open air.

In order to reduce this ſalt to powder, they diſſolve a large quantity of it in as ſmall a proportion of water as poſſible; then keep it conſtantly ſtirring over the fire, till the water exhales, and a white dry powder is left behind. See NITRE.

In order to purify the brimſtone employed, they diſſolve it with a very gentle heat; then ſcum and paſs it through a double ſtrainer. If the brimſtone ſhould happen to take fire in the melting, they have an iron cover that fits on cloſe to the melting veſſel, and damps the flame. The brimſtone is judged to be ſufficiently refined if it melts without yielding any fetid odour between two hot iron plates into a kind of red ſubſtance.

The coal for the making of gun-powder is either that of willow, or hazel, well charred in the uſual manner, and reduced to powder: and thus the ingredients are prepared for making this commodity; but as theſe ingredients require to be intimately mixed, and as there would be danger of their firing if beat in a dry form, the method is to keep them continually moiſt, either with water, urine, or a ſolution of ſal ammoniac: they continue thus ſtamping them together for twenty-four hours, after which the maſs is fit for corning and drying in the ſun, or otherwiſe, ſo as ſedulouſly to prevent its firing.

Different kinds of GUN-POWDER. The three ingredients of gun-powder are mixed in various proportions, according as the powder is intended for muſquets, great guns, or mortars; through theſe proportions ſeem not to be perfectly adjuſted, or ſettled by competent experience.

Semienowitz for mortars, directs 100 ℔ of ſalt-petre, 25 ℔ of ſulphur, and as many of charcoal; for great guns, 100 ℔ of ſalt-petre, 15 ℔ of ſulphur, and 18 ℔ of charcoal; for muſquets and piſtols 100 ℔ of ſalt-petre, 8 ℔ of ſulphur, and 10 ℔ of charcoal. Miethius extols the proportion of 1 ℔ of ſalt-petre to three ounces of charcoal, and two or two and a quarter of ſulphur; than which, he affirms, no gun powder can poſſibly be ſtronger. He adds, that the uſual practice of making the gun-powder weaker for mortars than guns, is without any foundation, and renders the expence needleſsly much greater: for whereas to load a large mortar, 24 ℔ of common powder is required, and conſequently to load it ten times 240 ℔, he ſhews by calculation, that the ſame effect would be had by 150 ℔ of the ſtrong powder.

To increaſe the ſtrength of powder, Dr. Shaw thinks it proper to make the grains conſiderably large, and to have it well ſifted from the ſmall duſt. We ſee that gun-powder, reduced to duſt, has little exploſive force; but

when the grains are large, the flame of one grain has a ready paſſage to another, ſo that the whole parcel may thus take fire nearly at the ſame time, otherwiſe much force may be loſt, or many of the grains go away as ſhot unfired.

Method of trying and examining GUN-POWDER. There are two general methods of examining gun-powder; one with regard to purity, the other with regard to its ſtrength. Its purity is known by laying two or three little heaps near each other upon white paper, and firing one of them; for if this takes fire readily, and the ſmoke riſes upright, without leaving any droſs, or feculent matter behind, and without burning the paper, or firing the other heaps; it is eſteemed a ſign that the ſulphur and nitre were well purified, that the coal was good, and that the three ingredients were thoroughly incorporated together; but if the other heaps alſo take fire at the ſame time, it is preſumed that either common ſalt was mixed with the nitre, or that the coal was not well ground, or the whole maſs not well beat, and mixed together; and if either the nitre or ſulphur be not well purified, the paper will be black or ſpotted.

In order to try the ſtrength of gun-powder, there are two kinds of inſtruments in uſe; but neither of them appear more exact than the common method of trying to what diſtance a certain weight of powder will throw a ball from a muſket.

There has been much talk of a white powder, which, if it anſwered the character given it, might be a dangerous compoſition: for they pretend that this white powder will throw a ball as far as the black, yet without making a report; but none of the white powder we have ſeen, ſays Dr. Shaw, anſwers to this character; being, as we apprehend, commonly made either with touchwood or camphor, inſtead of coal.

Obſervations on the Force of GUN-POWDER. Gun-powder fired either in vacuum, or in air, produces by its exploſion a permanent elaſtic fluid: for if a red-hot iron be included in a receiver, after being exhauſted, and gun-powder be let fall on the iron, the powder will take fire, and the mercurial gage will ſuddenly deſcend upon the exploſion; and though it immediately aſcends again, yet it will never riſe to the height it firſt ſtood at, but will continue depreſſed by a ſpace proportioned to the quantity of gun-powder which was let fall on the iron.

The ſame production likewiſe takes place, when gun-powder is fired in the air: for if a ſmall quantity of powder be placed in the upper-part of a glaſs tube, and the lower part of the tube be immerged in water, and the water be made to riſe ſo near the top, that only a ſmall portion of air is left in that part where the gun-powder is placed: if in this ſituation the communication of the upper-part of the tube with the external air be cloſed, and the powder be fired, which will eaſily be done by a burning glaſs, the water will in this experiment deſcend upon the exploſion, as the quickſilver did in the laſt; and will always continue depreſſed below the place at which it ſtood before the exploſion; and the quantity of this depreſſion will be greater, if the quantity of powder be increaſed, or the diameter of the tube be diminiſhed. From whence it is proved, that as well in air as in a vacuum, the exploſion of fired powder produces a permanent elaſtic fluid. It alſo appears from experiment, that the elaſticity or preſſure of the fluid produced by the firing of gun-powder, is, *cæteris paribus*, directly as its denſity. This follows from hence, that if in the ſame receiver a double quantity of powder be let fall, the mercury will ſubſide twice as much as in the firing of a ſingle quantity.

To determine the elaſticity and quantity of this elaſtic fluid, produced from the exploſion of a given quantity of gun-powder, Mr. Robins premiſes, that the elaſticity of this fluid increaſes by heat, and diminiſhes by cold in the ſame manner as that of the air; and that the denſity of this fluid, and conſequently its weight, is the ſame with the weight of an equal bulk of air having the ſame elaſticity, and the ſame temperature. From theſe principles, and from his experiments, for a detail of which we muſt refer the reader to his New Principles of Gunnery, in Scholium to Prop. II. he concludes, that the fluid produced by the firing of gun-powder will be $\frac{1}{100}$ of the weight of the gun-powder, and the ratio of the reſpective bulks of the powder, and the fluid produced from it, will be in round numbers 1 to 244.

Hence we are certain, that any quantity of powder fired in any confined ſpace, which it adequately fills, exerts, at the inſtant of its exploſion, againſt the ſides of the veſſel containing it, and the bodies it impels before it, a force at leaſt 244 times greater than the elaſticity of common air; or, which is the ſame thing, than the preſſure of the atmoſphere; and this without conſidering the great addition which this force will receive from the violent degree of heat with which it is endued at that time, the quantity of which augmentation is the next head of Mr. Robins's enquiry. He determines that the elaſticity of the air is augmented when heated to the extremeſt heat of red-hot iron, in the proportion of 796 to 194 $\frac{1}{3}$, and ſuppoſing that the flame of fired gun-powder is not leſs hot than red-hot iron, and the elaſticity of the air, and conſequently of the fluid, generated by the exploſion, being augmented by the extremity of this heat in the ratio of 796 to 194 $\frac{1}{3}$, it follows, that if 244 be augmented in this ratio, the reſulting number, which is 999 $\frac{1}{3}$, will determine how many times the elaſticity of the flame of fired powder exceeds the elaſticity of common air, ſuppoſing it to be confined in the ſame ſpace which the powder filled before it was fired.

Hence then the abſolute quantity of the preſſure exerted by gun-powder, at the moment of its exploſion, may be aſſigned: for ſince the fluid then generated has an elaſticity of 999 $\frac{1}{3}$, or in round numbers 1000 times greater than common air; and ſince common air by its elaſticity exerts a preſſure on any given ſurface equal to the weight of the incumbent atmoſphere, with which it is in equilibrio, the preſſure exerted by fired powder, before it has dilated itſelf, is 1000 times greater than the preſſure of the atmoſphere; and conſequently the quantity of this force on a ſurface of an inch ſquare, amounts to above ſix tun weight, which force however diminiſhes as the fluid dilates itſelf. The variations of the denſity of the atmoſphere does not any way alter the action of powder by any experiment that can be made. But the moiſture of the air has a very great influence on the force of it; for that quantity which in a dry ſeaſon would communicate to a bullet a velocity of 1700 feet in one ſecond, will not in damp weather communicate a velocity of more than 12 or 1300 feet in a ſecond, or even leſs, if the powder be bad and negligently kept.

The velocity of expanſion of the flame of gun-powder when fired in a piece of artillery, without either bullet, or any other body before it, is prodigious. By the experiments of Mr. Robins, it ſeems this velocity cannot be much leſs than 7000 feet in a ſecond. This, however, muſt be underſtood of the moſt active part of the flame: for as, as was obſerved before, the elaſtic fluid in which the activity of gun-powder conſiſts, is only $\frac{1}{100}$ of the ſubſtance of the powder, the remaining $\frac{99}{100}$ will in the exploſion be mixed with the elaſtic part, and will by its weight retard the activity of the exploſion; and yet they will be ſo compleatly united as to move with uncommon motion; but the unelaſtic part will be leſs accelerated than the reſt, and ſome of it will not even be carried out of the barrel, as appears by the conſiderable quantity of unctuous matter which adheres to the inſide of all fire-arms, after they have been uſed. Theſe inequalities in the expanſive motion of the flame render it impracticable to determine its velocity, otherwiſe than from experiments.

To recover damaged GUN-POWDER. The method of the powder-merchants is this; they put part of the powder on a ſail-cloth, to which they add an equal weight of what is really good, and with a ſhovel mingle it well together, dry it in the ſun, and barrel it up, keeping it in a dry and proper place. Others again, if it be very bad, reſtore it by moiſtening it with vinegar, water, urine, or brandy: then they beat it fine, ſearce it, and to every pound of powder add an ounce, an ounce and a half, or two ounces, according as it is decayed, of melted ſalt-petre. Afterwards, theſe ingredients are to be moiſtened and mixed well, ſo that nothing can be diſcerned in the compoſition, which may be known by cutting the maſs; and then they granulate it as aforeſaid. In caſe the powder be in a manner quite ſpoiled, the only way is to extract the ſalt-petre with water, according to the

the uſual manner, by boiling, filtrating, evaporating, and cryſtallizing; and then with freſh ſulphur and charcoal to make it up a-new again. In regard to the medical virtues of gun-powder, Boerhaave informs us, that the flame of it affords a very healthy fume in the height of the plague, becauſe the exploſive acid vapour of nitre and ſulphur corrects the air; and that the ſame vapour, if received in a ſmall cloſe pent-up place, kills inſects.

GUN-SHOT-WOUNDS, thoſe made by ſhot, bullets, &c. ſhot from ſome ſpecies of fire-arms.

Theſe wounds are attended with much worſe conſequences than wounds made with cutting inſtruments; for the parts are more ſhattered and torn, eſpecially when the ſhot falls upon the joints, bones, or any conſiderable part. Wounds of this kind have an eſchar formed upon them, and are therefore attended with little or no hæmorrhage at firſt, unleſs ſome very conſiderable veſſel happens to be wounded; but as ſoon as this eſchar falls off, the hæmorrhage is ſometimes ſo violent, as to endanger the life of the patient, unleſs the immediate aſſiſtance of a ſurgeon can be procured.

There being for the five or ſix firſt days little or no diſcharge of matter from theſe wounds, it is no wonder that gun-ſhot wounds exceed all others in the violence of their ſymptoms, ſuch as inflammation, pain, gangrene, &c.

The eſchar formed upon theſe wounds is not occaſioned ſo much by the heat of the bullets, as by the rapidity with which they deſtroy the parts; and the violence of the ſymptoms is chiefly owing to this manner of wounding. Nor is there any thing poiſonous in theſe wounds, as ſome have imagined; for nothing poiſonous enters the compoſition of either the powder or the ball.

Gun-ſhot wounds are ſome deeper than others; in ſome the muſcular parts alone are hurt; in others the veſſels, bones, or viſcera, are wounded. Sometimes the ball paſſes clear through; ſometimes it remains fixed in the wound, and often carries part of the wadding, or the patient's clothes with it. From the difference of theſe circumſtances very different ſymptoms muſt ariſe.

Gun-ſhot wounds in the cranium, even the ſlighteſt of them, are attended with very great danger, and frequently bring on terrible ſymptoms, from the concuſſion they occaſion in the internal parts; ſo that it is ſurprizing to ſee how ſmall an external wound upon this part, will bring on death, if not prevented by the trepan. Internal wounds of this ſort are alſo extremely dangerous; but, unleſs ſome large veſſel be wounded, they are frequently cured.

When they are inflicted on the bones or joints, they are attended with very bad ſymptoms; for in this caſe it is next to impoſſible to eſcape inflammation, gangrene, caries, and dangerous fiſtulæ, which either require amputation of the limb, or leave it without ſenſe or motion.

If any parts of the clothes, wadding, or any other extraneous body be forced into the wound, it muſt be removed before you can attempt to heal the wound; and the ſame caution is to be obſerved in regard to any ſplinters of bone: when theſe are removed, the hæmorrhage is to be ſtopped, then ſuppuration is to be promoted, and new fleſh encouraged, and care taken to procure an even cicatrix.

Extraneous bodies are much eaſieſt to be removed at firſt; for after ſome delay the tumor, and inflammation of the part, render it difficult and painful: beſides, the bullets will by degrees work themſelves deeper, and be buried under the muſcles, which will occaſion fiſtulæ, rigidity of the limb, and other inconveniencies. In extracting balls that lie deep, you muſt take great care not to lay hold of blood-veſſels or nerves; which accident will be beſt avoided, by introducing the forceps ſhut, and not opening them till you feel the ball.

Sometimes the orifices of theſe wounds are ſo narrow, that it is impoſſible to come at the body you are to extract, without making a larger opening; this then muſt be done on the moſt convenient ſide, always obſerving that no nerve, blood-veſſel, tendon, or ligament, lies in the way. When the parts are very much inflamed and ſwelled, an opening of this kind is frequently of ſervice; for by this means the obſtructed blood is diſcharged, and the bad conſequences of the inflammation are prevented. When the extraction of the ball is attempted, the patient muſt be put into the ſame poſture and ſituation that he was in when he received the wound. When the ball has penetrated ſo deep, that it may be eaſily felt with the finger on the oppoſite ſide, it is ſometimes better to make an inciſion there, and take it out in that place, than to attempt the getting it back the other way. If the wound cannot ſafely be enlarged, nor the ball extracted at firſt, without great pain and danger, it muſt be left in the wound, either till the pain is abated, or the wound is ſo enlarged by ſuppuration, that it either can work itſelf out, or be extracted with leſs danger. On the other hand, all other extraneous bodies are inſtantly to be removed, where there is danger of their bringing on pain, inflammation, and convulſions, by being left behind. If a ball has paſſed into the cavities of the body, it is beſt not to attempt to extract it, but to heal the wound, leaving it there. Perſons have carried a ball in them thus, for many years, without inconvenience; and, at one time or other, it frequently happens that it will work itſelf into ſome part of the body, out of which it may be extracted with ſafety.

If a large artery is wounded by the ball, either in the arms or legs, which will be known by the loſs of blood, the tourniquet muſt be applied, and, the blood being ſtopped, the veſſel muſt be taken up by a crooked needle; but, if this cannot be done, or little hopes of a cure appear from future dreſſings, it will be prudent to take off the limb juſt above the wound. When wounds of this kind have been well cleaned, and the blood ſtopped, the firſt intention is to uſe the utmoſt endeavours to prevent, or aſſuage the tumor and inflammation. The wound ſhould be dreſſed with lint dipped in warm ſpirits of wine, and covered with a compreſs wetted with the ſame liquor; or with camphorated ſpirits of wine, either alone, or diluted with lime water. Having done this, the next intention is to forward the ſuppuration of the bruiſed and torn parts; to which end, it is cuſtomary to uſe the common digeſtive made of turpentine diſſolved in the yolk of an egg, or a mixture of baſilicon and Arcæus's liniment, ſoftened with ſpirits of wine and oil; and, where there is a very great corruption of the parts, a little myrrh and aloes are to be added, as alſo Venice treacle, the brown ointment, and, where the occaſion requires it, and the nerves do not lie bare, a little of the red precipitate.

In deep wounds, where the ball has gone quite through, a ſkein of thread being drawn through the eye of a blunt needle, and well ſaturated with the digeſtive ointment, is to be paſſed through the wound in the manner of a ſeton, and kept there till the wound is found in a condition to heal, and then the common methods are purſued to heal and cicatrize. *Heiſter's Surgery.*

GUNTER's-LINE, called alſo the *Line of Numbers*, and the *Line of Lines*, is a graduated line uſually placed upon ſcales, ſectors, &c. ſo called from Edmund Gunter, its inventor.

This line is no other than a logarithmic ſcale of proportionals, wherein the diſtance between each diviſion is equal to the number of mean proportionals contained between the two terms, in ſuch parts as the diſtance between 1 and 10 is 10000, &c. Wherefore,

If the diſtance betwixt 1 and 10 upon the ſcale be made equal to 10000, &c. equal parts, and .954, &c. the logarithm of 9 of the ſame parts, be ſet off from 1 to 9, it will give the diviſion ſtanding againſt the number 9. In like manner, if .903, .845, .778, which are the logarithms of 8, 7, and 6, of the ſame equal parts, be ſet off from 1 to 8, 7, and 6, they will give the diviſions anſwering to the numbers 8, 7, and 6, upon the line. And after the ſame manner may the whole line be divided.

This line has been contrived various ways, for the advantage of having it as long as poſſible. It was firſt placed, by its inventor Edmund Gunter, on a two feet ſcale. After this, Wingate doubled the line, in order to render it ſuſceptible of working right on or a-croſs. Then, the learned Oughtred projected it in a circle, and alſo made it to ſlide: and, laſtly, it was projected in a kind of ſpiral, by Brown.

But the method of uſing or applying it in all is not very different. In Gunter's and Wingate's projection, com-

mon compaſſes are uſed; in Oughtred's and Brown's flat compaſſes, or an opening index; and in the ſliding rule no compaſſes at all, the ſlider ſupplying the place of the compaſſes.

Deſcription of GUNTER's *Line.* This line is uſually divided into an hundred parts, every tenth whereof is numbered, beginning with 1, and ending with 10. So that, if the firſt great diviſion 1 repreſent one tenth of any integer or whole number, the next 2 will repreſent 2 tenths; 3, three tenths, &c. and the intermediate diviſions ſo many 100th parts of the ſame integer. Or, if theſe ſubdiviſions repreſent 10 integers, then each of the larger diviſions will repreſent 100, and the whole line will be 1000. In like manner, it may be extended to 10000 by making each ſubdiviſion 100. Hence, it is eaſy to conceive, that any number whatſoever may be found upon the rule, by increaſing or decreaſing the large diviſions, and, conſequently, this ſingle line will repreſent the whole table of logarithms.

Uſe of GUNTER's *Line.*—1. One number being given to be multiplied by another, to find their product.

Suppoſe the numbers given were 8 and 4, to find their product.—Extend the compaſſes from 1 to 4, and that extent laid from 8, the ſame way, will reach to 32, the product required. Or, if you work by the ſliding-rule, ſet 1, at the beginning of the ſliding-piece, againſt 4 on the upper or fixed piece; and againſt 4 on the ſlider ſtands 32, on the upper or fixed piece, which is the product required. Whence it is abundantly evident, that the ſliding-piece performs the office of the compaſſes, and therefore, when the method of ſolving any problem by the compaſſes is underſtood, there will be no difficulty of ſolving the ſame by the ſliding-rule.

2. One number being given to be divided by another, to find the quotient.—Suppoſe it were required to divide 64 by 4. Extend the compaſſes from 4 to 1, and the ſame extent, laid the ſame way, will reach from 64 to 16, the quotient required.

3. Three numbers being given to find a fourth in direct proportion.—Let the numbers given be 7, 22, and 14. Extend the compaſſes from 7 to 22, which extent, laid the ſame way, will reach from 14 to 44, the fourth proportional required.

4. To find a mean proportional between 2 given numbers.—Biſſect the diſtance between the two given numbers, and the point of biſſection will fall on the proportional ſought. Thus, if the numbers given be 32 and 8, the middle point between them will be 16, which is the mean proportional required.

5. To extract the ſquare root of any number.—Biſſect the diſtance between 1 on the line, and the point repreſenting the given number; the half whereof being laid from one will give the root required. Thus the ſquare root of 9 will be found to be 3, of 81, 9, &c. The reaſon of theſe operations will be eaſily conceived, by conſidering the nature of logarithms; for, as we have already obſerved, this line is no other than a projection of the table of logarithms, and, conſequently, whatever is ſaid of the latter may juſtly be applied to the former. See LOGARITHMS.

GUNTER's-QUADRANT, one made of wood, braſs, &c. containing a kind of ſtereographic projection of the ſphere on the plane of the equinoctial; the eye being ſuppoſed placed in one of the poles.

Beſides the uſe of this quadrant in finding heights and diſtances, it ſerves alſo to find the hour of the day, the ſun's azimuth, and other problems of the globe. See the article *Gunter's* QUADRANT.

GUNTER's SCALE, called by navigators ſimply the Gunter, is a large ſcale, generally two feet long, and about an inch and a half broad, with artificial lines delineated on it, of great uſe in ſolving queſtions in trigonometry, navigation, &c.

The line of numbers on theſe ſcales conſiſts of two equal lengths, commonly called two radii; the firſt containing the logarithms of numbers from 10 to 100; and in the ſecond are inſerted thoſe between 100 and 1000, or ſuch of them as can conveniently be introduced.

Theſe diviſions are taken from a ſcale of equal parts; ſuch, that 100 make the length of one radius; and from this ſcale the diviſions for the ſines, tangents, and verſed ſines, are alſo taken. Now, from this conſtruction of the line of numbers, it is plain, that, as the numbers in one radius exceed thoſe in the other, by one place in the ſcale of numeration, therefore the differences of their indices muſt alſo be unity: ſo that ſuch numbers only, whoſe index differs by 1, can be eſtimated in a length of two radii; but in a length of three radii, numbers, whoſe indices differ by 2, may be read; and a difference of 3 may be reckoned in a length of 4 radii, &c. The tables of logarithmic ſines, tangents, ſecants, and verſed ſines, are generally computed for a circle, whoſe radius is 10,000,000: therefore,

In the ſines, the index 9 belongs to all between	90	0	0	and	5	44	36
The index 8	5	44	36	and	0	34	23
The index 7 to all between	0	34	23	and	0	3	27
6	0	3	27	and	0	0	21 &c.
In the tangents, the index 9 belongs to all between	45	0	and	5	42	10	

And the indices, 8, 7, 6, &c. fall as in the ſines.

In the verſed ſines, the index 10 belongs to all between	180	0	and	90	0
9 belongs to all between	90	0	and	25	51
8	25	51	and	8	7
7	8	7	and	2	34
6	2	4	and	0	45 &c.

Now, as the length of the Gunter's ſcale admits of no more than two radii, or of ſuch numbers only, whoſe index differs by unity; therefore, within this length, no more of the ſines, tangents, or verſed ſines, can be introduced, than thoſe whoſe index differs by unity: and as not only the greateſt number among the ſines and tangents, but alſo thoſe more generally wanted, have the indices 9 and 8 differing by unity; therefore all the ſines from 90° to 0° 34′, and all the tangents from 45° to 0° 34′, are thoſe only, which are put on theſe ſcales; the diviſions anſwering to the leſſer ſines and tangents being omitted for want of room. And this is the reaſon why the ſine of 90°, and the tangent of 45°, are limited by the ſame termination as the ſecond radius on the line of numbers.

To conſtruct the Line of logarithmic Sines on GUNTER's *Scale.*—From the ſcale of equal parts, take the numbers expreſſing the arithmetical complements of the log-ſines of the ſucceſſive degrees, and parts of degrees, intended to be put on the ſcale, deſcending orderly from 90°; then theſe diſtances, ſucceſſively laid from the mark repreſenting 90° at the right-hand end of the ſcale, will give the ſeveral diviſions of a ſcale of logarithmic ſines.

For the ends of any ſcale being aſſigned, the progreſſive diviſions of that ſcale are laid thereon from that end, which repreſents the beginning of the progreſſion; or the ſame diviſions may be laid from the other end, by taking the complements of the terms to the whole length of the ſcale.

Conſequently the arithmetical complements of the ſines are to be laid from the diviſion repreſenting 90 degrees.

To conſtruct the Line of logarithmic Tangents on GUNTER's *Scale.*—Theſe are laid down in the ſame manner, and for the ſame reaſons, that the ſines were; the tangent of 45° ſtanding againſt the ſine of 90°.

The diviſions for the tangents above 45° are reckoned on the ſame line from 45° towards the left hand; or any tangent and its cotangent are expreſſed by the ſame diviſion.

Thus one mark ſerves for 40° and 50°, and the diviſion at 30° ſerves alſo for 60°; that at 20° ſerves for 70°, &c. and the like is to be underſtood for the intermediate diviſions.

For as the tangent of an arc is to a radius;

So is radius to the cotangent of that arc.

Therefore the tangent is equal to the ſquare of radius divided by the co-tangent.

And the co-tangent is equal to the ſquare of radius divided by the tangent.

Now, the radius being unity, its ſquare is alſo unity.

Therefore the tangent and co-tangent of any arc are the reciprocals one of the other.

But the reciprocals of numbers are correlatives to the arithmetical complements of their logarithms.

Therefore the logarithms of a tangent and its co-tangent are arithmetical complements one of the other, and conſequently will fall at equal diſtances from 45 degrees.

Therefore, in the line of logarithmic tangents, the diviſions to degrees under 45 ſerve alſo for thoſe above, both being equally diſtant from 45 degrees.

To conſtruct the Line of logarithmic verſed Sines on GUNTER's *Scale.*—As the greateſt number of degrees will fall within the limits of the ſcale by beginning at 18°, therefore the termination of this line is at 18°, which is put againſt 90° on the ſines: and although the numbers annexed to the diviſions increaſe in the order from right to left, yet they are only the ſupplements of the verſed ſines themſelves.

Now ſubtract the logarithmic verſed ſines of ſuch degrees and parts of degrees as are intended to be put on the ſcale, from the logarithm verſed ſine of 180°; then the remainder taken from the foreſaid ſcale of equal parts, and laid ſucceſſively from the termination of this line, will give the ſeveral diviſions ſought.

The following Table to every 10 degrees was conſtructed in the foregoing manner, and are the numbers to be taken from the ſcale of equal parts, for the degrees they ſtand againſt.

Deg.	Supplements of Verſed Sines.	Deg.	Supplements of Verſed Sines.	Deg.	Supplements of Verſed Sines.
180	0,00000	120	0,12494	60	0,60206
170	0,00331	110	0,17327	50	0,74810
160	0,01330	100	0,23149	40	0,93190
150	0,03011	90	0,30103	30	1,17401
140	0,05402	80	0,38387	20	1,52066
130	0,08545	70	0,48282	10	2,21941

From this table it appears, that the leaſt verſed ſine which can be introduced within the length of a double radius, falls between 10° and 20°, where the index changes from 1 to 2; which will happen about 11° 28′.

If a table of logarithm verſed ſines to 180° are wanting, they are eaſily made by the following rule:

"Take the logarithm ſine of 30 degrees from twice the logarithm ſine of (N) any number of degrees; the remainder is the logarithm verſed ſine of (2 N, or) twice thoſe degrees."

For it is a well known geometrical property, that the ſine of any arc (A) is a mean proportional between radius (R) and half the verſed ſine of twice that arc.

Therefore, putting v for the verſed ſine, and s for the ſine;

The $v\,2\,A = \left(\frac{2\,s\,s\,A}{R} = s\,s\,A \times \frac{2}{R} = s\,s\,A \times \frac{2}{10} =\right)$ $s\,s\,A \times \frac{1}{5}$; radius being 10.

Or the log. $v\,2\,A = 2$ log. $s\,A -$ log. 5.

But, when radius is 10, the ſine of 30° is 5.

Therefore the log. $v\,2\,A = 2$ log. $s\,A -$ log. ſine of 30°.

Moſt of the writers on this ſubject give the following rule for laying down the diviſions of this line:

"From the line of logarithmic ſines, take the diſtance between 90° and any arc; that diſtance being twice repeated, from the termination of the line of verſed ſines, will give the diviſion for twice the complement of that arc."

Thus the diſtance between 90° and 20° on the ſines twice repeated gives the verſed ſine of 140°; or twice 70°, the complement of 20°. For the diviſions to be laid on this line, are the differences between the logarithm verſed ſine of 180°, and the logarithm verſed ſines of the ſucceſſive arcs.

Now the difference between the logarithm verſed ſines of 180°, and of any arc 2 A, is log. ver. ſine 180 − 2 log. ſin. A + log. ſin. of 30°.

Or, 10,30103 + 9,69897 − twice log. ſin. of A.

Or, 20,00000 − twice logarithm ſine of A.

Or the arithmetical complement of twice log. ſine of A.

That is, the difference between the logarithm verſed ſine of 180°, and the logarithm verſed ſine of any arc, is equal to double the arithmetical complement of the logarithm ſine of half that arc, rejecting the indices.

But as the differences give the diviſions to the ſupplements of the real verſed ſines, therefore the arithmetical complement of the logarithm ſine of any arc, being doubled, will give the diſtance of the diviſion for the ſupplement of twice that arc on the line of verſed ſines.

Thus, for 70°, the logarithm ſine is 9,97299.

The arithmetical complement is 0,02701.

Its double is 0,05402.

Which is the number in the foregoing table ſtanding againſt 140°, and is the ſupplement verſed ſine of twice 70 degrees.

Now, as the arithmetical complement of the log. ſines of arcs are the diſtances on the line of ſines between 90°, and the diviſions to thoſe arcs; therefore the diſtances between 90° and any arc, being twice repeated, will give the diviſion of the ſupplemental verſed ſine to twice the co-ſine of that arc. *Phil. Tranſ.* Vol. XLIX.

GURNARD, in ichthyology, the Engliſh name of two ſpecies of trigla.

Theſe fiſhes, from their different colours, are called the grey and red gurnard. The grey gurnard has a bifid and ſpinoſe ſnout, with two ſpines at each eye. The red kind has likewiſe the roſtrum bifid, and the coverings of the gills ſtriated, and each of them armed with three ſpines. This laſt is a very remarkable ſpinoſe fiſh, which ſeldom exceeds a foot in length.

Both theſe fiſhes make a ſingular noiſe, when out of the water, not unlike the grunting of a hog; whence their Engliſh name.

GUSSET, in heraldry, is formed by a line drawn from the dexter or ſiniſter chief points, and falling down perpendicularly to the extreme baſe.

GUTTÆ, in architecture, are ornaments in form of little cones, in the platform of the Doric corniche, or architrave, underneath the triglyphs, repreſenting a ſort of drops or bells, uſually ſix in number. They are ſometimes called lachrymæ, companæ, or campanulæ.

GUTTÆ *Roſacea*, in medicine, denotes a red or pimpled face; a diſtemper which, though not always owing its original to hard drinking, is nevertheleſs moſt incident to tipplers of ſtrong beer, wines, ſpirits, &c.

As to the cure, beſides making a revulſion by bleeding, bliſtering, cupping, iſſues, &c. the diet ought to be moiſtening and cooling, as lettuce, purſlain, ſorrel, and ſpinach: the drink may be an emulſion of the cold ſeeds, milk and water, clarified whey, &c.

In the uſe, however, of this cooling regimen, great caution is neceſſary: for, if a perſon be taken off at once from his ſtrong liquors, and allowed nothing but whey, or milk and water, it may coſt him his life, by haſtening a ſudden decay of heat, palling his appetite, and bringing on a leucophlegmatia, or dropſy.

As for what concerns topics, much caution is likewiſe to be uſed. If there be only redneſs without pimples, and the diſeaſe recent, refrigerants and repellents take place: but, if puſtules appear, diſcutients muſt be mixed; and if theſe puſtules ſeem hard, and the diſeaſe be of long ſtanding, there may be reaſon for emollients to ripen and digeſt the tough and viſcid matter, which is afterwards to be let out.

If the diſeaſe be ſtubborn, and the tubercles grown hard, we are to begin with emollients, both fotus and ointment: ſuch are the decoction of mallows, vervain, Solomon's ſeal, and linſeed, alſo a cerate of ſperma-ceti, or Bates's white cerate. *James's Med. Dict.*

GUTTÆ *Serena*, barbarouſly ſo called by the Latin writers of the lower ages, which the Greeks term *αμαρυωσις*, in medicine, is a total blindneſs in the principal parts of the immediate organ of viſion, the eye ſtill continuing clear and ſeemingly unaffected.

This diſorder proceeds from various cauſes, of which the moſt common is an obſtruction gradually formed in the arteries of the retina by a ſizy blood; whereby the rays of light which ſhould depict the images of objects on the bottom of the eye, falling on theſe dilated blood-veſſels, produce no effect; whence the ſight is either diminiſhed, or entirely loſt, according to the degree of the obſtruction. Again, this diſeaſe is ſometimes owing to a palſy of the nerves of this ſame membrane, as it in ſome

meaſure

meaſure deſtroys their ſenſibility, whereby the impulſe of the corpuſcles of light on them is not ſufficient to make them tranſmit objects to the brain. In ſhort, I have obſerved that this ſpecies of blindneſs is alſo occaſioned by a preſſure on the optic nerves, either by the extravaſation of a glutinous humour, or by a hard tumor formed upon the place, where they paſs from their thalami into the eyes; whereby the paſſage of the animal ſpirits to the brain is totally intercepted. To preſerve this organ, which has ſo great a ſhare in making life uſeful and agreeable, we ought firſt to know how to diſtinguiſh the ſeveral ſpecies of the guttæ ſerena abovementioned, and their good and bad ſymptoms.

Wherefore a gradual dilatation of the pupil is a ſign of an obſtruction in the blood-veſſels by a ſizy blood. For this dilatation is the work of nature, in order that the detriment, which the ſight ſuffers by many of the rays of light falling on the ſmall arteries, inſtead of the nervous fibrillæ, may be compenſated by taking in a greater number of theſe rays. Hence the palſy of the nerves ſeldom or never occaſions this dilatation; but the preſſure on the optic nerve, either by an extravaſated humour, or a tumor gradually increaſing, is attended with a wider pupil for the aforeſaid reaſon.

Upon this principle it is that the ſecond and third ſpecies of the guttæ ſerena may be deemed incurable, as their cauſes are rendered inacceſſible by their very ſituation within the ſkull. Wherefore it is only the firſt ſpecies of this blindneſs that is curable; unleſs perhaps there may be ſome faint hopes of relieving that ſort which proceeds from a palſy of the retina, by antiparalytic medicines, of which the principal are aromatics, chalybeates, and the fœtid gums.

The cure, in general, conſiſts in removing the obſtruction of the veſſels, and correcting the lentor of the blood. Wherefore, firſt of all, blood is to be drawn both from the arm and the jugular, and to be repeated according to the degree of the diſeaſe. And it will be of uſe to apply cupping-glaſſes, with deep ſcarifications under the occiput, in order to let out blood this way from the lateral ſinuſes of the brain: then it will be neceſſary to give cathartics, eſpecially ſuch as purge groſs humours: but as nothing is found more powerful than quickſilver for inciding and expelling groſs and viſcid humours, it will be very proper to join calomel to other cathartics, or rather to take it by itſelf, and a few hours after it ſome gentle purgative.

And this method often ſucceeds when the diſeaſe is beginning or recent; but if it be of ſome ſtanding, it requires a plentiful ſalivation raiſed by mercurials taken inwardly in ſmall quantities, and at ſhort intervals. For mercury, by its extraordinary weight and diviſibility into extremely minute globules, penetrates into the inmoſt receſſes of the body, ſcours the glands and veſſels, and carries off the ſordes by the moſt convenient outlets. *Mead's Monita & Præcepta.*

GUTTERS, in architecture, a kind of canals in the roofs of houſes, ſerving to receive and carry off the rain.

Gutters, with reſpect to their poſition, are of two kinds: ſuch as come ſomething near a parallelism with the horizon; and ſuch as incline towards a vertical poſition to the horizon.

GUTTURAL, a term applied to letters or ſounds pronounced or formed as it were in the throat. There are four guttural letters in the Hebrew, viz. אהחע, which, for memory's ſake, are termed ahachah. See LETTER.

GUTTY, *Gutté*, in heraldry, a term uſed when any thing is changed or ſprinkled with drops.

In blazoning, the colour of the drops is to be named, as gutty of ſable, of gules, &c.

GUY, in naval affairs, a rope uſed to keep ſteady any weighty body which is hoiſted into, or lowered out of, a ſhip, or to prevent any thing from being ſhaken at ſea by the agitation of the ſhip on the waves.

GUZES, in heraldry, roundles of a ſanguine or murry colour. Theſe, from their bloody hue, are by ſome ſuppoſed to repreſent wounds.

GYMNASIARCH, *Gymnaſiarcha*, in antiquity, the maſter of a gymnaſium or place of exerciſe.

The word is Greek, γυμνασιαρχης, and derived from γυμνασιον, a place of exerciſe, and αρχων, a head or maſter.

This office was of great importance, as all the youth were truſted to this maſter's care to be formed to exerciſes of the body. He had three officers under him: the xyſtarch, who was maſter of the athletæ or wreſtlers: the gymnaſta, who had the direction of all the other exerciſes; as that they ſhould be performed in due time and properly; that the youth attempted nothing beyond their ſtrength, or injurious to their health: and the pædotriba, who taught the exerciſes mechanically without underſtanding their theory.

Under theſe were ſeveral ſubalterns or ſervants for the inſtruction of the youth.

GYMNASIUM, the place where the above exerciſes were performed, being a public edifice, under proper maſters.

The word is Greek, γυμνασιον, and is derived from γυμνος, naked, as they put off their clothes, the better to perform their exerciſes.

The Greeks were the firſt who had gymnaſia; particularly the Lacedæmonians, and afterwards the Athenians; from whom the Romans borrowed them.

At Athens were three of theſe places of exerciſe; the academy, where Plato taught; the lyceum, where Ariſtole read his lectures; and the cynoſarges, deſtined for the common people.

Vitruvius gives us the form of the ancient gymnaſia, lib. 5. c. 11. They were alſo called palæſtræ, from wreſtling, one of the moſt uſual exerciſes performed therein; and thermæ, as baths and bagnios made a principal part among the Romans. In Homer's time theſe exerciſes were performed always in drawers; but one Orſippus being entangled by their undoing, and ſo worſted, he threw them quite aſide in Olymp. XXXII. and this was afterwards followed by the reſt.

The gymnaſia had ſeveral apartments. M. Burette reckons the twelve following, as, 1. The exterior porticos, where the philoſophers and other ingenious men diſputed and read their lectures and other performances. 2. The ephebeum, where the youth learned their exerciſes in private. 3. The coryceum, apodyterion, or gymnaſterion, a wardrobe where they ſtripped either to bathe or exerciſe. 4. The elæotheſium, alipterion, or unctuarium, for the unctions before or after the bath, wreſtling, &c. 5. The coniſterium or coniſtra, where they covered themſelves with duſt or ſand to dry up the oil or ſweat. 6. The palæſtræ, where wreſtling, pugilate, pancratia, &c. were performed. 7. The ſphæriſterium or tennis-court for all exerciſes with balls. 8. Large unpaved alleys, between the porticos and walls, quite round the edifice. 9. The xyſti or porticos for the wreſtlers in winter or bad weather; and, 10. Thoſe for ſummer or fine weather, that were moſtly open, and others planted with trees. 11. The baths conſiſting of different apartments. 12. The ſtadium, a large ſemi-circular ſpace covered with ſand, and ſurrounded with ſeats for the ſpectators.

The exerciſes may be reduced to two claſſes, as depending on the action of the body alone, or requiring external inſtruments. The former were of two kinds, orcheſtrice and palæſtrice. Under orcheſtrice were compriſed dancing, cubiſtice or tumbling, ſpheriſtice or tennis, and all exerciſes with balls. Palæſtrice compriſed wreſtling, boxing, pancratia, hoplomachia, running, leaping, throwing the diſcus, the exerciſe of the javelin and hoop, or τροχος, which was an iron hoop, about ſix feet in diameter beſet with iron rings. It was driven with an iron-rod, and required ſtrength and dexterity to direct it.

There were alſo medicinal exerciſes, as walking, vociferation, and holding the breath.

The bodily exerciſes that depended on external agents were mounting the horſe, riding in a chaiſe, litter, or other wheel carriage, rocking, ſwinging, and likewiſe ſwimming. Hoffman reckons up thirty-five gymnaſtic exerciſes.

GYMNASTICS, the art of performing the ſeveral bodily exerciſes, as wreſtling, running, fencing, dancing, &c. See the article WRESTLING, &c.

The part of medicine which regulates the exerciſes of the

the body, whether for preſerving or reſtoring health, is alſo termed gymnaſtic.

GYMNOSOPHISTS, a ſect of philoſophers who cloathed themſelves no farther than modeſty required. There was ſome of theſe ſages in Africa; but the moſt celebrated clan of them was in India. The African gymnoſophiſts dwelt upon a mountain in Ethiopia, near the Nile, without the accommodation either of houſe or cell. They did not form themſelves into ſocieties like thoſe of India, but each had his private retirement, where he ſtudied and performed his devotions by himſelf. If any perſon had killed another by chance, he applied to theſe ſages for abſolution, and ſubmitted to whatever penances they enjoined. They obſerved an extraordinary frugality, and lived only upon the fruits of the earth. Lucan aſcribes to theſe gymnoſophiſts ſeveral new diſcoveries in aſtronomy.

As to the Indian gymnoſophiſts, they dwelt in the woods, where they lived upon the wild products of the earth, and never drank wine, nor married. Some of them practiſed phyſic, and travelled from one place to another: theſe were particularly famous for their remedies againſt barrenneſs. Some of them, likewiſe, pretended to practiſe magic, and to foretel future events.

In general, the gymnoſophiſts were wiſe and learned men: their maxims and diſcourſes, recorded by hiſtorians, do not in the leaſt ſavour of a barbarous education, but are plainly the reſult of great ſenſe, and deep thought.

They kept up the dignity of their character to ſo high a degree, that it was never their cuſtom to wait upon any body, not even upon princes themſelves; for which reaſon Alexander, who would not condeſcend to viſit them in perſon, ſent ſome of his courtiers to them in order to ſatisfy his curioſity. Their way of educating their diſciples is very remarkable. Every day, at dinner, they examined them how they had ſpent the morning; and every one was obliged to ſhew, that he had diſcharged ſome good office, practiſed ſome virtue, or improved in ſome part of learning: if nothing of this appeared, he was ſent back without his dinner. They held a tranſmigration of ſouls; and it is probable that Pythagoras borrowed his doctrine from them.

GYMNOSPERMIA, in botany, a ſeries or ſub-diviſion of the didynamia claſs of plants; comprehending all thoſe with labiated flowers, without any pericarpium or capſule ſurrounding their ſeeds, which are only lodged in the baſe of the cup; whence the name gymnoſpermia. See the article DIDYNAMIA.

GYNÆCEUM, among the ancients, the apartment of the women, a ſeparate room in the inner part of the houſe, where they employed themſelves in ſpinning, weaving, and needle-work.

GYNANDRIA, in botany, a claſs of plants, in which the male and female parts of the flower are joined at their origin, the ſtamina or male parts of which grow to the piſtillum or female part, and not to the receptacle of the ſeed.

The word is formed of the Greek γυνη, female, and ανηρ, male.

Among the plants of this claſs are the paſſion-flower, birth-wort, &c.

The general character of this claſs of plants is very obvious; they are diſtinguiſhed at firſt ſight from all others, by the ſtamina being placed upon the ſtyle; or, in other words, the receptacle is elongated into the form of a ſtyle, and bears on it both the piſtil and ſtamina.

GYPSUM, or PLASTER-STONE, in natural hiſtory, a genus of foſſils naturally and eſſentially ſimple, not inflammable nor ſoluble in water, and compoſed of ſmall flat particles; which form bright, gloſſy, and in ſome degree tranſparent maſſes, not flexible or elaſtic, not giving fire with ſteel, nor fermenting with or being ſoluble in acid menſtrua, and very eaſily calcining the fire.

Of theſe gypſums, ſome are harder, others ſofter; and are of ſeveral colours, as white, grey, red, green, &c. ſometimes diſtinct, and ſometimes variouſly blended together.

The texture of all the gypſums being ultimately the ſame, it may be ſufficient to obſerve, that their origin is plainly from particles of a determinate nature and ſubſtance, and of a certain and invariable figure, an oblong, flat, and irregularly angular one. Theſe we ſometimes ſee, as indeed is moſt natural to them, diſpoſed without order or regularity, into looſe, complex, friable maſſes; at others, they are getting out of their native order, and emulating the ſtructure of other claſſes of bodies, of which they are indeed properly the baſis, and appearing ſomewhat in the figure of the fibrariæ; and at other times, of the foliaceous compoſite flakes of the ſelenitæ: the ſpecies which have theſe ſtructures, are truly varying from the gypſums into thoſe bodies they emulate; for the fibrariæ are only a peculiar arrangement of theſe very particles, and the ſelenitæ only more broad flakes of the ſame, like thoſe of the foliaceous talcs.

The gypſums are much uſed in plaſter, for ſtuccoing rooms, and caſting buſts and ſtatues.

GYPSUM STRIATUM, ſtriated plaſter-ſtone, the whitiſh, leſs gloſy tricheria, with ſhort thick filaments. See TRICHERIA.

H.

H A B

H E B

H, The eighth letter of the Engliſh alphabet, and ſixth conſonant.

It is in the old Greek alphabet, and is probably derived from the Phœnician Cheth ח, by putting a ſtroke acroſs the middle, inſtead of each end. It is formed by an effort of the larynx to modify the ſound of the following vowel, by a ſtrong exſpiration of the breath between the lips, cloſing with a gentle motion of the lower jaw to the upper, and the tongue nearly approaching the palate. Thus, the vowel *e* in *health*, *hero*, *heaven*, &c. is differently modified from what it is in the words *endive*, *eating*, *elect*, &c.

It is a conſonant of the guttural kind, as the throat concurs more to its formation than any other of the organs of ſpeech.

Menage diſtinguiſhes two kinds of *h*; the one an aſpirate, which is a conſonant; and the other a mute, which has no peculiar ſound diſtinct from that of the immediately following vowel or diphthong.

When the *h* is preceded by a *c*, both together often ſound like the Hebrew ש, with a point over the right horn, as *charity*, &c.

The *c h* in moſt words derived from the Greek, and expreſſed in that language by χ, is generally ſounded like a *k*, as *echo*, *chorus*, &c. though ſometimes ſoftened, as *Cherſoneſus*.

P h is pronounced like an *f*; as *phraſes*, *Philiſtines*, *phlegm*, &c. moſt of theſe words being of Greek, or Oriental original, proper names, &c. and wrote in Greek with a φ, and with a פ in the Hebrew.

H in ancient authors we meet with inſtead of *f*; particularly in the Spaniſh, where moſt of the words borrowed from the Latin, beginning with an *f*, take the *h* inſtead of it, as *hablari* for *fabulari*, *haba* for *faba*, &c.

The ſharp accent of the Greeks, which is the ſame with our *h*, is frequently changed for an *s*, as ἅλς, ſal, ἑπτὰ, ſeptem, &c.

Anciently *h* was put for *ch*: thus, of *Chlodovicus* was formed *Hludovicus*, as we find in the coins of the ninth and tenth centuries; in proceſs of time the ſecond of the *h*'s being much weakened, the *h* was entirely dropped, and was written *Ludovicus*.

The *h* is ſometimes found prefixed to the *c*, as *Hcarolus*, *hcalendæ*, &c. for *Carolus* and *calendæ*.

H alſo, among the ancients, denotes 200, according to the Monkiſh verſe.

H quoque ducentos per ſe deſignat habendos.

When a daſh was added at top, $\overline{H}$ ſignified 200,000.

HABBAKUK, or the prophecy of Habbakuk, a canonical book of the Old Teſtament.

There is no mention made in Scripture, either of the time when this prophet lived, or of the parents from whom he was deſcended; but according to the authors of the lives of the prophets, he was of the tribe of Simeon; and a native of Bethzacar. As he foreſaw the taking of Jeruſalem by Nebuchadnezzar, he fled to Oſtracin in Arabia, where he lived for ſome time; but after the Chaldæans had made themſelves maſters of Jeruſalem, and were on their return home, he returned into Judæa, where he employed himſelf in agriculture; but as he was carrying the reapers their dinner, he is ſaid to have been tranſported by an angel to Babylon, with what he had provided for his people in the field; which he ſet before Daniel, who was ſhut up in the lions den, and was tranſported back again to Judæa, where he died, before the end of the captivity.

He is reported to have been the author of ſeveral prophecies which are not extant; but thoſe that are indiſputably his, are contained in three chapters. In theſe the prophet complains very pathetically of the diſorders which he obſerved in the kingdom of Judæa. God reveals to him, that he would ſhortly puniſh them in a very terrible manner by the arms of the Chaldæans. He foretels the conqueſts of Nebuchadnezzar, his metamorphoſis, and death. He predicts, that the vaſt deſigns of Jehoiakim would be fruſtrated. He ſpeaks againſt a prince (probably the king of Tyre) who built with blood and iniquity; and he accuſes another king (perhaps the king of Egypt) of having intoxicated his friend, in order to diſcover his nakedneſs. The third chapter is a ſong or prayer to God, whoſe majeſty he deſcribes with the utmoſt grandeur and ſublimity of expreſſion.

HABDALA, a ceremony of the Jews, obſerved on the ſabbath in the evening, when every one of the family is come home. At that time, they light a taper, or lamp, with two wicks at leaſt: the maſter of the family then takes a cup with ſome wine, mixed with fragrant ſpices; and after having repeated a paſſage or two of Scripture, as for example, "I will take the cup of ſalvation, &c." Pſal. cxvi. and, "The Jews had light and gladneſs, &c." Eſth. viii. he bleſſes the wine and ſpices. Afterwards he bleſſes the light of the fire, and then caſts his eyes on his hands and nails, as remembering that he is going to work. The whole is intended to ſignify that the ſabbath is over, and is from that moment divided from the day of labour which follows. For this reaſon the ceremony is called habdala, which ſignifies diſtinction.

HABEAS CORPORA, in law, a writ iſſued for bringing in a jury, or ſuch of them as refuſe to appear upon the venire facias, for the trial of a cauſe brought to iſſue.

It commands the ſheriff to have the jurors before the judges on ſuch a day, &c. and is of the ſame nature in the Common pleas, as the diſtringas juratores in the court of King's bench.

HABEAS CORPUS, in law, is a writ of two kinds, the one being the great writ of the Engliſh liberty, which lies where a perſon is indicted for any crime or treſpaſs before juſtices of the peace, or in a court of any franchiſe, and on being impriſoned, has offered ſufficient bail, which has been refuſed, though the caſe be bailable; in which caſe he may have this writ out of the King's bench, in order to remove himſelf thither, to anſwer the cauſe at the bar of that court.

The

The practice in this caſe, is firſt to procure a certiorari out of the court of chancery, directed to all the juſtices, for removing the indictment into the King's bench; and upon that to obtain this writ, directed to the ſheriff, for cauſing the body of the party to be brought at a certain day.

The other kind of habeas corpus is uſed for bringing the body of a perſon into court, who is committed to any goal or priſon, either in criminal or civil cauſes; which writ will remove the perſon and cauſe from one court and priſon to another.

No habeas corpus, or other writ, to remove a cauſe from out of an inferior court, can be allowed, if the ſame be not delivered to the judge of the court, before the jury who are to try the cauſe have appeared, and before any of them are ſworn, 43 Eliz. c. 5.

The habeas corpus act, 31 Car. II. c. 2. has ordained, that a perſon may have a habeas corpus from any judge, on complaint made and view of the warrant of commitment, (except ſuch perſon is committed for treaſon or felony expreſſed in the warrant, or ſome other offence that is not bailable) which habeas corpus muſt be made returnable immediately; and on producing a certificate of the cauſe of commitment, the priſoner is to be diſcharged on bail given to appear in the court of King's bench the next term, or next aſſizes, &c. Perſons committed for either treaſon or felony, expreſsly mentioned in the warrant, upon a motion made in open court, in the firſt week of the term, or day of ſeſſions, &c. after commitment, are to be brought to trial; and if they are not indicted the next term or ſeſſions after commitment, on a motion made the laſt day of that term, they ſhall be let out upon bail, except it appear on oath that the king's witneſſes are not ready; and in caſe they are not indicted or tried the ſecond term after commitment, they ſhall be diſcharged.

Judges denying a habeas corpus, ſhall forfeit 500 l. and if an officer refuſe to obey it, or to deliver a true copy of the commitment-warrant, he forfeits 100 l. for the firſt offence.

HABEAS CORPUS AD PROSEQUENDUM, a writ for the removal of a perſon in order to proſecution and trial in the proper county.

HABEAS CORPUS AD FACIENDUM ET RECIPIENDUM, a writ iſſued out of the court of Common-pleas, on behalf of defendants ſued in inferior courts, to remove their cauſe into the ſaid court.

HABEAS CORPUS AD RESPONDENDUM, a writ that lies where a perſon is impriſoned at another's ſuit in any priſon except that of the King's bench, and a third perſon would ſue the priſoner there; in which caſe this writ will remove ſuch perſon from the priſon where he is, into the King's bench, to anſwer the action in that court.

HABEAS CORPUS AD SATISFACIENDUM, a writ that lies againſt a perſon in the Fleet-priſon, &c. to charge him in execution. The delivery of this writ to the warden is ſufficient.

HABENDUM, in law, a term ſignifying to have and to hold.

A deed or conveyance has two principal parts; the premiſes and the habendum. The office of the firſt is, to expreſs the names of the grantor, the grantee, and the things granted: that of the habendum, to ſhew what eſtate or intereſt the grantee is to have in what is granted. According to lord Coke, the habendum is to limit the eſtate, ſo that the general implication, which by conſtruction of law paſſes in the premiſes, is by the habendum controlled and qualified. Thus in a leaſe to two perſons, to have and to hold to the one for life, alters the implication of the joint-tenancy in the freehold, which would paſs by the premiſes, were it not for the habendum.

HABERDASHER, in commerce, a ſeller of hats, or of ſmall wares.

HABERE FACIAS POSSESSIONEM, a writ that lies where one has recovered a term for years in an action of ejectment, in order to put him into poſſeſſion again.

HABERE FACIAS SEISINAM, a writ that lies where a perſon has recovered land in the king's court; directed to the ſheriff, commanding him to give ſeiſin of the land recovered.

HABERE FACIAS VISUM, is a writ that lies in divers caſes, as in dower, formedon, &c. where it is neceſſary to take a view of the lands or tenements in queſtion.

HABERGION, a ſmall coat of mail, or only ſleeves and gorget of mail, formed of little iron rings, or maſhes linked into each other. See GORGET.

HABILIMENTS *of War*, in our ancient ſtatutes, ſignify armour, harneſs, utenſils, or other proviſions for war, without which there is ſuppoſed no ability to maintain war.

HABIT, in philoſophy, an aptitude or diſpoſition either of mind or body, acquired by a frequent repetition of the ſame act.

This habit is by ſome of the ſchoolmen termed *habitus qualitativus*, a qualitative habit, and defined a quality adventitious to a thing, fitting and diſpoſing it either to act or ſuffer. Others again define habit an affection of the mind or body, perſiſting by long uſe and continuance. Hence habits may be diſtinguiſhed into thoſe of the mind and of the body: thus virtue is called an habit of the mind; ſtrength, an habit of the body. All natural habits, whether of body or mind, are no other than the body and mind themſelves conſidered as either acting or ſuffering; or they are modes of the body or mind wherein either perſeveres, till effaced by ſome contrary mode.

Cuſtom, ſays Mr. Locke, ſettles habits of thinking in the underſtanding, as well as of determining in the will, and of motions in the body, all which ſeem to be but trains of motion in the animal ſpirit, which once ſet a-going, continue on in the ſame ſteps they have been uſed to, which by often treading are worn into a ſmooth path, and the motion in it becomes eaſy as well as natural. See ASSOCIATION.

The archbiſhop of Cambray defines habits in general to be the certain impreſſions left in the mind, by means of which we find a greater eaſe, readineſs, and inclination to do any thing formerly done, by having the idea ready at hand to direct us how it was done before.

Thus, for example, we form the habit of ſobriety, by having always before us the inconveniencies of exceſs; the reflections of which being often repeated, render the exerciſe of that virtue continually more and more eaſy.

HABIT, in medicine, denotes the ſettled conſtitution of the body, or the habitude of any thing elſe, as the ſtructure or compoſition of a body, or the parts thereof.

HABIT is alſo uſed for a dreſs or garb, or the compoſition of garments, wherewith a perſon is covered; in which ſenſe we ſay, the habit of an eccleſiaſtic, of a religious, &c. a military habit, &c.

HABITUDE, among ſchoolmen, the reſpect or relation one thing bears to another. See the article RELATION.

HABITUDE is alſo uſed by philoſophers for what we commonly call habit, or a certain diſpoſition or habitude for the performing or ſuffering certain things, acquired by repeated acts of the ſame kind.

HADDOCK, the Engliſh name of a well known fiſh of the gadus-kind, with a bearded mouth, and three fins on the back: its body is whitiſh, the upper-jaw longeſt, and the tail a little forked.

HADE, among miners, ſignifies the ſteep deſcent of a ſhaft, or the like paſſage.

HÆMANTHUS, guinea-orchis, in botany, a genus of plants, the corolla of which conſiſts of a ſingle petal, erect, and divided into ſix erect linear ſegments; the tube is very ſhort, and angular: the fruit is a roundiſh berry, containing three cells; the ſeeds are ſingle and triquetrous; the involucrum has ſometimes ſix leaves.

The flowers ſtand at the top in a kind of little umbel, and are of a very beautifully ſtellated appearance.

HÆMATITES, in natural hiſtory, the blood-ſtone, a kind of mineral ſo called, on account of its reſembling curdled blood, or from its quality of ſtopping blood.

The word is Greek, αἱματίτης, and is derived from αἷμα, blood.

We are to diſtinguiſh carefully between two very different ſpecies of foſſils, called by the common Engliſh name blood-ſtone; the one is a ſemi-pellucid gem, of a green colour, ſpotted with red, and is properly called the heliotrope; the other is a mere ore of iron, and a very rich

rich one. The laſt of theſe is the ſubſtance to be deſcribed in this place.

It is a very ponderous foſſil, ſometimes of a paler, ſometimes of a deeper red, and not unfrequently bluiſh; it is ſometimes found in large irregular maſſes, but more frequently in flat pieces, with botryoide ſurfaces, or in the fragments of ſuch, which, as theſe maſſes naturally break at the jointings of the protuberances that form the ſurface, are uſually rounded at the end, and of a ſomewhat conic or pyramidal figure. Theſe maſſes are of a naturally ſmooth and gloſſy ſurface, and when broken, are found to be compoſed of a number of cruſts laid evenly under one another, and of a regularly ſtriated texture; as theſe cruſts are gradually ſmaller and ſmaller within the maſs, and the ſtriæ all converge toward a center at the baſe of each of them, it is not wonderful that they ſhould naturally ſeparate on breaking into pieces of a pyramidal or conic figure.

This kind of iron ore is very various in its degree of purity and hardneſs, as well as in its figure. The fineſt maſſes of all are thoſe whoſe ſurface terminates in bubbles or round protuberances; the coarſeſt pieces have nothing of this ſtructure, but are compoſed of large ſtriæ, and eaſily ſplit longitudinally according to them: theſe pieces are what the ancients called by a diſtinct name ſchiſtus. There is alſo yet a more impure kind, which is ſcarcely at all either botryoide on the ſurface, or ſtriated, but yet is truly of the ſame kind with the reſt, and is not inferior to them in virtue. The hæmatites of all theſe three kinds is found in England, and in great abundance alſo in the German mines, where maſſes of it are ſometimes met with quite black and of an elegant poliſh; and others covered with golden armature, as high and elegant as if of abſolute leaf gold, laid on in the common way of gilding. Blood-ſtone is to be choſen for medicinal uſe the higheſt coloured and moſt like cinnabar that can be had, and ſuch as is heavieſt and formed with the fineſt ſtriæ. It is accounted aſtringent and deſiccative. It is given in powder, from ten grains to twenty-five for a doſe in hæmorrhages, and is uſed in diſtemperatures of the eyes.

HÆMOPTOSIS, in medicine, a ſpitting of blood, occaſioned by the rupture or eroſion of ſome veſſel in the lungs, commonly attended with a cough and preſſure on the thorax.

The word is Greek, αιμοπτυσις, and is derived from αιμα, blood, and πτυω, to ſpit.

HÆMORRHAGE, *Hæmorrhagia*, in medicine, an eruption of the blood from any part of the body.

The word is Greek, αιμορραγια, and derived from αιμα, blood, and ρηγνυμι, to burſt.

The ſpontaneous evacuations of blood, produced naturally, are made from ſuch parts of the body as are of a lax and tender texture, have very minute and ſlender veſſels every where diſperſed, and not braced up throughout by firm membranes; ſuch as the interior part of the noſtrils, the bronchia, the gums, ſtomach, the ilium, the extremity of the rectum, the uterus and vagina.

The diſpoſition of hæmorrhages is for the moſt part hereditary, and conveyed from parents to their children; but it is moſt ſpeedily put in action, and exerts itſelf, by means of ſuch external cauſes, as render the circulation of the blood too briſk, or increaſe the inteſtine commotion of its parts. The moſt conſiderable of the cauſes are, all exerciſes of the body and mind more intenſe than uſual; aliments or medicines, taken internally, which are either too hot, acrid, or ſpirituous; as alſo the prepoſterous and unſeaſonable uſe of baths, ſudorifics, and purgatives.

As eruptions of blood, when ariſing from a repletion of the veſſels, and redundance of blood, are highly ſalutary, and beneficial to the conſtitution; ſo they are full of danger, when excited by a malignant acrid matter, as in malignant and exanthematous fevers: and when they riſe from an obſtruction, induration, or corruption of the viſcera, eſpecially of the liver, ſpleen, or lungs, they generally prove mortal, becauſe they readily terminate in a cachexy, a dropſy, the morbus niger of Hippocrates, or an hectic which proves fatal.

Since preternatural eruptions of blood generally draw their origins from ſpaſmodic conſtrictions of the veins, we hence plainly underſtand, why hypochondriac patients, in whom the ſtomach and whole nervous canal of the inteſtines are continually afflicted with flatulent diſtentions, and ſpaſmodic ſtrictures, by reaſon of the irregularity of the periſtaltic motion, are ſo highly ſubject to the hæmorrhoids; and why, if the blood is not diſcharged in that manner, their ſymptoms are greatly exaſperated.

With reſpect to the cure of hæmorrhages in general, I would have it obſerved, that their practice is highly prepoſterous, who, maintaining that a redundance of red blood, ſo called by way of eminence, is univerſally the material, as well as accidental cauſe of theſe diſorders, uſe frequent veneſections for their cure; though at the ſame time, at the beginning of the diſorder, for the ſake of prevention, eſpecially in ſanguineous habits, ſeaſonable veneſection is highly ſalutary and beneficial. But the juſteſt and moſt rational intentions of cure conſiſt in driving the impetus of the blood from the part affected by proper remedies; ſuch as bathing the feet, clyſters, frictions, and ligatures of the external parts, warm covering, fomentations, and baths. Then the ſpaſmodic ſtrictures of the nervous parts are to be relaxed. And laſtly, by gentle laxatives, as caſſia, &c. moderate diaphoretics, and abſtinence from light feeding, which generates blood, the redundance of the ſerous colluvies is to be removed, and its accumulation for the future prevented. *Frederic Hoffman.*

HÆMORRHAGE, or *Bleeding at the Noſe*, is owing to the more plentiful appulſe of blood to the noſtrils, by a ſtronger motion of the heart, whereby the ſmall arteries in the pituitary coat become turgid, and too much diſtended, till at length they gape, and the blood guſhes out. A bleeding at the noſe may be promoted when perſons of ſedentary lives, that indulge their appetites, and ſo become plethoric, put their blood into extraordinary agitation, by any of the cauſes already mentioned, or by volatile medicines, hot baths, or ſuddenly chilling their feet, &c. This hæmorrhage differs much as to the quantity: ſome loſe only a few drops, ſome ſeveral ounces, and ſome five or ſix pounds. No hæmorrhage is more apt to return; which it does to ſome in a few days, to others in a few hours. To the plethoric it is generally ſalutary; and there are many inſtances of a vertigo, ſcotomia, dull heavy pains of the head, a phrenzy, and even an epilepſy, being carried off by it. On the contrary, from its ſuppreſſion there have ariſen vertigoes, apoplexies, epilepſies, convulſions, noiſe in the ears, hardneſs of hearing, and even a gutta ſerena.

But enormous and long continued bleedings at the noſe, when they ariſe from ſpaſms of the internal parts, and are preceded with coldneſs of the extreme parts, and fainting fits, generally occaſion death: it is alſo dangerous in ſpotted and malignant fevers, and in chronical diſeaſes. If the bleeding is very inordinate, it will be proper to uſe cooling emulſions, gentle or ſtronger opiates, to moderate the ſpaſtic ſtrictures, as occaſion ſhall require. Camphor mixed with nitre and calx of antimony, will be highly neceſſary, if the matter of exanthemata or cutaneous eruptions is the cauſe of the hæmorrhage, as is often the caſe. A revulſion may be made from the head by bleeding in the lower parts; then by temperate pediluvia, and putting the hands into warm water. After a revulſion by bleeding, there is nothing equal to nitre, to appeaſe the orgaſm of the blood; next to theſe are vegetable acids, ſuch are the juice of Seville oranges, barberries, the water and juice of wood ſorrel; but more eſpecially the diluted ſpirit of vitriol, tincture of roſes, &c.

Externally refrigerants may be mixed with diſcutients, and applied to the forehead, noſe, and neck. In perſons of a bilious conſtitution, cold water alone drank freely, has a good effect.

HÆMORRHOIDAL. The veins and arteries of the rectum and fundament are ſo denominated, as being the ſeat of the hæmorrhoids.

HÆMORRHOIDS, *Hæmorrhoides*, the piles, or a diſcharge of blood from the hæmorrhoidal veins about the anus and rectum.

The word is Greek, αιμορροις, ſignifying the ſame thing, and derived from αιμα, blood, and ρεω, to flow.

Every liberal diſcharge of blood from the veins of the anus

anus is not to be accounted exceſſive and preternatural; but in order to form an eſtimate of this circumſtance, we are carefully to conſider the veſſels, the habit of body, the ſtrength, the age, and the conſtitution of the patient; for it frequently happens that the diſcharge of a certain quantity of blood proves ſalutary and beneficial to ſome; whereas the evacuation of an equal quantity proves hurtful and injurious to others; nor is every hæmorrhoidal diſcharge, though larger than uſual, and excited by the increaſed quantity and commotion of the blood, to be eſteemed a diſeaſe; but only ſuch a diſcharge as continues long, impairs the ſtrength, deſtroys the appetite, the due digeſtion of the aliments, nutrition, and the other functions of the body; and conſequently lays a foundation for violent chronical diſorders.

Every evacuation of blood from the inteſtinum rectum is ſupplied from the hæmorrhoidal veſſels; but the external hæmorrhoidal veſſels rarely flow profuſely, but readily degenerate into painful varices, which, when opened, diſcharge blood, though ſeldom in large quantities. But the internal hæmorrhoidal veſſels, which are ramifications of the ſplenic branch, and are diſtributed to the interior ſubſtance of the inteſtinum rectum, and the ſphincter ani, together with the ſmall arteries ariſing from the inferior meſeraic veſſels, not only diſcharge a large quantity, but, when ſuppreſſed, generate thoſe diſeaſes which ariſe from diſorders of the liver, ſpleen, pancreas, meſentery, and inteſtines.

It is uſually agreed that this ſalutary evacuation from the veins of the anus is owing to a difficult circulation of the blood through the hæmorrhoidal veins, in conſequence of their perpendicular ſituation, and its difficult return to the vena portæ and the liver; and that the diſcharge actually happens, when the extremities of the veſſels, in the inteſtinum rectum, are ſo diſtended by the blood accumulated in them, as at laſt to be ruptured.

The cure.—As this diſorder may proceed from various cauſes, ſo there muſt be various intentions of cure purſued, and different remedies made choice of.

It frequently happens, that when, in plethoric bodies, the hæmorrhoidal diſcharge, uſual at other times, is for ſome time ſtopped, it not only appears again ſuddenly, upon any violent commotion either of body or mind, the liberal uſe of ſpirituous liquors, too hot baths, or upon taking medicines increaſing the inteſtine motion of blood, but continues long, and is attended with a large and ſtrong pulſe. When this is the caſe, the firſt ſtep to be taken is to divert the impetus of the blood; for this purpoſe veneſection in the arm, or an immerſion of the arms in a tepid mixture of water and wine, are of ſingular ſervice: then we are to uſe ſuch things as check the exceſſive inteſtine motion of the ſulphureous parts of the blood, eſpecially things of a diluting and refrigerating nature, ſuch as drinking cold water, eſpecially of the chalybeate kind, tincture of roſes prepared with ſpirit of vitriol, a decoction of hartſhorn, mixed with citron or lemon juice. When, together with a loſs of ſtrength, and an injured ſtate of the nobler functions, a large hæmorrhoidal diſcharge continues for a long time, and the viſcera begin to be tainted, whilſt, at the ſame time, the blood is rather aqueous and ſerous than fibrous, and of a due conſiſtence; thoſe medicines are highly beneficial, which gradually and mildly carry off, by ſtool, the peccant bilious juices, and at the ſame time invite the humours from the inteſtinum rectum to the coats and glands of the other inteſtines. The moſt efficacious of theſe are preparations of rhubarb, with currants and tamarinds; or, if the body is bilious, with cream of tartar, exhibited in a potion rendered agreeable by an eleoſaccharum, prepared with the oil of citron.

In that more obſtinate and difficultly cured ſpecies of the diſorder, which ariſes from an obſtruction, an infarction, or increaſed bulk, of any of the viſcera; ſuch as the liver, ſpleen, and, in women, the uterus;—if there is ſtill any place for the means of relief, ſuch medicines are to be choſen as reſolve the obſtructions without throwing the humours into too violent a commotion.

Among the principal cauſes of a too copious hæmorrhoidal diſcharge, we may juſtly reckon a want of due tone in the inteſtinum rectum, together with its component membranes and veſſels: for this reaſon ſuch medicines are alſo to be uſed as reſtore the ſtrength of parts too much weakened and relaxed; as the extracts of caſcarilla and red ſaunders.

In order to obtain the deſigned effect, external applications of an aſtringent nature are alſo to be uſed; ſuch as the decoction of balauſtine flowers, red-roſes, myrrh, and the Peruvian bark.

In the cure of violent hæmorrhoidal diſcharges, veneſection is to be premiſed, and the primæ viæ cleanſed, either with recent caſſia, or the beſt rhubarb, exhibited in a decoction: then both internal and external medicines, of a corroborative and gently aſtringent nature, may be ſafely uſed.

When a ſudden ſtoppage of the hæmorrhoidal diſcharge is ſucceeded by an uneaſineſs of the præcordia, inflations, reſtleſſneſs, and difficulty of breathing, it is to be recalled by mild laxatives, emollient clyſters, and ſuppoſitories.

In no diſeaſe is an accurate and cautious regimen more neceſſary than in this, ſince, in conſequence of a neglect in this particular, the moſt efficacious remedies will not produce their deſired effect.

When the diſorder is once removed, due pains are to be taken, in order to prevent its return. This intention is moſt commodiouſly and effectually anſwered by veneſection three or four times inſtituted every year; by cleanſing the primæ viæ once a month; and by the prudent uſe of mineral waters, or only of chalybeated milk; and laſtly, all ſuch aliments and laxatives as excite pain, are carefully to be abſtained from.

HAGAI, a canonical book of the Old Teſtament, ſo called from the prophet of that name, who, in all probability, was born at Babylon, from whence he returned with Zerubbabel.

This prophet, by the command of God, exhorted the Jews, after their return from the captivity, to finiſh the rebuilding of the temple, which they had intermitted for fourteen years. His remonſtrances had the deſired effect; and to encourage them to proceed in the work, he aſſured them from God, that the glory of this latter houſe ſhould be greater than the glory of the former: which was accordingly fulfilled, when Chriſt honoured it with his preſence; for, with reſpect to the building, this latter temple was nothing in compariſon of the former.

HAGGARD FALCON, the greeniſh legged falcon, with a livid back. It is a large ſpecies, equal to a full grown hen in ſize. See the article FALCON.

HAGIOGRAPHA, or holy writings, a name given to a particular diviſion of the Old Teſtament, as containing hymns to God, and moral precepts for the conduct of life. The books diſtinguiſhed by this term were the Pſalms, Proverbs, Eccleſiaſtes, and the Song of Solomon.

HAGIOSIDERON, in the Greek church, a name given to an inſtrument made of iron, uſed by the Greeks, under the dominion of the Turks, to ſupply the place of bells, the uſe of which is prohibited. It is a plate of iron about three inches broad, and ſixteen long, faſtened by the middle to a chain or cord, and hung at the church door; on this they ſtrike with an iron-hammer, with a kind of meaſure or cadence that is not diſagreeable.

HAIL, *Grando*, in phyſiology, a watery concretion in the form of pellucid white globules, that fall from the air.

It is thought to be drops of rain frozen in their paſſage through the middle region: or according to the Carteſians, the fragments of a frozen cloud, half melted, precipitated and congealed again.

Hail is of various figures, according to the degrees of heat or cold of the air through which the liquified clouds paſs. It frequently attends thunder and lightning; the nitre that contributes to the one, having alſo a large ſhare in the production of the other.

HAIR, *Crinis* or *Capillus*, a ſort of tegument for the greateſt part of animals. It is found on all parts of the human body, except the ſoles of the feet and palms of the hand.

Hair properly lives and receives nutriment to diſtend it like the other parts of the body; however, this growth

is of a different kind from that of the reſt of the body, and is not immediately derived therefrom, nor reciprocated therewith. It grows like plants out of the earth, or as ſome plants ſhoot from the parts of others; from which, though they draw the nutriment, each has its diſtinct life and œconomy.

Hairs are obſerved by the microſcope to be hollow and furniſhed with a multitude of veſſels; and, however they appear ſmooth to the naked eye, the microſcope ſhews them knotted like ſome ſorts of graſs, and to ſend out branches from their joints.

The branching of the hair is pretty viſible at the extremities by the help of a microſcope; for it is very apt to ſplit, eſpecially if worn too long, or kept too dry; and by the ſame means it appears like a bruſh.

Each hair has a little bulbous or oval root in the ſkin, which is ſometimes plucked away with it. The hair is commonly reputed an excrement, and whatever the nature of its nouriſhment be, it ſeems to be more ſimple than the other humours of the body. For long after death, when all the other parts and humours are corrupted, the hair will vegetate.

The ſize of hair depends on the magnitude of the pores they iſſue from: if thoſe be ſmall, theſe are fine; if the pores are ſtraight, the hairs are ſo too; if thoſe be oblique or ſinous, the hair is curled. Their length depends on the quantity of the proper humour to feed them; and their colour on the quality of that humour: whence at different periods of life the colour uſually differs.

Hair, ſince perukes have been in uſe, makes a conſiderable article in commerce. That of the growth of the northern countries is much perferred to that of the more ſouthern ones.

The merit of good hair conſiſts in its being well fed, and neither too coarſe nor too ſlender; the bigneſs rendering it leſs ſuſceptible of an artificial curl, and diſpoſing it rather to frizzle; and the ſmallneſs making its curl of too ſhort duration. It ſhould be about twenty-five inches long; and as it falls ſhort of this, it decreaſes in value.

Hair is ſold from five ſhillings to five pounds an ounce, according to its quality. The grey is the moſt valuable, next to that the white, &c.

The ſcarcity of grey and white hair put the dealers in that commodity upon artificial methods of rendering hair of theſe colours. They ſpread the hair to bleach on the graſs, after waſhing it firſt in a lixivious water: they alſo dye hair with bizmuth; both which artifices are detected by boiling and drying it.

HAIR'S-BREADTH, a meaſure of length, being the forty-eighth part of an inch.

HAKE, in ichthyology, the Engliſh name of the gadus, with two fins on the back, and the under jaw longeſt. It grows to two feet or more in length, but is the ſlendereſt of all the gadi.

HALBARD, or HALBERT, in the art of war, a well known weapon, carried by the ſerjeants of foot and dragoons.

It is a ſort of ſpear, the ſhaft of which is about five feet long, and made of aſh, or other wood. Its head is armed with a ſteel point, edged on both ſides, not unlike the point of a two-edged ſword. But beſides this ſharp point, which is in a line with the ſhaft, there is a croſs piece of ſteel, flat and pointed at both ends; but generally with a cutting edge at one extremity, and a bent ſharp point at the other; ſo that it ſerves equally to cut down, or puſh withal. It is alſo uſeful in determining the ground betwixt the ranks, and in adjuſting the files of a battalion.

HALBERT, among farriers, is a ſmall piece of iron an inch broad, and three or four inches long, ſoldered to the toe of a horſe's ſhoe, to hinder a lame horſe from treading on his toe.

Theſe halbert-ſhoes neceſſarily conſtrain a lame horſe, when he goes at a moderate pace, to tread or reſt on his heel, which lengthens and draws out the back ſinew, that was before in ſome meaſure ſhrunk.

HALCYON, in ornithology, a name given by the ancients to the iſpida, or king-fiſher. See the article KING-FISHER.

HALCYON DAYS, *Dies halcyonii*, in antiquity, a name given to ſeven days before and as many after the winter ſolſtice; by reaſon the halcyon, invited by the calmneſs of the weather, laid its eggs in neſts built on the rocks, cloſe by the brink of the ſea, at this ſeaſon.

HALF-BLOOD, in law, is where a man marries a ſecond wife, the firſt being dead, and by the firſt venter has a ſon, and by his ſecond venter has likewiſe a ſon, the two brothers in this caſe are but of half blood; they being iſſue by different venters; and on that account, lands in fee cannot deſcend from one to the other; except in caſe of crown-lands, dignities, or eſtates tail. But half blood is no impediment to an adminiſtration, which may be granted to that as well as to the whole blood, of the effects of an inteſtate; and the half-blood ſhall come in for a ſhare of his perſonal eſtate, equally with the whole blood, as the brothers by different venters are next of kin in equal degree. 22 Car. II. c. 10.

HALF-MOON, *Demi-Lune*, in fortification, a work which is commonly made before the curtain or flanked angle of the baſtion: the former generally conſiſts of two little flanks and two faces, which terminate in a ſaliant angle towards the fields; the gorge of the demi lune is terminated by two lines continued from the counterſcarpe of the foſſé, that form an entering angle towards the place, about the middle of the curtain. The demi-lune on the flanked angle of the baſtion differs only from the former, in that it is formed by a circular line; and hence it takes its name demi-lune.

The moderns make uſe of good counterguards to cover the baſtions inſtead of the demi-lunes.

They call a demi-lune what was formerly denominated a ravelin, only that this laſt work has no flanks, and has two faces terminating in a ſaliant angle towards the field.

A demi-lune is ſaid to be crowned when it is covered by a crowned work: it is in like manner ſaid to be a tenaille, when on the right and left it has two works conſtructed in a right angle on the flanked angle of the demi-lune, by the prolongation of its two faces, between twenty-eight and thirty fathoms; each of theſe works having two faces terminating in a ſaliant angle towards the field, and a ditch of nine fathoms that ſeparates them from the demi-lune and counterſcarpe

Laſtly, a demi-lune is called a horned-work, when it is counter-guarded by two works that advance in form of a horn towards the country, having before it a little demi-lune, or lunette, that covers the intermediate ſpace betwixt them, and conſequently the flanked angle of the demi-lune.

HALF-SEAL, that uſed in the the court of chancery for ſealing commiſſions to delegates, upon any appeal, in eccleſiaſtical or marine cauſes.

HALF-TANGENTS. See the articles TANGENT and SCALE.

HALIARDS, in the marine language, the ropes or tackles by which the ſails are hoiſted up along the maſts or ſtays of the ſhip.

HALL, in architecture, a large room at the entrance of a fine houſe and palace. Vitruvius mentions three kinds of halls; the Tetraſtyle, with four columns, ſupporting the platfond, or ceiling; the Corinthian, with columns all round let into the wall, and vaulted over; and the Egyptian, which had a periſtyle of inſolated Corinthian columns, bearing a ſecond order with a ceiling.

The hall is properly the fineſt as well as firſt member of an apartment; and in the houſes of miniſters of ſtate, magiſtrates, &c. is the place where they diſpatch buſineſs, and give audience. In very magnificent buildings, where the hall is larger and loftier than ordinary, and placed in the middle of the houſe, it is called a ſaloon. See APARTMENT.

HALL, in old writers, is alſo uſed for a manſion-houſe; and to this day, in many parts of the kingdom, gentlemen's ſeats are called halls.

HALLAGE, a fee or toll paid for cloth brought to be ſold in Blackwell hall, London.

HALLELUJA, a word ſignifying, praiſe the Lord.

The ſinging halleluja was a ſort of invitatory, or call to each other, to praiſe the Lord.

St. Auſtin ſays, that in ſome churches, it was ſung only

only on Eaſter-day, and the fifty days of Pentecoſt; but that even in thoſe churches where it was moſt in uſe, it was never uſed in the time of Lent. The fourth council of Toledo forbids the ſinging it not only during Lent, but on all other days of faſting; and by the ſame council it is appointed to be ſung after the reading of the goſpel. It was alſo ſung at funerals, as St. Jerom informs us in his epitaph of Fabiola, where he ſpeaks of the whole multitude ſinging pſalms together, and making the golden roof of the church ſhake with echoing hallelujas.

HALO, in phyſiology, a meteor, in form of a luminous ring, or circle, of various colours, appearing round the bodies of the ſun, moon, or ſtars.

The word is formed of the Greek αλως, or αλων, area.

That around the moon is the moſt uſual, and is called *corona*, crown.

Naturaliſts conceive the halo to ariſe from a refraction of the rays of light in their paſſing through the fine rare veſiculæ of a thin nubecula, or vapour, towards the top of our atmoſphere; which account they confirm hence, that a quantity of water being thrown up againſt the ſun, as it breaks and diſperſes into drops, it forms a kind of halo, or iris, exhibiting the colours of the natural rainbow.

M. Huygens ſuppoſes halos, or circles round the ſun, to be formed by ſmall round grains of a kind of hail, made up of two different parts, one of which is opake, and incloſed in the other, which is tranſparent; which is the general ſtructure obſerved in hail.

After the ſame manner he accounts for the parhelia; only that he imagines the icy grains of an oblong figure, and rounding at the ends, like cylinders with round convex tops. Where ſome of theſe cylinders are in an erect poſition, the circle they form will be white, by reaſon of the reflexion of the rays of the ſun on the ſurface of theſe cylinders. He proceeds to account for the coloured halo's and parhelia, from the ſame hypotheſis; and produces an experiment of a glaſs cylinder, a foot long, having within an opake kernel (which was a cylinder of wood), and the ambient ſpace filled with water: this cylinder, being expoſed to the ſun, and the eye diſpoſed in a proper place, the ſeveral ſucceſſive reflexions and refractions neceſſary to produce ſuch an effect did plainly appear.

The light which comes through drops of rain by two refractions, without any reflexion, Sir Iſaac Newton obſerves, ought to appear ſtrongeſt, at the diſtance of about twenty-ſix degrees from the ſun, and to decay gradually both ways, as the diſtance from him increaſes and decreaſes: and the ſame is to be underſtood of light, tranſmitted through ſpherical hailſtones.—Add, that if the hail be a little flatted, as is often the caſe, the light tranſmitted may grow ſo ſtrong at a little leſs diſtance than that of twenty-ſix degrees, as to form a halo about the ſun or moon; which halo, as often as the hailſtones are duly figured, may be coloured; and then it muſt be made red within by the leaſt refrangible rays, and blue without by the moſt refrangible ones; eſpecially if the hailſtones have opake globules of ſnow in their center, to intercept the light within the halo, as Huygens has obſerved, and make the inſide thereof more diſtinctly defined than it would otherwiſe be.

Such hailſtones, though ſpherical, by terminating the light by the ſnow, may make a halo red within, and colourleſs without, and darker in the red than without, as uſed to be: for of thoſe rays which paſs cloſe by the ſnow, the rubiform will be leaſt refracted, and ſo will come to the eye in the directeſt lines.

HALTER-CAST, among farriers, an excoriation of the paſtern occaſioned by a horſe's endeavouring to ſcrub the itching part of his body near the head and neck, when one of his hinder feet entangling in the halter, he ſometimes receives very dangerous hurts in the hollow of the paſtern by his ſtruggling to diſengage himſelf.

For the cure of this, take linſeed oil and brandy, of each an equal quantity; ſhake them together in a bottle till they are well mixed, and anoint the place morning and evening, having cut firſt away the hair; but care muſt be taken to keep the foot very clean.

HALTING, among farriers, a limping or going lame, or irregularity in the motion of a horſe, ariſing from a lameneſs in the ſhoulder, leg, or foot, which makes him ſpare the part, or uſe it timorouſly.

HALYMOTE, in old law books, ſignifies a holy or eccleſiaſtical court. See the article COURT.

HAM, in anatomy, the part behind the knee. See KNEE and LEG.

HAM, in old law writers, a Saxon word uſed for a home or dwelling place, for a borough and a village, and alſo for a little narrow ſlip of meadow.

HAM, in cookery, the leg and thigh of a hog ſeaſoned and dried.

HAMADRYADS, *Hamadryades*, fabulous deities revered among the ancient heathens, who were ſuppoſed to preſide over woods and foreſts, and to be incloſed under the bark of oaks, &c. and to live and die with the trees they belong to.

The word is Greek, αμαδρυαδες, and compounded of αμα, together, and δρυς, an oak.

HAMBLING, or HAMELLING, in the foreſt law, is the hamſtringing of dogs, or cutting the great tendon called the hamſtring.

HAMLE, the name of the eleventh month of the Ethiopian year, beginning on the twenty-fifth of June, old ſtyle.

HAMLET, HAMEL, or HAMPSEL, is a ſmall village, or part of a pariſh.

HAMMER, a well known tool uſed by mechanics, conſiſting of an iron head, fixed croſſwiſe upon a handle of wood.

HAMMOCK, among ſailors, a piece of canvas about ſix feet long, and three feet wide, drawn together at the two ends, and hung horizontally under the deck for the ſailors to ſleep in. In time of battle they are ſtrongly faſtened and laid above the rails on the quarter-deck and fore-caſtle, to barricade and prevent the execution of ſmall ſhot.

HAMSOKEN, in old law books, ſignifies the liberty or privilege a man enjoys in his own houſe. It is alſo ſaid to ſignify a franchiſe granted to lords of manors, by which they hold pleas, and take cognizance of the breach of that immunity.

HANAPER, or HANPER, in chancery. See HANPER.

HAND, *Manus*, in anatomy; the laſt part of the upper extremity is divided into the carpus, metacarpus, and fingers, or into the inſide, hollow, or palm, and into the outſide or back of the hand.

The carpus or wriſt, conſiſts of eight ſmall, unequal, and irregular bones; and, taken all together, repreſent a ſort of grotto of an irregular quadrangular figure, and connected principally with the baſis of the radius.

The bones of the carpus are divided into two rows, and each row conſiſts of four bones; and, to diſtinguiſh theſe eight bones from each other, they are called firſt, ſecond, third, and fourth bones of the firſt or ſecond row, beginning to count from the radius or thumb.

The firſt bone of the firſt row Lyſerus calls os ſcaphoides or naviculare, from its reſemblance to a ſmall boat; the ſecond os lunare, becauſe one of its ſides is in form of a creſcent; the third os cuneiforme; the fourth os piſiforme, or biculare, and lenticulare, from its figure and ſize; the firſt of the ſecond row, os trapezium; the ſecond os trapezoides or pyramidale; the third os magnum; and the fourth os unciforme.

The bones of the carpus are articulated with each other by arthrodia, but the firſt row forms a ſort of ginglymus with the ſecond. The inner ſubſtance of all theſe bones is ſpongy, and their ſurfaces are not very compact.

The metacarpus conſiſts of four bones, one ſide of which forms the palm of the hand, the other the back of the hand. Theſe bones are long, thicker at the extremities than at the middle, and of an unequal length and bigneſs. The firſt is the largeſt, the reſt are leſſened by degrees in all their dimenſions. The fingers make the third part of the hand, and terminate the whole upper extremity; they are five in number in each hand, called the thumb, the fore-finger, the middle-finger, the ring-finger, and the little-finger. The thumb is the biggeſt of all the fingers; next to that, the third, called the long-finger; the ſecond and fourth are ſhorter than the third; the

the fourth being a very little longer than the ſecond; the fifth is the ſmalleſt of all.

Each thumb and finger conſiſt of three pieces, called phalanges; the firſt of which is longer and thicker than the ſecond; and the ſecond than the third.

The carpus is the baſis and center of all the motions of the hand, except that of rotation: by means thereof we can bend the hand in all directions, but with more eaſe towards the ſides and edges, than any other way.

The radius is in a manner the handle of the hand; and it is chiefly by means thereof that we can move the hand reciprocally as on the axis, turning either edge of it towards the body. This motion is termed pronation, and when the cubital or ſmall edge is towards the body, it is termed ſupination. In the natural and moſt ordinary ſituation of the hand, the palm is turned towards the body, and not the edges.

The ulna ſupports the handle of the hand, without being itſelf articulated with the hand.

All the bones of the carpus, metacarpus, and fingers, are cruſted over with cartilages.

The ligaments of the carpus are very numerous: ſome of them tie each bone to one or two neighbouring bones in the ſame rank; and theſe are compoſed of a great number of very ſhort filaments; ſome of them tie the bones of one row to thoſe of the other, which are likewiſe made of many filaments, but not ſo ſhort as the former. Laſtly, there are other ligaments of the carpus, by which the three firſt bones of the firſt row are connected to the bones of the fore-arm: and to theſe may be added the ligaments, by which the bones of the ſecond row are joined to thoſe of the metacarpus, and firſt phalanx of the thumb.

There is likewiſe a conſiderable ligament called the inner tranſverſe or annular ligament of the carpus.

The bones of the metacarpus, beſides the ſhort ligaments by which they are tied to the ſecond row of the bones of the carpus, have ſeveral ligaments by which both their baſes and heads are connected together. The baſes of the third and fourth bones are not ſo cloſely tied as the reſt; and therefore they have a very ſenſible motion, which, however, is greater in the fourth than in the third.

The heads of theſe bones are firmly tied to each other by a ſtrong tranſverſe ligament, ſituated in the palm of the hand. The firſt phalanx of the thumb is fixed to the os trapezium by ſhort ligaments, which paſs obliquely over the articulation. The firſt phalanx of the other four fingers are joined to the heads of the metacarpal bones by ligaments like the former, which are ſtrengthened by adhering to the tranſverſe ligament. The ſecond phalanx of the thumb is joined to the firſt by ligaments of the ſame kind.

The third phalanx of the thumb is joined to the ſecond, the ſecond phalanges of the other finger to the firſt, and the third to the ſecond, by lateral ligaments that ſpread from a point fixed in the lateral tubercles of the heads of the phalanges, and are interſected by their other extremity, like radii, in the baſes of the neighbouring phalanges.

The two firſt phalanges of each finger have a very ſtrong ligamentary vagina inſerted in the rough lines or ridges on their flat ſides.

All theſe bones would be uſeleſs, if they were not furniſhed with muſcles, in order to move them in ſuch directions and for ſuch purpoſes as the exigencies of mankind may require. The ancient anatomiſts mention but one muſcle belonging to the palm, which is the palmaris longus: but Fallopius deſcribes the palmaris brevis, communicated to him by Johannes Baptiſta Cunanus, an eminent anatomiſt, his cotemporary, and was firſt publiſhed by Valverda, in his anatomy written in Spaniſh.

The muſcles of the four fingers are divided into common and proper: the common are ſuch as ariſe from the external or internal protuberances of the os humeri, and ſubdividing themſelves, are inſerted into moſt, if not all the fingers; theſe are the perforatus, perforans, lumbricales, and extenſor communis digitorum.

The proper muſcles have their beginnings diſtinct, and are inſerted, without any ſubdiviſion, into each reſpective finger, as the interoſſei, extenſor indicis, abductor indicis, extenſor minimi digiti, and abductor minimi digiti.

Authors diſagree concerning the number, riſe, and inſertion of the muſcles of the thumb, which may partly proceed from that great variety obſervable in divers ſubjects: theſe are the flexor tertii internodii, or longiſſimus pollicis, abductor pollicis, flexor primi et ſecundi oſſis pollicis, abductor pollicis; extenſor primi internodii pollicis, extenſor ſecundi internodii oſſis pollicis, and extenſor tertii internodii oſſis pollicis.

The muſcles of the carpus are generally well deſcribed by moſt authors, and receive their names from their ſituation and uſe, as flexor carpi radialis, flexor carpi ulnaris, extenſor carpi radialis, and extenſor carpi ulnaris. All theſe muſcles are deſcribed under their proper names.

The cubital artery, in its courſe between the heads of the ulna and radius, ſends off two principal branches, the one internal, the other external, called the interoſſeous arteries of the fore-arm; the external interoſſeous artery is diſtributed to the ulnaris externus, extenſor digitorum communis, to the extenſores pollicis, indicis, and minimi digiti, communicating with ſome branches of the internal interoſſeous artery: a little farther it unites with a branch of the internal interoſſeous artery, being diſtributed with it on the convex ſide of the carpus and back of the hand, communicating with the arteria radialis and a branch of the cubitalis.

By theſe communications this artery forms a ſort of irregular arch, whence branches are detached to the external interoſſeous muſcles, and the external lateral parts of the fingers.

The internal interoſſeous artery goes to the convex ſide of the carpus and back of the hand, where it communicates with the external interoſſeous artery, the radialis and internal branches of the cubitalis.

From the origin of the two interoſſeæ, the cubitalis runs down between the perforatus, perforans, and ulnaris internus, along the ulna, ſending branches to the neighbouring parts: afterwards it paſſes over the internal tranſverſe ligament of the carpus, by the ſide of the os piſiforme; and having furniſhed the ſkin, palmaris brevis, and metacarpus, it ſlips under the aponeuroſis palmaris, giving off one branch to the hypothenar minimi digiti, and another which runs towards the thumb. It likewiſe ſends off a branch, which, running between the third and fourth bones of the metacarpus, reaches to the back of the hand, where it communicates with the external interoſſeous artery. Afterwards, having ſupplied the interoſſeous muſcles, it communicates with the radialis, and they both form an arterial arch in the hollow of the hand. This arch from its convex part ſends off three or four branches; the firſt goes to the inner and back part of the little finger; the other three run in the interſtices of the four metacarpal bones, near the heads of which each is divided into two branches, which paſs along the two internal lateral parts of each finger; and at the ends of the fingers theſe digital arteries unite. Sometimes the arch terminates by a particular branch in the middle fingers, and then it communicates with the radial artery. This arch likewiſe ſends from its concave ſide, towards the ſecond phalanx of the thumb, a branch for the lateral internal part thereof, and then ends near the head of the firſt metacarpal bone, by a communication with the radialis, having firſt given a branch to the foreſide of the index, and another to the ſide of the thumb next the former. It likewiſe ſends ſmall twigs to the interoſſeous muſcles, the lumbricales, palmaris, and other neighbouring parts; and, laſtly, to the integuments.

The radial artery, having reached the extremity of the radius, runs nearer the ſkin, eſpecially towards the anterior edge of the bone, being the pulſe we feel there. It gives off a branch there to the thenar; and alſo, communicating with the arch of the cubital artery in the palm, and ſending off ſome cutaneous branches, it detaches one along the internal lateral part of the thumb, and turns toward the hollow of the hand: at this turning it ſends off a branch to the external lateral part of the thumb. It likewiſe ſends branches which run more or leſs tranſverſely, and communicates with an oppoſite branch of the cubitalis, furniſhing the external interoſſeous muſcles and integuments of the back of the hand and convex ſ

of the carpus. Laſtly, the radial artery terminates near the baſis of the firſt metacarpal bone. When the arch of the cubitalis ends at the middle finger, the radialis runs along the inner or concave part of the firſt metacarpal bone, at the head of which it terminates by two branches; one runs along the inner and anterior lateral part of the index, the other paſſes between the flexor tendons of this finger and the metacarpal bone; and, having communicated with the cubital branch of the middle finger, advances on the poſterior lateral part of the index, all the way to the end of that finger, where it unites again with the firſt branch.

The vena cephalica, having reached the extremity of the radius, is diſtributed by numerous areolæ, almoſt in the ſame courſe with the radial artery. A particular branch goes out from it which runs more or leſs ſuperficially between the thumb and metacarpus, by the name of cephalica pollicis. The areolæ furniſh the interoſſeous muſcles and integuments, and communicate with a ſmall branch from the baſilica, called by the ancients ſalvatella; which goes to that ſide of the little finger next the ring-finger. In the other fingers this vein follows nearly the ſame courſe with the artery.

The cubital nerve, at the lower extremity of the ulna, is divided into two branches, one large, the other ſmall: the large branch paſſes under the great tranſverſe ligament of the carpus, to that part of the palm which anſwers to the laſt two fingers, where it gives ſome filaments to the integuments and ligaments of the carpus. Afterwards it divides into three branches, one of which forms a kind of arch, being diſtributed to the neighbouring ſmall muſcles of the thumb and to the interoſſei; the ſecond is bifurcated, and goes to the correſponding lateral concave parts of the ring and little fingers; and the third goes to the oppoſite lateral part of the little finger, and to the neighbouring muſcles.

The ſmall branch goes to that part of the back of the hand, which anſwers to the laſt two fingers: it is diſtributed to the lateral convex parts of theſe two fingers, in the ſame manner as the other branch to the lateral concave parts. It likewiſe ſupplies the muſculus hypothenar, metacarpus, and the integuments, and communicates with a branch of the nervus medianus.

After that, the internal cutaneous nerve dividing into two branches, the one is ramified on the ſkin that covers the wriſt and beginning of the palm; the other, running a little more backward along the integuments which cover the muſculus ulnaris internus and ulna, is ramified all the way to the little finger.

The radial nerve is diſtributed to all the integuments which cover the radius, and to thoſe which cover the exterior parts of the carpus, and back of the hand, all the way to the thumb. Having got to the lower part of the radius, it is diſtributed into three branches to the convex lateral parts of three fingers and a half. One branch goes to the internal lateral part of the thumb and to the integuments. The ſecond is divided into two for the external lateral part of the thumb, and anterior lateral part of the index, giving filaments in its paſſage to the integuments of the metacarpal bones: the third is divided into ſeveral ramifications which go to the poſterior lateral parts of the index, to both ſides of the middle finger, and to the anterior lateral part of the ring-finger. Through all this courſe this branch ſupplies the integuments and interoſſeous muſcles. The trunk or largeſt branch is loſt in the extenſor digitorum communis, and in the muſcles of the carpus and thumb, having firſt communicated with a branch of the muſculo-cutaneous nerve. *Winſlow.*

HAND, in the manege, a meaſure of four inches, or of a clinched fiſt, by which the height of a horſe is computed. Thus a horſe of war ſhould be ſixteen hands high.

Hand is alſo uſed for the diviſion of a horſe into the fore and hind parts. The parts of the fore-hand are the head, neck, and fore-quarters; and thoſe of the hind-hand include all the other parts of his body.

Hand is alſo uſed for the horſeman's hand. Thus ſpear-hand, or ſword-hand, is the horſeman's right hand; and bridle-hand is his left hand.

HAND-BREADTH, a meaſure of three inches.

HAND-HOOK, an inſtrument uſed by ſmiths to twiſt ſquare iron.

HAND-SCREW, an inſtrument more uſually called a jack. See the article JACK.

Harmonical HAND, in muſic, a name given to the ancient diagram. See DIAGRAM.

Impoſition of HANDS, the ceremony of laying the hands on the head of a perſon to be ordained. See ORDINATION.

HANDS, in heraldry, are borne in coat armour dexter and ſiniſter, that is, right and left, expanded or open. Theſe are the moſt neceſſary parts of the human body, as they ſerve to expreſs all ſorts of actions, and even our very thoughts and deſigns; thus joining of hands is an univerſal token of friendſhip, and clapping of hands a general mark of applauſe.

HANDING *the Sails*, in the ſea-language, the ſame as furling, which ſee.

HANDSPIKE, a ſort of bar uſed to heave the windlaſs round at the time of weighing the anchor. It is alſo uſed as a lever on many occaſions. See the article WINDLASS.

HANKS, in the marine, certain wooden rings fixed upon the ſtays of a ſhip, to which the ſtay-ſails are faſtened in different places, as a curtain is faſtened to the rings which run upon its rod: by theſe the ſails are eaſily extended upon the ſtays to their utmoſt ſtretch.

HANPER, HANAPER, or HAMPER, an office of the chancery, anſwering to the fiſcus of the Romans.

HANSE, or HANS, a company of merchants united for the promotion and advantage of trade.

HANSE-TOWNS, port-towns of Germany, of which Lubec and Hamburg were the chief. They were formerly all of them imperial cities, confederated for their mutual defence, and the protection of their trade.

HAPPINESS, among philoſophers, conſiſts in the enjoyment not only of the goods of the body, as health, ſtrength, neatneſs, decency, &c. but alſo of the more refined goods of the mind, as knowledge, memory, taſte, and eſpecially the moral virtues, magnanimity, fortitude, benevolence, &c.

HAQUEBUT, HAGBUT, HARQUEBUSS, or ARQUEBUSE, a kind of fire-arm.

The word is French, *arquebuſe*, and derived from the Italian *arco*, a bow, and *buſio*, a hole; on account of the touch-hole at which the priming is put, and as it ſucceeded to the ancient bow.

HARANGUE, a ſpeech made by an orator in public.

It is frequently uſed for a pompous and prolix declamation.

HARBINGER, an officer of the king's houſhold, having four yeomen under him, who ride a day's journey before the court, when it travels, to provide lodgings, &c.

HARBOUR, a place where ſhips may ride ſafe at anchor, chiefly uſed in ſpeaking of thoſe ſecured by a boom and chain, and furniſhed with a mole. See BOOM, CHAIN, and MOLE.

HARDENING, the act of communicating a greater degree of hardneſs to a body than it had before.

Steel and iron are hardened and tempered divers ways, as by the hammer; quenching it, when hot, in cold water; caſe-hardening, &c.

To harden and temper Engliſh, Flemiſh, and Swediſh ſteel, they heat it pretty high, then ſuddenly quench it in water to make it very hard: Spaniſh and Venice ſteel need only a blood-red heat, and then be quenched. Sometimes they rub ground indigo and ſallad oil upon it with a woollen rag, while it is heating, and let it cool of itſelf.

If the ſteel be too brittle for an edge, ſpring, &c. bring it down thus: take a piece of grind-ſtone or whet ſtone, and rub hard the work on it to take the black ſcurf off, and brighten it; then let it heat in the fire, and it will gradually change colour, coming firſt to a light goldiſh colour, then to a darker goldiſh colour, and at laſt to a blue colour: chooſe which of theſe the work requires, and quench it ſuddenly in water.

Caſe-HARDENING is a leſſer degree of ſteel-making, and performed by baking razors, files, knife-blades, &c.

in a kind of oven, and laying over them a ſtrata of powdered charcoal, hoofs, horns, &c. ſo as to exclude the air; and thus by baking to give a coat of ſteel to theſe inſtruments ſome depth below their ſurface.

Others cover the iron or ſteel all over with a compoſition of an equal quantity of powdered horn, bay-ſalt, and ſtale urine, or white wine vinegar, well mixed together, and then wrap it up in loam or plate iron, and bring the whole to the fire to a blood-red heat, and no higher; and, laſtly, take it out and quench it.

HARDENING *of Timber*. The Venetians are famous for the ſoundneſs of their ſhips, which do not rot as thoſe of other nations, but will endure many times the common period. Tachenius tells us, that the whole ſecret of this conſiſts in the manner of their hardening of their timber intended for this ſervice; and that this is done by ſinking it in the water while green, and leaving it there many years. This prevents the alkali, or that ſalt which furniſhes the alkali in burning, from exhaling afterwards; and by this means the timber becomes almoſt as incorruptible as ſtone. It is evident that the exhaling of this ſalt, and the rotting of wood, have ſome very great connection with one another, ſince, the more ſound any piece of timber is, the more ſalt it proportionably yields; and the wood which is rotten is found on trial to contain no ſalt at all. See the article TIMBER.

HARDNESS, in philoſophy, that quality in bodies, whereby their parts mutually cohere together, ſo as not to give way to an external impulſe, nor yield inwards, without breaking. Hardneſs in this ſenſe is in contradiſtinction to ſoftneſs. See the article ATTRACTION *of Coheſion*.

HARDS, or HURDS, the coarſer part of hemp or flax, ſeparated from the fine. See the articles HEMP and FLAX.

HARDY SHRUBS, among gardeners, are thoſe which endure the auſterity of the winter.

The two hardieſt ſhrubs we are poſſeſſed of, are the ivy and box; theſe ſtand the ſeverity of our ſharpeſt winter unhurt, while other ſhrubs periſh, and trees have their ſolid bodies ſplit and torn to pieces. In the hard winter of the year 1683, theſe two ſhrubs ſuffered no injury any where; though the yews and hollies, which are generally ſuppoſed very hardy, were this winter in ſome places killed, and in others, ſtripped of their leaves, and damaged in their bark. Furze buſhes were found to be ſomewhat harder than theſe, but they ſometimes periſhed, at leaſt down to the root. The broom ſeemed to occupy the next ſtep of hardineſs beyond theſe; this lived where the others died; and where even this died, the juniper ſhrubs were ſometimes found unhurt. This laſt is the only ſhrub that approaches to the hardineſs of the box and ivy, but even this does not quite come up to them; for while they ſuffer nothing in whatever manner they are expoſed, the juniper, though it bears cold well under the ſhelter of other trees, yet cannot bear the viciſſitudes of heat and cold, inſomuch that ſome juniper ſhrubs were found half dead, and half vigorous; that ſide which faced the mid-day ſun, having periſhed by the ſucceſſive thawings and freezings of its ſap; while that which was not expoſed to the viciſſitudes of heat, had bore the cold perfectly well. Such ſhrubs as are not hardy enough to defy the winter, but appear half dead in the ſpring, may often be recovered by Mr. Evelyn's method of beating their branches with a ſlender hazel wand, to ſtrike off the withered leaves and buds, and giving a free paſſage to the air to the internal parts. Where this fails, the method is to cut them down to the quick; and if no part of the trunk appears in a growing condition, they muſt be taken off down to the level of the ground. *Phil. Tranſ.* N°. 165.

HARE, in zoology, an animal of the lepus kind, diſtinguiſhed by its abrupt tail and black eyes. It greatly reſembles the rabbit, but is larger, and ſomewhat longer, in proportion to its thickneſs; and its ears are remarkably long, being always in a poſition to receive the leaſt ſound, and moveable with ſurpriſing eaſe.

HARE-LIP, *Lebium Laporinum*, in ſurgery. See the article LIP.

HARIOT, or HERIOT, in law, a due belonging to a lord at the death of his tenant, conſiſting of the beſt beaſt, either horſe, ox, or cow, which he had at the time of his death; and in ſome manors, the beſt goods, piece of plate, &c. are called hariots.

HARLEQUIN, a buffoon or merry-andrew; but is now uſed for a perſon of extraordinary agility, dreſſed in party-coloured cloaths, the principal character in a pantomime entertainment. See the article PANTOMIME.

HARMONIA, in anatomy, a ſpecies of articulation, being a kind of ſymphyſis intended for abſolute reſt. See ARTICULATION.

HARMONICA, or, as it is often improperly called, ARMONICA, among muſicians, is an inſtrument compoſed of muſical glaſſes.

The following is a very curious inſtrument of this kind, made by the inventor Mr. Thomas Dobb of St. Paul's church-yard; and, being the moſt perfect as well as fineſt toned inſtrument in uſe, may with great propriety be conſidered as an improvement in muſic.

The inſtrument has this peculiar property, that it never varies or goes out of tune; and is ſo conſtructed as to play a thorough baſs: the contrivance is as follows:

A A A A (plate LXXII. *fig.* 1.) the frame with the treddle or lever for the foot to put the machine in motion, faſtened at one end to the croſs-bar of the frame 1, with a leather ſtrap for a joint, and goes the whole length clear through the other end between two ſtraight pillars, 2, 3, made to fit, that it may work freely up and down, at the ſame time keeping it in its proper poſition, ſo as to turn the above wheel round. B B, the caſe to contain the glaſſes, four feet ſix inches long, and fourteen inches ſquare, with an octogon top opening in the middle when played on, and locked up at other times. C, the large wheel, with a leaden weight caſt on it, and turned quite true, and fixed on the ſpindle with the glaſſes, with a peg turned with a nob on the end to keep the ſtring on when faſtened to the treddle, and turned with the foot, which is fixed in the ſide of the wheel, three inches from the center: the uſe of the weight is to regulate the motion, and overcome the friction of the fingers in playing. D, E, F, G, the glaſſes of a ſemi-circular form perfectly tuned, and of different ſizes, as in the plate, ſo as to get the tones proper to make the inſtrument of three octaves, or more, including the ſemi-tones, with a hole through the center to faſten on the arbor or ſpindle H, ſo as to run nearly true when turned to play on the inſtrument, and then laid horizontally between two rollers fixed at each end of the caſe, which makes them turn quite eaſy, and prevents friction.

What remains further to be ſaid of the inſtrument is with regard to the method of performing on it, which is done by friction in the following manner: The glaſſes are rubbed all over with a wet ſpunge dipped in very clean water: care muſt be taken that no greaſe comes to them; for was the glaſs greaſy, it would be impoſſible to get out any tone: the ſame care muſt likewiſe be taken that your hands are clean. Mr. Dobb always, before he begins to play on the inſtrument, rubs all his fingers over with whiting or chalk, and waſhes it clean off, which gives the fingers a roughneſs, that, when preſſed on the glaſſes, brings the tone out immmediately; ſo that you may play any tune, either in full chorus, or only in parts, as is moſt agreeable.

This inſtrument is beſt adapted to ſlow muſic; for in that is moſt diſcovered thoſe exquiſite fine tones peculiar to it; and which, if run over in a hurry, would not be ſo diſtinctly heard; though by a proper execution every thing might doubtleſs be done on this that can be performed on any other inſtrument.

HARMONICAL ARITHMETIC, that part of arithmetic which conſiders muſical intervals, expreſſed by numbers, in order to our finding their mutual relations, compoſitions, and reſolutions.

HARMONICAL COMPOSITIONS, in a general ſenſe includes both harmony and melody, that is, of muſic or ſongs, both in a ſingle part, and in ſeveral parts.

HARMONICAL INTERVAL, in muſic, denotes the difference of two ſounds, which is agreeable to the ear, whether in conſonance or ſucceſſion; and are, therefore, the ſame with concord. See the articles CONCORD and INTERVAL.

HARMONICAL PROPORTION. See the article PROPORTION.

HARMONICAL SERIES, a ſeries of many numbers in continual harmonical proportion. Thus if there are four or more numbers, of which every three immediate terms are harmonical, the whole will make an harmonical ſeries: ſuch is 30 : 20 : 15 : 12 : 10. Or, if every four terms immediately next each other are harmonical, it is alſo a continual harmonical ſeries, but of another ſpecies, as 3, 4, 6, 9, 18, 36, &c.

HARMONICAL SOUNDS, an appellation given, by Mr. Sauveur, to ſuch ſounds as always make a determinate number of vibrations, in the time that one of the fundamentals, to which they are referred, makes one vibration.

Harmonical ſounds are produced by the parts of chords, &c. which vibrate a certain number of times, while the whole chord vibrates once.

The relations of ſounds had only been conſidered in the ſeries of numbers, 1 : 2, 2 : 3, 3 : 4, 4 : 5, &c. which produced the intervals called octave, fifth, fourth, third, &c. Mr. Sauveur firſt conſidered them in the natural ſeries, 1, 2, 3, 4, 5, &c. and examined the relations of ſounds ariſing thereſrom. The reſult is, that the firſt interval, 1 : 2, is an octave; the ſecond, 1 : 3, a twelfth; the third, 1 : 4, a fifteenth, or double octave; the fourth, 1 : 5, a ſeventeenth; the fifth, 1 : 6, a nineteenth, &c.

This new conſideration of the relations of ſounds, is more natural than the old one; and is, in effect, all the muſic that nature makes without the aſſiſtance of art. See the articles CHORD, VIBRATION, ORGAN, &c.

HARMONICS, *Harmonica*, a diviſion of the ancient muſic. It conſiders the differences and proportions of ſounds with reſpect to gravity and acuteneſs, in contradiſtinction to rhythmica or metrica.

HARMONY, in muſic, the agreeable reſult of an union of ſeveral muſical ſounds, heard at the ſame time.

The word is Greek, ἁρμονία, from ἁρω, to fit or adapt.

As a continued ſucceſſion of muſical ſounds produces melody, ſo a continued combination of them produces harmony.

Harmony, ſtrictly taken, denotes conſonance, and ſo is equivalent to ſymphony. The ancients ſeem to have been entirely unacquainted with harmony, the ſoul of modern muſic. We have inſtances indeed of their joining ſeveral voices or inſtruments in conſonance; but they were either uniſons or octaves in every note; and ſo all performed the ſame melody, and conſtituted one and the ſame thing.

When the parts differ not in the tenſion of the whole, but in the different relations of the ſucceſſive notes; it is this that conſtitutes the modern harmony.

In every compounded ſound, where there are no more than three ſimple ones, there are three kinds of relation, to wit, the primary relation of every ſimple ſound to the fundamental, or graveſt, whereby they make different degrees of concord with it; the mutual relations of the acute ſounds with each other, whereby they mix either concord or diſcord into the compound; and the ſecondary relation of the whole, whereby all the terms unite their vibrations, or coincide more or leſs frequently.

Suppoſe four ſounds A, B, C, D, of which A is the graveſt, B next, then C, and D the acuteſt. Here A is the fundamental; and the relations of B, C, and D to A are primary relations: ſo if B be a third *g* above A, that primary relation is 4 to 5; and if C be fifth to A, that primary relation is 2 to 3; and if D be octave to A, that is 1 to 2. For the mutual relations of the acute terms B, C, D, they are had by taking their primary relations to the fundamental, and ſubtracting each leſſer from each greater; thus B to C is 5 to 6, a third *l*; B to D is 5 to 8, a ſixth *l*, &c.

Laſtly, to find the ſecondary relation of the whole, ſeek the leaſt common dividend to all the leſſer terms of the primary relations, that is, the leaſt number that will be divided by each of them exactly; this is the thing ſought, and ſhews, that all the ſimple ſounds coincide, after ſo many vibrations of the fundamental as the number expreſſes.

So in the preceding example, the leſſer terms of the three primary relations are 4, 2, 1, whoſe leaſt common dividend is 4; conſequently, at every fourth vibration of the fundamental, the whole will coincide.

The proper ingredients of harmony are concords, and all diſcords, at leaſt in the primary and mutual relations, are abſolutely forbidden. It is true, diſcords are uſed in muſic, only to ſet off the concords by their contraſt.

Hence any number of concords being propoſed to ſtand in primary relation with a common fundamental, we diſcover whether they conſtitute a perfect harmony, by finding their mutual relations. Thus, ſuppoſe the greater third, fifth, and octave given, their mutual relations are all concord, and therefore may ſtand in harmony; for the greater third and fifth are to one another as 5 : 6, a leſſer third; the greater third and octave are as 5 : 8, a leſſer fourth; and the fifth and octave are as 3 : 4, a leſſer fourth. But if 4th, 5th, and octave be propoſed, it is evident they cannot ſtand in harmony; becauſe betwixt the fourth and fifth there is a diſcord, namely, the ratio 8 : 9.

To know if ſounds can ſtand in harmony, find the primary and all the mutual relations which muſt be concord. So 4 : 5 : 6 : 8 may ſtand in harmony, as each to each is concord; but 4, 6, 9 cannot, becauſe 4 : 9 is diſcord.

The perfection of harmonies depends on all the three relations; upon comparing two harmonies, which have an equal number of terms, that which has the beſt primary and ſecondary relations, is moſt perfect. But in caſes where the advantage is in the primary relation of the one, and the ſecondary of the other, there is no certain rule: the primary are certainly the moſt conſiderable; but how the advantage in theſe ought to be proportioned to the diſadvantage in the other, or *vice verſa*, we know not: ſo that a well tuned ear muſt be the laſt reſort.

Harmony is divided into ſimple and compound. Simple is that where there is no concord to the fundamental above an octave. The ingredients of ſimple harmony are the ſeven ſimple original concords, of which there can be but eighteen different combinations that are harmony, as in the following table.

Fifth Oct.	2.	Third *g* 5th	4.	Third *g* 5th	Oct.
Fourth Oct.	3.	Third *l* 5th	10.	Third *l* 5th	Oct.
Sixth *g* Oct.	3.	Fourth 6th *g*	3.	Fourth 6th *g*	Oct.
Third *g* Oct.	4.	Third *g* 6th *g*	12.	Third *g* 6th *g*	Oct.
Third *l* Oct.	5.	Third *l* 6th *l*	5.	Third *l* 6th *l*	Oct.
Sixth *l* Oct.	5.	Fourth 6th *l*	15.	Fourth *l* 6th *l*	Oct.

The octave is compoſed of a fifth and fourth, or a ſixth and third, which have a variety of greater and leſſer; out of theſe are the firſt ſix harmonies compoſed: then the fifth being compoſed of the greater third and leſſer third, and the ſixth of the fourth and third; from theſe ariſe the next ſix of the table; then an octave joined to each of theſe ſix, make the laſt ſix. Of the firſt ſix in the table each has an octave, and their preference is according to the perfection of that other leſſer concord joined to the octave. In the next ſix the preference is given to the two combinations with the fifth, whereof that which has the third *g* is beſt; then to theſe two combinations with the ſixth *g*, of which that which has the fouith is beſt. The laſt ſix are not placed laſt as the leaſt perfect, but as the moſt complex, being the mixtures of the preceding twelve. They are plainly preferable to the preceding ſix, as having the ſame ingredients and an octave more.

Compound harmony adds to the ſimple harmony of one octave that of another octave. The variety of this is eaſily found out of the combinations of the ſimple harmonies of ſeveral octaves.

Harmony may alſo be divided into that of concords, where nothing but theſe are admitted; and into that of diſcords, where they are intermixed with concords.

HARMONY is ſometimes applied to a ſingle voice, when ſonorous and ſoft; or to a ſingle inſtrument, when yielding a very agreeable ſound.

HARMONY alſo denotes a certain agreement between the ſeveral parts of a diſcourſe, which renders the reading thereof agreeable.

HARMONY, in architecture, an agreeable relation between the parts of a building.

HARMONY, in painting, both in the compoſition and colours of a picture: the former denotes the connexion between the figures, with reſpect to the ſubject of the piece; in the colouring it denotes the agreeable mixture of different colours. M. de la Chambre derives the harmony of colours from the ſame proportions as that of ſounds. On this principle he lays down green as the moſt agreeable colour correſponding to the octave; red to a fifth; yellow to a fourth, &c.

HARMONY *of the Spheres*, a ſort of muſic much talked of by many of the philoſophers and fathers, ſuppoſed to be produced by the ſweetly tuned motions of the ſtars and planets.

Pre-eſtabliſhed HARMONY, a celebrated ſyſtem of M. Leibnitz, whereby he accounts for the communication between the ſoul and body.

Philoſophers univerſally held, that the ſoul and body act phyſically on each other. Des Cartes firſt ſhewed that the heterogeneity of their nature did not admit of ſuch real union, and that they could only have an apparent one, of which God is the mediator. M. Leibnitz, unſatisfied with either of theſe hypotheſes, eſtabliſhes a third. A ſoul is to have a certain ſeries of thoughts and deſires; a body, which is only a machine, is to have a certain ſeries of motions, that are determined by the combination of its mechanical diſpoſition with the impreſſions of external objects.

If now a ſoul and body be ſo framed that the whole ſeries of deſires and motions of each exactly correſpond, this ſoul and body will have a relation to one another, not by any actual union, but by the conſtant and perpetual correſpondence between the actions of both. Now God puts together this ſoul and body, which had ſuch an antecedent correſpondence, ſuch a pre-eſtabliſhed harmony. And ſo of other ſouls and bodies that have been or ever will be joined.

The ſame principle he extends to the kingdoms of nature and grace, to account for the apparent communication betwixt them, and to make phyſical and moral evil correſpond. See *Leibn. Eſſais de Theodicée.*

HARNESS, the furniture put upon a horſe to draw in a coach, or other wheel carriage.

HARNESS-GALLS, ſwellings or ſoreneſs on the breaſts of coach horſes, occaſioned by the galling of the harneſs, eſpecially in rainy weather.

To cure this, firſt ſhave off the hair about the ſore very cloſe, and rub the whole breaſt with a lather of water and black ſope; then waſh that part of the breaſt which is uſually covered with the petrel, with ſalt-water, ſuffering it to dry of itſelf. If the hardneſs of any part of the harneſs occaſions the galling, take it away, or cover it with little bolſters.

HARP, a muſical inſtrument of the ſtring-kind, of a triangular figure, and held upright between the legs to be played upon with the fingers or nails.

The word is variouſly derived; ſome derive it from the High Dutch *harpff*; others from the Saxon *herrpa*; both ſignify the ſame thing.

Bell HARP, a muſical inſtrument of the ſtring-kind; thus called from the common players upon it ſwinging it about as a bell on its biaſs.

It is about three feet long; its ſtrings, which are of no determinate number, are of braſs or ſteel wire, fixed at one end, and ſtretched acroſs the ſound-board, by ſcrews fixed at the other end. It takes in four octaves, according to the number of ſtrings, which are ſtruck only with the thumbs, the right hand playing the treble, and the left the baſe; and in order to draw the ſound the clearer, the thumbs are armed with a little wire-pin. This may perhaps be the lyra or cythara of the ancients; but we find no mention of it under the name it now bears, which muſt be allowed to be modern.

HARPIES, *Harpyæ*, ἁρπυιαι, in antiquity, rapacious impure ſorts of monſters, of the bird-kind, deſcribed by Virg. Æn. III. The ancients looked on the harpies as a ſort of genii.

There were three harpies, Aello, Ocypete, and Celœno; which laſt Homer calls Pedarge.

HARPINEER, or HARPONEER, the perſon who manages the harping-iron.

HARPINGS. See the article SHIP-BUILDING.

HARPING-IRON, or HARPOON, a large ſpear or javelin, made of forged iron, and five or ſix feet long; it is faſtened to a line, and uſed in the whale fiſhery.

HARPSICHORD, the moſt harmonious of all the muſical inſtruments of the ſtring-kind. It is played on after the manner of the organ, and is furniſhed with a ſet and ſometimes with two ſets of keys; the touching or ſtriking of theſe keys move a kind of little jacks, which alſo move a double row of chords or ſtrings, of braſs or iron, ſtretched over four bridges on the table of the inſtrument.

HARRIER, a kind of hound, endowed with an admirable gift of ſmelling, and very bold in the purſuit of his game.

There are ſeveral kinds of harriers; ſome being for the hare, the fox, the wolf, hart, weaſel, badger, &c.

HARROW, in agriculture, an inſtrument uſed by huſbandmen to break the clods of earth, and to draw the ground over the ſeed when ſown. It is a ſort of wooden drag, made in form of a ſquare, with large iron teeth, or tines, not unlike thoſe of a horſe. See HORSE.

HART, a ſtag, or male deer, in the ſixth year. See STAG and CERVUS.

HART, among ſailors, a ſort of dead-eye with only one hole in it, uſed to draw tight the ſtays. See DEAD-EYE and STAY.

HART-ROYAL, one that has been hunted by the king or queen, and eſcaped with life; in which caſe proclamation is uſually made, that none kill or offend him, as being a hart-royal proclaimed.

HART'S HORNS, *Cornua Cervi*, in pharmacy, the whole horns of the common male deer, as ſeparated from the head, without farther preparation.

The chemical analyſis of hart's horn is ſufficiently known: it yields a water highly impregnated with a volatile ſalt, which is called ſpirit of hart's horn, with a fetid oil, and a volatile ſalt by the common diſtillation in a retort. The remainder in the bottom of the retort, after the diſtillation is finiſhed, is black; but on being calcined in an open fire, it becomes white and friable, and is what is kept in the ſhops under the name of burnt hart's horn. Beſide theſe preparations, we uſe the thin ſhavings of the horns, which, on long boiling in water, become a jelly: this jelly is nutritive and ſtrengthening; it is ſometimes given in diarrhœas; but a decoction of burnt hart's horn in water is more frequently uſed for this purpoſe, and is what is called hart's horn drink.

The ſalt of hart's horn is a great ſudorific, and is given in fevers of many kinds with great ſucceſs; the ſpirit has the ſame and all the other virtues of volatile alkalis, and is uſed to bring people out of faintings by its pungency, on holding it under their noſe, and at the ſame time pouring ſome drops of it in water down the perſon's throat.

HARVEST, the time or ſeaſon that the corn is ripe and fit to be reaped and taken into barns.

HARVEST-FLY, in zoology, a large four-winged fly of the cicada kind, very common in Italy, and erroneouſly ſuppoſed to be a graſs-hopper. See CICADA.

HASSIDEANS, or ASSIDEANS, an application given to thoſe Jews who reſorted to Mattathias, to fight for the law of God, and the liberties of their country.

HASTA, among medalliſts, a kind of javelin, unſhod or headed with iron; or rather an ancient ſort of ſcepter, longer than ordinary, occaſionally given to the gods.

HASTATED LEAF, among botaniſts, one reſembling the head of an halbert.

HAT, a covering for the head, chiefly made of hair, wool, &c. worked, fulled, and faſhioned to the figure of the head, and worn by the men throughout the weſtern part of Europe.

Hats are ſaid to have been firſt ſeen about the year 1400; at which time they became of uſe for country wear, riding, &c.

F. Daniel relates that, from the reign of Charles VI. 1449, the uſe of hats and caps is to be dated, which then began to take place of chaperoons and hoods. In proceſs of time the cuſtom paſſed from the laity to the clergy; but this was looked upon as a crying abuſe, and ſeveral regulations were publiſhed to prohibit it, enjoining the

to keep to the uſe of chaperpons made of black cloth with decent cornets faſtened to their hats, and this upon pain of ſuſpenſion and excommunication. It is true, the uſe of hats is ſaid to be of a longer ſtanding among the eccleſiaſtics of Brittany by two hundred years; but theſe were no other than a kind of caps, whence aroſe the ſquare cap now uſed in colleges.

Method of making HATS.—Hats are made either of wool, or the hair of divers animals, as the beaver, hare, rabbit, camel, &c. The proceſs is much the ſame in all. The fineſt hats are made of the pure hair of the beaver; women tear off the long hair with a knife, like a ſhoemaker's knife, and the ſhort hair they ſcrape off with another kind of knife: then they mix one third of dry caſtor to two thirds of old coat, which is a ſkin that has been worn ſome time by the ſavages. This ſtuff, ſo mixed, is carded and weighed out into parcels, according to the ſize and thickneſs of the hat intended: then each parcel is teazed with the bow-ſtring to purify it from all filth, and to make the ſtuff fall preciſely together, which is the moſt difficult part of the work. Thus they form hats of an oval figure, ending at top in an acute angle. With what ſtuff remains they ſtrengthen them where they happen to be ſlender. They purpoſely make them thicker in the brim near the crown, than towards the circumference, or crown itſelf. They next harden the hats into cloſer flakes, by preſſing down the hardening leather upon them; after which they are carried to the baſon, upon which, laying one hat at a time, they ſprinkle it over with water, and mould it: the heat of the fire, the water, and the preſſing, embody the ſtuff into a ſlight airy felt. The maker, having turned up the edges of this felt round the mould, lays it by and takes another, which when reduced to the ſame conſiſtence and form, he joins them together, ſo as to meet in an angle at top, making only one conical cap.

The next proceſs is to remove the hat to the receiver, or trough, upon the plank or ſloping ſide of which the baſoned hat is laid, being firſt dipped in the kettle: here the hatter rolls and unrolls it, one part after another, firſt with the hand, and then with a little wooden roller, dipping it from time to time for four or five hours, before it can be properly fulled: in which violent labour the workmen have their hands guarded with thick leather, called gloves. A hat thus wrought is reduced to a proper ſhape on the block tied down by a commander, and all under this ſtring is left for the brim; then it is ſet to dry; and when dry enough, it is ſinged by holding it over a flare of ſtraw, &c. then pounced to take off the coarſer nap; then they uſe the ſeal-ſkin; and, laſtly, card it to raiſe the fine cotton; then fitting it to the block, they tie it, cut round the edges, and ſend it to the dyer's, who boils it in a copper that holds between ten and twelve dozen, with a dye of logwood, verdigriſe, copperas, alder-bark, galls, and ſumac, for three quarters of an hour at a time for ten or twelve times ſucceſſively, taking every hat out after each boiling. The dyer returns it to the maker, who hangs it to dry in the roof of a ſtove, under which is a charcoal fire; and thus prepares it for ſtiffening, which is done with melted glue, or gum ſeneca, ſmeared over it with a bruſh, and rubbed in with the hand; then ſpreading a cloth over the ſteaming baſon, and ſprinkling it with water to raiſe a ſtrong ſteam to force in the ſtiffening, it is placed thereon brim downwards; and when it is moderately hot, the workman ſtrikes gently on the brim, with the flat of his hand, to make the jointings incorporate, turning it this way and that, ſetting it at laſt on the crown: then it is put on the block, bruſhed and ironed on the ſtall-board, and thus finiſhed ready to be lined.

HAT is alſo uſed in a figurative ſenſe, to ſignify the dignity of a cardinal, or a promotion to that dignity.

HATS are alſo made for women's wear, of chips, ſtraw, or cane, by platting, and ſewing the plats together; beginning with the center of the crown, and working round till the whole is finiſhed. Hats for the ſame purpoſe are alſo wove and made of horſe-hair, ſilk, &c.

HATCHEL, or HITCHEL, a tool with which flax and hemp are combined into fine hairs. It conſiſts of long iron-pins, or teeth, regularly ſet in a piece of board.

There are ſeveral ſorts of hatchels, each finer than the other, with which flax and hemp are prepared for ſpinning. See FLAX and HEMP.

HATCHES, or HATCH-WAYS, certain holes in the decks of a ſhip, through which the cargo paſſes into the hold and lower apartments: hatches are alſo the covers which lie over theſe holes.

HATCHET, a ſmall light ſort of an ax, with a baſil-edge on its left ſide, and a ſhort handle, as being to be uſed with one hand.

Hatchets are uſed by various artificers, and more particularly in hewing of wood.

HATCHING, the action whereby fœcundated eggs, after a proper time of incubation, exclude their young.

The learned M. Reaumur has obliged the world with an ingenious treatiſe on the method of hatching chickens by an artificial heat.

HATCHING, or HACHING, in deſigning, &c. the making of lines with a pen, pencil, graver, or the like; and the interſecting or going acroſs thoſe lines with others drawn a contrary way, is called counter-hatching. The depths and ſhadows of draughts are uſually formed by hatching,

Hatching is of ſingular uſe in heraldry, to diſtinguiſh the ſeveral colours of a ſhield, without being illuminated: thus, gules or red is hatched by lines drawn from the top to the bottom; azure, by lines drawn acroſs the ſhield; and ſo of other colours. See the articles GULES, AZURE, &c.

HATCHMENT, in heraldry, a name ſometimes uſed for an atchievement, or eſcutcheon over a gate, door, or on the ſide of an houſe.

HATCHMENT alſo ſignifies the marſhalling of ſeveral coats of arms in an eſcutcheon. See the article MARSHALLING.

HATTOCK, a ſhock of corn containing twelve ſheaves: others make it only three ſheaves laid together.

HAVEN, a ſea-port or harbour. See the article HARBOUR.

HAVER, a term uſed by country people for oats.

HAUNCH, or HANCH, the hip, or that part of the body between the laſt ribs and the thigh.

HAUNT, among ſportſmen, the place to which game are accuſtomed to reſort: among hunters, it is the walk of a deer, or the place of his ordinary paſſage.

HAUTBOY, a muſical inſtrument of the wind kind, ſhaped much like the flute, only that it ſpreads and widens towards the bottom, and is ſounded through a reed. The treble is two feet long; the tenor goes a fifth lower, when blown: it has only eight holes; but the baſs, which is five feet long, has eleven.

HAW, in botany, &c. a ſort of berry, the fruit of ſeveral ſpecies of meſpilus, thence denominated haw-thorns. See MESPILUS.

HAW, in farriery, is a ſwelling and ſponginеſs that grows in the inner corner of the eye of a horſe, ſo large ſometimes as to cover a part of the eye.

The method of curing it is eaſily performed by cutting part of it away; but the farriers are apt to cut away too much: the wound may be dreſſed with honey of roſes; and if a fungus or ſpongy fleſh ariſes, it ſhould be ſprinkled with burnt allum, or touched with blue vitriol.

HAWK, a ſynonymous term with falcon, though, by ſome, reſtrained to the leſſer ſort of falcons. See FALCON.

HAWKER, in commerce, a pedlar, or perſon that goes about the country ſelling wares: this name is ſaid to ariſe from their uncertain wandering, like perſons who with hawks ſeek their game where they may find it.

HAWKING, the exerciſe of taking wild-fowl by means of hawks.

HAWSE, in naval architecture, that part of a ſhip's bow through which the cable paſſes, and is drawn into and let out of the ſhip.

HAY, any kind of graſs, cut and dried, for the food of cattle.

Whatever uplands are deſigned to be mowed for hay, are to be ſhut up in the beginning of February, and no cattle ſuffered to come upon them afterwards; but the

meadows and marſh lands, where the graſs grows quicker, need not be ſhut up till April, except the ſpring be bad; and many farmers feed thoſe meadows which are in danger of overflowing till the firſt of May, and then ſhut them up for mowing.

In ſpring, the ſtones, ſticks, and all other kinds of foulneſs that lie upon the land, are to be picked up, and the mole-hills all levelled and ſpread, becauſe they hinder the mowers. If the meadows lie any thing uneven, or if they have been trodden down in winter, they ſhould be rolled all over with a large wooden roller; the mowers will then be able to cut much cloſer; for this, and the quantity of the hay, will very well anſwer the trouble.

The time of mowing the graſs muſt be proportioned to its ripeneſs; nothing can be more prejudicial to the crop, than the cutting it too ſoon, becauſe the ſap is not then fully come out of the root; and ſuch graſs, when dried into hay, ſhrinks up almoſt into nothing. It is very wrong alſo to let it ſtand too long, for, when the ſeed has been ripened, and is ſhed, the moiſture of the ſap all dries away out of the ſtalks, and they become no better than ſo much ſtubble; as is plainly ſeen in thoſe graſſes which grow in hedges, and, not being moved, die away after they have perfected their ſeeds, and become taſteleſs and very different from hay. The middle or latter end of June is the general ſeaſon for mowing; and the red flowers of the honey-ſuckle beginning to wither, generally give the farmer notice that the time is coming on. But he may be more aſſured of this, by the drops or heads of the graſs looking full, bending downward, and looking brown; it is then in the proper ſtate to be cut down.

If there is great plenty of the hay, and it lie thick in the ſwath, the hay-makers ſhould follow the mowers, and turn the ſwaths, as they cut them, unleſs there ſeems danger of wet weather; but in that caſe it is better to let them lie in the ſwath. At night it muſt be made up into little cocks, and theſe in the morning muſt be ſpread and turned, ſo that the other ſide may wither. After this it is to be made into ſmall cocks again, and the next day it is to be ſpread again, and drawn into long rows, which they call winrows. From theſe it is to be made up into large cocks after a little drying; and theſe large ones, if any wet comes, are to be ſpread open once again before they are carried in.

Mowing of land too often, or continuing it too long, is a very great prejudice to it, unleſs it have the advantage of being fed and renewed by land-floods at times. The farmer who has not this advantage to his lands, ſhould feed them once in two or three years, inſtead of making hay from them, unleſs he chuſes to lay on manure conſtantly to keep them in heart. Feeding the hay lands is the ſame ſort of reſpite that fallowing is to corn lands, both very neceſſary and advantageous.

Saint-foin HAY is of ſeveral ſorts, which may be diſtinguiſhed by the following terms, viz. 1. The virgin. 2. The bloſſomed. 3. The full grown. And 4. The threſhed hay. The firſt of theſe is beyond compariſon the beſt. It muſt be cut before the bloſſoms generally appear; for when it ſtands till it is full blown, the moſt ſpirituous and nouriſhing parts of its juice are ſpent, the ſap is much impoveriſhed, and the ſaint-foin can never recover that richneſs it had in its virgin-ſtate. But this fine hay cannot well be had of uncultivated ſaint-foin, becauſe that may not be much above an handful high when it is in a condition to be cut; it would then make a very light crop, and would be a great while before it ſprang up again; but the rich will have two or three tuns to an acre, and ſpring again immediately for a ſecond crop; ſo that little or none in quantity would be loſt by ſo great an improvement of its quality.

The ſecond ſort is that cut in the flower, which, tho' much inferior to the virgin-hay, far exceeds any other kind as yet commonly propagated in England; and if it be a full crop, it may amount to three tuns an acre. This is that ſaint-foin which is commonly made, and the larger it is, the more nouriſhing it is for horſes.

The next ſort of ſaint-foin is the full grown, cut when the bloſſoms are gone, or going off: this alſo is good hay, though it falls ſhort by many degrees of the goodneſs of the other two ſorts: but it makes a greater crop than either of them, becauſe it grows to its full bulk, and ſhrinks little in drying.

The laſt ſort is the threſhed hay, which when not damaged by wet weather, has been found more nouriſhing to horſes than coarſe water-meadow hay; and, when it is cut ſmall by an engine, is good for cattle, and much better than the chaff of corn. The beſt time to cut it, is when the greateſt part of the ſeed is well filled; the firſt-blown ripe, and the laſt-blown beginning to be full.

The goodneſs of the hay depends greatly upon the manner of ordering it. The beſt hay in all England is made of ſaint-foin, without ever ſpreading it. This method, though it be longer before it be finiſhed, coſts leſs labour than the other. If ſaint-foin be laid up pretty green, it will take no damage, provided it be ſet in ſmall round ricks, with a large baſket drawn up in the middle of each, to have a vent-hole through which the ſuperfluous moiſture of the hay may tranſpire. As ſoon as its heating is over, theſe ricks ought to be thatched; and all ſaint-foin ricks, that are made when the hay is full dried in the cocks, ought to be thatched immediately after the making them. That which is laid up moſt dried, will come out of the rick of a green colour; but that which has been much heated in the rick, will be brown.

The ſeed affords the owner another opportunity of making a profit of his ſaint-foin: but this, if the hoeing huſbandry were general, would not be vendible in great quantities for planting; becauſe the ordinary crop of an acre will produce ſeed enough to drill an hundred acres, which would not want planting for a long time. The other uſe then of this ſeed is for provender; and it has been affirmed by ſome, who have made trials of it, that three buſhels of good ſaint-foin ſeed given to horſes, will nouriſh them as much as four buſhels of oats; and when well ordered, it is ſo ſweet that moſt ſorts of cattle are greedy of it.

HAY-BOTE, in law, a liberty to take thorns, and other wood, to make and repair hedges, gates, fences, &c. by a tenant for life or years.

HAY-BOTE is alſo taken for wood for the making of rakes and forks, uſed in making hay.

HAYWARD, the perſon who keeps the common herd or cattle of a town.

He is appointed by the lord's court, and his office is to ſee that the cattle neither break nor crop the hedges of incloſed grounds; he is alſo to look to the fields, and impound cattle that commit treſpaſs therein.

HAZARD, a game on dice, without tables, is very properly ſo called, ſince it ſpeedily makes a man, or ruins him.

It is played with only two dice; and as many may play at it as can ſtand round the largeſt round table. It is certainly one of the moſt bewitching and ruinous games played on the dice. Happy, therefore, the man who either never heard of it, or who has reſolution enough to leave it off in time. See CHANCE and GAMING.

HAZLE, *Corylus*, in botany. See CORYLUS.

Witch-HAZLE, a name ſometimes given to the elm. See ELM.

HAZLE-EARTH, in agriculture, a moderately compact earth, much approaching to the nature of the chiefly ſoil, and indeed properly a ſpecies of it, but always containing a large quantity of reſin-coloured ſand.

HEAD, *Caput*, the uppermoſt or foremoſt part of the body of an animal. When viewed on the outſide, it is divided into the hairy ſcalp and the face. The hairy ſcalp covers the upper part of the os frontis, the ossa parietalia, the os occipitis, and the upper and lower portions of the temporal bones. The uppermoſt part of the hairy ſcalp is termed the vertex or fontanella; the back part, occiput; the lateral parts, the temples. See CRANIUM.

HEAD-ACH, *Cephalagia*, a very painful ſenſation in the nervous membranes of the head, proceeding from various cauſes, and frequently accompanied with a variety of troubleſome ſymptoms, according to its different degree and ſituation.

As the cauſes of this diſorder are various, they ought to be carefully diſtinguiſhed and enquired into, becauſe in removing them the whole method of cure in a great meaſure

measure conſiſts: but in general the intentions of cure in this diſorder are theſe following.

Firſt, if the blood and humours are impetuouſly conveyed to the head, and remain there, they are partly to be derived to the more ignoble parts, and partly to be diſcuſſed by proper remedies.

Secondly, the ſpaſmodic ſtrictures of the membranes of the head, generally produced by an acrid cauſtic matter, are to be relaxed, that the fluids, whoſe progreſſive motion through the membranes was by this means hindered, may now circulate with the greater freedom.

Thirdly, the material cauſe of the diſorder, which is peccant with reſpect to its quality, is to be corrected and gently evacuated through proper emunctions. And,

Laſtly, in order to prevent a relapſe, the whole head and nervous ſyſtem are to be corroborated by proper remedies, and more eſpecially by a well choſen diet and regimen.

If the cauſe of the pain is too large a quantity of blood violently propelled to the head, by the ſpaſm of the lower parts, no remedy affords a more inſtantaneous relief than veneſection, which ought to be performed as near the part affected as is poſſible, in order to make the more effectual derivation, under the tongue, for inſtance, in the forehead, or in the external jugular veins, or by the application of leeches behind the ears; but with this caution, that if the body is plethoric, or too turgid with blood, a vein is to be previouſly opened at the ancles, and the next, or the ſecond day after, a vein is to be breathed about the head. It is alſo adviſable, before this ſtep is taken, to evacuate the contents of the inteſtines; which is commodiouſly, and to the great relief of the patient, effected by the commonly family clyſters, or by infuſions of manna and rhubarb, with an addition of ſome aperient ſalt, ſuch as cream of tartar, or the Sedlitz ſalt.

In order to check the too violent orgaſm and tumultuous commotion of the redundant and effervеſcent blood, it is proper to exhibit a gentle diaphoretic and correcting mixture, prepared of the waters of lime flowers, lilies of the valley, elder, black cherries, with an addition of a proper quantity of diaphoretic antimony, purified nitre, calcined hart's horn, cinnabar, and ſyrup of white poppies. Externally a diſcutient and correcting epithem is to be applied, with a double linen cloth, to the forehead and head. The epithem, for this intention, may be prepared in the following manner:

Take of the vinegars of roſes and rue, each one ounce and a half; of the ſpirit of roſes two drams, in which ſix grains of camphire have been diſſolved; of purified nitre two ſcruples; of the oil of rhodium fifteen drops.

Or the following emulſion may be uſed with conſiderable ſucceſs.

Take of the kernels of peaches, and of bitter almonds, each half an ounce; of white poppy ſeeds two drams; of the waters of roſes, elder flowers, and black cherries, each two ounces; make into an emulſion, to which add of nitre half a dram, of camphire five grains diſſolved in oil of ſweet almonds: mix all together.

But another and quite different method of cure is neceſſary, if a pain, which generally continues for a conſiderable time, and is accompanied with a torpor and ſenſe of weight, is produced by a quantity of viſcid and peccant ſerum, ſtagnating within or without the veſſels of the membranes of the brain; in which caſe neither venections, nor the milder laxatives, are ſufficiently efficacious; ſo that it is proper to exhibit ſome more efficacious medicines, which have at once a power of diſſolving the thick and glutinous humours, and expelling the contents of the inteſtines: both theſe intentions are excellently anſwered by the following pills.

Take of pure gum ammoniac, ſagapenum, the beſt myrrh, roſated aloes, extract of black hellebore, reſin of jalap, mercurius dulcis, and prepared cinnabar, each half a dram; of the extract of ſaffron, of the powder of caſtor, and of the ſalt of amber, each fifteen grains: mix it up into a maſs; out of every ſcruple of which make twelve pills, ſix of which may be taken at night, and the remaining ſix in the morning.

The patient is at this time to abſtain from all aliments, except weak broths. When three days are expired, the ſame remedy may be repeated. When the peccant ſerum is by means of theſe pills ſufficiently evacuated, we are to have recourſe to ſuch medicines as corroborate the veſſels, reſtore the tone, and are at the ſame time diuretic.

HEAD-MOULD-SHOT, a diſeaſe in children, wherein the ſutures, generally the coronal, have their edges ſhot over each other, ſo as to compreſs the internal parts. This diſeaſe uſually occaſions convulſions, and admits of no cure, unleſs room could be given by a divulſion of the ſutures. This diſorder is oppoſite to the horſe-ſhoe head. See the article HORSE-SHOE-HEAD.

HEAD is alſo uſed for the top or extremity of any thing; thus we ſay, the head of a tree, the head of a bone, the head of a nail, &c.

HEAD, in architecture, an ornament of carved work, or ſculpture, frequently ſerving as the key of an arch, or platband, on other occaſions.

Theſe ſort of heads uſually repreſent ſome of the divinities, virtues, ſeaſons, ages, &c. with their attributes, as a thunderbolt for Jupiter, a diadem for Juno, a trident for Neptune, a crown of ears of corn for Ceres, a helmet for Mars, a caduceus for Mercury, &c.

The heads of beaſts are alſo uſed in places ſuitable, as an horſe's head for an equery; a deer's or boar's head, for a park or foreſt; a dog's head for a kennel; a bullock's, or ſheep's, for a ſhambles or market-houſe. In the metopes, friezes, and other parts of certain antique Doric temples, we ſee repreſentations of bullocks, or rams-heads, as a ſymbol of the ſacrifices offered there.

HEAD, in heraldry. The heads of men, beaſts, or birds, are very frequent in armoury, and borne either full-faced, looking forward, or ſide-faced in profile, when only one half of the face appears, which differences ought to be mentioned in blazoning, to avoid miſtakes; as a head, or heads fronting; or a head, or heads ſide-faced, or in profile: thus, Vert, a chevron gules, between three Turks heads couped ſide-faced proper, is borne by the name of Smith. And again, Or, a croſs gules, between four blackmoors heads, couped at the ſhoulders proper, is borne by the name Juxon. As the head is the principal part of the body, ſo it is of courſe the nobleſt bearing.

HEAD, among huntſmen, is uſed for the horns of a deer, as a hart, buck, &c. See ANTLERS, ROYALS, CROCHES, &c.

HEAD, in the military art. Head of a work is the front of it next the enemy, and fartheſt from the place, as the front of a hornwork is the diſtance between the flanked angles of the demi-baſtions; the head of a double tenaille is the ſaliant angle in the middle; and the two other ſides which form the re-entering angles. See the article FRONT.

HEAD, in painting, ſculpture, &c. a repreſentation of that part of the human body, whether in colours, draught, or creux: if taken from the life, or ſuppoſed to bear a juſt reſemblance to the perſon, it is more properly called portrait. See PORTRAIT.

HEAD-BOROUGH, the perſon who is chief of the frank-pledge in boroughs, or who anciently had the government within his own pledge. See the article FRANK-PLEDGE.

HEAD-BOROUGHS, at this time, are a kind of conſtables. See CONSTABLE.

HEAD-LAND, in huſbandry, is taken to ſignify the upper-part of land left for the turning of the plough.

HEAD-TIN, in metallurgy, a preparation of tin-ore toward the fitting it for working into metal. When the ore has been pounded and twice waſhed, that part of it which lies uppermoſt, or makes the ſurface of the maſs in the tub, is called head-tin: this is ſeparated from the reſt, and after a little more waſhing becomes fit for the blowing-houſe.

Moor's HEAD is underſtood of a horſe with a black head and feet; the body being uſually of a roan colour. Among engineers a Moor's head is uſed for a kind of bomb or granado ſhot out of a cannon. Among chemiſts it is a cover, or capital, of an alembic; having a long neck to convey the vapours raiſed by the fire into a veſſel, which ſerves as a refrigeratory. See ALEMBIC.

Dragon's

Dragon's HEAD, in aſtronomy, &c. is the aſcending node of the moon, or other planet. See the article NODE.

HEADS, a term uſed by builders for that kind of tile which they uſe to lay at the eaves of a houſe; being the full breadth of a common tile, and but half a tile in length. See the article TILE.

HEALING, in architecture, the covering a roof with lead, tiles, ſlate, or the like.

HEALTH, *Hygieia Hygeia*, a proper diſpoſition of the body, and all its parts for performing their reſpective functions; and this conſiſts in a due connexion. It is likewiſe applied to the mind, and then it means a juſt diſpoſition of the rational powers and paſſions to perform their proper actions; and this, in a great meaſure, depends on bodily health.

The preſervation and reſtoration of health conſtitute the objects of the arts of medicine. The continuance of health depends principally on the ſix non-naturals, air, food, exerciſe, the paſſions, evacuation and retention, ſleeping and waking. The ancients erected a goddeſs, to whom they ſuppoſed the care of health to belong: the Greeks worſhipped her under the name Υγιεια, and the Romans under that of Salus. Her temple at Rome was on the Mons Quirinalis, where ſhe had a ſtatue crowned with medicinal herbs.

She is repreſented in medals with a ſerpent ſtretched on her left arm, and holding a patera to it with the right: ſometimes ſhe has an altar before her with a ſerpent twiſted round, raiſing its head to take ſomething out of the ſame; with the inſcription SAL. AUG.

HEAM denotes in animals the ſame as after-birth or ſecundines in women.

HEARING, *Auditus*, one of the external ſenſes, being the act of faculty of perceiving ſounds; its organ is the ear, particularly the auditory nerve diffuſed through it; its objects are certain vibrations of the air. See the article SOUND.

The ear and its ſeveral membranes, nerves, canals, &c. are vehicles for the reception, modification, and tranſmiſſion of ſound to the brain, which is the ſeat of this ſenſe. See EAR.

HEARSE, among ſportſmen, a hind of the ſecond year of her age. See HIND.

HEART, *Cor*, in anatomy, a muſcular body ſituated in the cavity of the thorax, on the anterior part of the diaphragm, between the two laminæ of the mediaſtinum. It is ſomewhat conical, flatted on the ſides, round at the top, and oval at the baſis; this laſt is accompanied with appendices, called auriculæ, and by large blood-veſſels; and all theſe are included in a membranous capſula, named pericardium.

It is hallow within, and divided by a ſeptum, which runs between the edges into two cavities; one of which is thick and ſolid, called the left ventricle; the other thin and ſoft, termed the right ventricle; though in their natural ſituation, the right ventricle is placed more anteriorly than the left. Each ventricle opens at the baſis by two orifices, one of which anſwers to the auricles, the other to the mouth of a large artery; one of which may be termed the auricular orifice, the other the arterial orifice. The right ventricle opens into the right auricle, and into the trunk of the pulmonary artery; the left into the left auricle, and into the great trunk of the aorta. At the edges of theſe orifices are ſeveral moveable pellicles, called valves, of which ſome are turned inward towards the ventricles, that let the blood enter the heart, but hinder it from going out the ſame way, and are called triglochines or tricuſpides; others turned towards the great veſſels, which ſuffer the blood to go out of the heart, but hinder it from returning, and are called ſemi-lunares or ſigmoidales. The tricuſpides of the left ventricle are likewiſe termed nitrales.

The inner ſurfaces of the ventricles have thick fleſhy productions called columnæ. To the extremities of theſe columnæ or pillars are faſtened ſeveral tendinous cords, the other ends are joined to the tricuſpides. There are likewiſe other ſmall, ſhort, tendinous ropes along both the edges of the ſeptum, in an obliquely tranſverſe ſituation forming a kind of net-work.

The cavities of the ventricles are ſmall deep foſſulæ, near each other, with ſmall prominent interſtices between. The greateſt part of the foſſulæ are orifices of the venous ducts.

The fleſhy fibres of the heart, eſpecially thoſe of the right ventricle, are either bent into arches, or folded into angles, the latter being longer than the former. The middle of theſe arches, and the angles of the folds, are turned towards the apex of the heart; and the extremities of the fibres toward the baſis. Theſe fibres not only differ in length, but in their directions, which are very oblique in all, but much more ſo in the long or folded fibres than in the ſhort ones.

Each ventricle is compoſed of its proper diſtinct fibres; but the left has many more than the right. By carefully unravelling all the fibres of the heart, we find it to be made up of two bags contained in a third.

The tubes which croſs tranſverſely are much more numerous than thoſe which croſs longitudinally; which will ſerve to rectify the falſe notion about the motion of the heart, that it is performed by a contortion like a ſcrew; that the heart is ſhortened in the time of contraction, and lengthened in dilatation.

The tricuſpidal valves of the right ventricle are three triangular productions, very ſmooth on that ſide next the auricle, and on the ſide next the ventricle ſeveral membranous and tendinous expanſions, and their edges notched. The valves of the auricular orifice of the left ventricle are of the ſame ſtructure, and but two in number.

The ſemi-lunar valves are ſix in number, three belonging to each ventricle, ſituated at the mouths of the great arteries, and may be properly enough called valvulæ arteriales.

The auricles are muſcular bags, ſituated at the baſis of the heart, one towards the right ventricle, the other towards the left, and joined together by an inner ſeptum and external communicating fibres, much like the ventricles; one of them being called the right auricle, the other the left. They are very uneven on the inſide, but ſmoother on the outſide, and terminate in a narrow, fat, indented edge, like a cock's comb.

The right auricle is larger than the left, and it joins the right ventricle by a common tendinous opening. It has two other openings united into one, and formed by two large veins, which meet and terminate there, almoſt in a direct line, called vena cava, ſuperior and inferior; the notched edge of this auricle terminates obliquely in a kind of obtuſe point, which is a ſmall production of the great bag, and is turned towards the middle of the baſis of the heart.

The whole inner ſurface of the right auricle is uneven, by reaſon of a great number of prominent lines, which run acroſs the ſides of it, and communicate with each other by ſmaller lines, which lie obliquely in the interſtices between the former.

The left auricle is pretty thick and unequally ſquare, into which the four veins open that are called venæ pulmonares, and which has a diſtinct appendix belonging to it, like a third ſmall auricle.

Beſides the great common veſſels, the heart has ſome peculiar to itſelf, called the coronary arteries and veins, as in ſome meaſure they crown the baſis of the heart. Theſe arteries, which are two in number, called the right and left coronaries, go out from the beginning of the aorta, and afterwards ſpread round the baſis of the heart, to the ſubſtance of which they ſend numerous ramifications. The exterior courſe of the veins is pretty much the ſame with that of the arteries; their trunk opens principally into the right auricle, by a particular orifice, furniſhed with a ſemi-lunar valve: all the coronary veſſels and their ramifications communicate with each other. The pericardium conſiſts of three laminæ, the middle and principal of which is compoſed of very fine tendinous filaments croſſing each other in different directions. The external lamina ſeems to be a continuation of the outer coat of the heart, auricles, and great veſſels.

The pericardium is cloſely connected to the diaphragm not at the apex, but exactly at that place which anſwers to the flat or lower ſide of the heart; the reſt of the heart lies upon the diaphragm without any adheſion. The external lamina, or more properly common covering, is formed by the duplicature of the mediaſtinum. The

HEART.

Fig. 1.

Fig. 3. Heart.

Fig. 2. Heart.

Fig. 4. Heart.

Heliostata.

Fig. 6.

Fig. 5. Heliostata.

Fig. 7. Hexagon.

5 JA 59

internal lamina is perforated by an infinite number of very ſmall holes, through which a ſerous fluid continually tranſudes, in the ſame manner as in the peritonæum: ſometimes, upon diſſection, it is of a reddiſh colour, which may be owing to a tranſudation of blood through the fine membrane of the auricles.

The heart and parts belonging to it are the principal inſtruments of the circulation of the blood. The two ventricles ought to be conſidered as two ſyringes ſo cloſely joined together as to make but one body, and furniſhed with ſuckers in contrary directions to each other; ſo as that, by drawing one of them, a fluid is let in, and forced out again by the other.

The heart is made up of a ſubſtance capable of contraction and dilatation. When the fleſhy fibres of the ventricles are contracted, the two cavities are leſſened in an equal and direct manner, more according to the breadth or thickneſs, than according to the length of the heart; becauſe the number of tranſverſe fibres is much greater than that of the longitudinal ones.

The fleſhy fibres, thus contracted, do the office of ſuckers, by preſſing upon the blood in the ventricles; which blood being forced to the baſis of the heart, preſſes the tricuſpidal valves againſt each other, opens the ſemilunares, and ruſhes with impetuoſity through the arteries and their ramifications, as through ſo many elaſtic tubes. The blood thus puſhed on enters the capillary veſſels, and is from thence forced to return by the veins to the auricles, which like retirements lodge in the blood returned by the veins during the time of a new contraction, which is termed ſyſtole.

The contraction or ſyſtole ceaſes immediately; and in that time the auricles, which contain the venous blood, being contracted, force the blood through the tricuſpidal valves into the ventricles, the ſides of which are thereby dilated, and this dilatation is called diaſtole. In this manner does the heart perform the circulation, and that three different ways: the firſt and moſt univerſal kind of circulation is that by which almoſt all the arteries of the body are filled by the ſyſtole of the heart, and the greateſt part of the veins evacuated by the diaſtole.

The ſecond kind of circulation, oppoſite to the firſt, is through the coronary veſſels of the heart, the arteries of which are filled with blood, during the diaſtole of the ventricles, and the veins emptied during the ſyſtole.

The third kind is that of the left ventricle of the heart, through the venous ducts of which a ſmall quantity of blood paſſes, without going through the lungs, which is the courſe of all the remaining maſs of blood. *Winſlow.*

Explanation of plate LXXIII.

Fig. 1. The human heart ſeen in its convex part, and in a horizontal ſituation.

B, Branches of the coronary vein.
C, Branches of the coronary artery.
D, The right auricle.
E, Branches of veins, going from the right auricle.
F, The left auricle.
G, The trunk of the aorta.
H, The trunk of the pulmonary artery.
I, The aſcending trunk of the vena cava.
K, The deſcending trunk of the vena cava.
L, L, L, Branches of the aorta riſing upwards.
M, One of the branches of the pulmonary artery.
N, N, N, Branches of the pulmonary vein.

Fig. 2. The heart opened to ſhew the parts of its ventricles.

A, The muſcular ſeptum which divides the ventricles.
B, The right ventricle opening into the right auricle and into the trunk of the pulmonary artery.
C, The left ventricle opening into the left auricle and into the great trunk of the aorta.

Fig. 3 and 4 repreſent the heart in different poſitions to ſhew the fibres and orifices of the venous ducts.

A, Aſcending trunk of the vena cava.
B, The trunk of the aorta.
C, Branches of the pulmonary vein.
D, Deſcending trunk of the vena cava.
E, Part of the right auricle cut away to ſhew the different ranging of the internal fibres and venous ducts.

To find the Force of the HEART. — Let $p =$ the weight of the left ventricle, or a quantity of blood equal to th ſame weight. S = the internal ſurface of the ſame; $l =$ the mean length of the filaments of blood iſſuing from the ſame; $s =$ the ſection of the aorta; $q =$ the quantity of blood contained in the left ventricle; $t =$ the time in which the blood would be expelled from the heart, taking away the reſiſtance of the arteries, and of the blood going before; $v =$ the variable velocity with which the blood iſſuing from the heart would flow through the aorta, abſtracted from the reſiſtance; $x =$ any variable length of the aorta, deſcribed by the blood guſhing from the heart; z the time in which the length x is deſcribed.

Hence the mean variable velocity of the blood contiguous to the ventricle, or the mean velocity of the ventricle itſelf, is $= \frac{sv}{S}$, and the motion of the ventricle $= p \times \frac{sv}{S}$: the motion of the iſſuing blood is $= sv \times \overline{l + x}$; and therefore the ſum of theſe, or the power of the ventricle $= sv \times \overline{\frac{p}{S} + l + x}$: all this is evident from the common principles of mechanics. But $v = \frac{\dot{x}}{\dot{z}}$; for the velocity is always equal to the ſpace divided by the time. Now for v put its equal $\frac{\dot{x}}{\dot{z}}$, and we ſhall have $\frac{s\dot{x}}{\dot{z}} \times \overline{\frac{p}{S} + l + x}$, for the fluxion of the forces, whoſe fluent $\frac{sx}{z} \times \overline{\frac{p}{S} + l + \frac{x}{2}}$ is the required force itſelf; which, when z becomes t, and sx becomes q, will be $\frac{q}{t} \times \overline{\frac{p}{S} + l + \frac{q}{2s}}$.

In the ſame manner the power of the right ventricle will be found equal to $\frac{q}{t} \times \overline{\frac{\pi}{\Sigma} + \frac{q}{2\sigma}} + \lambda$, wherein the ſame things are ſignified by the Greek letters in the right ventricle, as by the Latin letters in the left, q and t being the ſame in both. Hence the whole force of the heart will be expreſſed by $\frac{q}{t} \times \overline{\frac{p}{S} + l + \frac{q}{2s} + \frac{\pi}{\Sigma} + \frac{q}{2\sigma}} + \lambda$.

If we ſuppoſe $p = 8$ ounces avoirdupoiſe $= 13,128$ cubic inches; $\pi = 4 = 6,564$; S $= 10$ ſquare inches; $l = 2$ ſquare inches; $\Sigma = 10$; $\lambda = 1\frac{1}{2}$; $q = 2$ ounces avoirdupoiſe $= 3,282$ cubic inches; $s = 0,4185$ ſquare inches; $\sigma = 0,583$; $t = 0''$, 1. Theſe three laſt by Dr. Keill's experiments.

By the above theorem the force of the ventricles will be equal to the motion of the underwritten weights; that is,

	Pounds	Ounces
Of the left ventricle — —	9	1
Of the right ventricle — —	6	3
Of the whole heart — —	15	4

Of which weights the velocity will be ſuch, as that a line of an inch long might be deſcribed by the ſame in one ſecond of time.

Corol. 1. As often as the pulſe becomes quicker, either the reſiſtance is leſſened, or the force of the heart is increaſed, or a leſs quantity of blood than uſual is expelled by the heart at each contraction.

2. If the pulſe becomes ſlower than uſual, either the reſiſtance is increaſed, or the power of the heart is diminiſhed, or a greater quantity of blood is thrown out of the heart.

3. When the reſiſtance is increaſed, the pulſe will neceſſarily become ſlower, or the force of the heart will be increaſed, or a leſs quantity of blood than uſual will be ſqueezed out of the heart.

4. When the reſiſtance is leſſened, either the pulſe is accelerated, or a greater quantity of blood is thrown out at every ſyſtole, or the force of the heart is diminiſhed.

5. If the force of the heart be increaſed, either the reſiſtance will neceſſarily be increaſed, or the pulſe will be accelerated, or more blood will be thrown out by the heart.

6. If the force of the heart be diminiſhed, either the reſiſtance will neceſſarily be diminiſhed, or the pulſe will become ſlower, or leſs blood will be ſqueezed from the heart.

7. When a leſs quantity of blood is diſcharged by the heart, either the pulſe will be accelerated, or the force

of the heart diminiſhed, or the reſiſtance will be increaſed.

8. When more blood is ſqueezed out of the heart, either the pulſe will become ſlower, or the force of the heart will be increaſed, or the reſiſtance will be diminiſhed.

Schol. We have contented ourſelves to eſtimate the internal ſurfaces of the ventricles ſomething near the truth, ſince it ſeems very difficult to determine them exactly, or to take account of that diminution they muſt undergo in contracting: for whether we make them twelve or eight ſquare inches, the change made in the forces would be found to be but very little: this alſo may be obſerved of the mean length of the filaments of blood. We have alſo neglected the differences by which both the arteries and their branches neareſt the heart are increaſed by ſection, as being very difficult to be eſtimated, and almoſt inſenſible; otherwiſe the force of the heart muſt be made ſomething ſmaller than is before determined.

HEAT, *Calor*, one of the qualities of the body, oppoſed to cold. Its preſence is known, and its degree meaſured by the expanſion of the air or ſpirit in the thermometer. It is properly a ſenſation excited in us by the action of fire, ſo that it is a particular modification of our minds, and not any thing exiſting in that form in the body that occaſions it. Heat, in the body that communicates it, is only motion; in the mind, a particular diſpoſition of the ſoul.

Heat, with reſpect to the effect produced on us, is eſtimated by its relation to the organ of feeling, no object appearing to be hot, unleſs its heat exceed that of our bodies.

Heat, as it exiſts in the hot body, and enables it to produce ſuch and ſuch effects on our organ, is variouſly conſidered by the philoſophers.

Ariſtotle and the Peripatetics define heat a quality or accident, whereby homogeneous things are collected together, and heterogeneous things ſeparated: but heat cannot be ſaid to do either this or that univerſally; all its effects depend on the circumſtances of application: thus, to do the ſame thing in different bodies, different degrees of heat are required; add to this, that the ſame degree of heat ſhall have oppoſite effects on different bodies.

The Epicureans and other Corpuſcularians define heat an eſſential property of fire, the ſame in reality with it, only diſtinguiſhed therefrom in the manner of our conception. Heat then, on their principles, is no other than the volatile ſubſtance of fire itſelf, reduced into atoms, and emitted in a continual ſtream from the ignited bodies; ſo as not only to warm the objects near them, but kindle them, if inflammable. In effect, theſe corpuſcles flying off from the ignited body, while yet within the ſphere of its flame, by their motion conſtitute fire; but when got beyond it, ſo as only to be perceivable by the feeling, they take the denomination of heat, as they ſtill excite that ſenſation in us.

The Carteſians, improving on this doctrine, aſſert heat to conſiſt in a certain motion of the inſenſible particles of a body, like that whereby all the parts of the human body are agitated by the motion of the heart and blood.

Our lateſt and beſt writers of experimental and chemical philoſophy differ very conſiderably about heat; the fundamental difference is, whether it be a peculiar property of one certain immutable body called fire, or whether it may be produced mechanically in other bodies, by inducing an alteration in the particles thereof.

The former tenet, which is that of Democritus, and as ancient as the ſyſtem of atoms, had given way to that of the Carteſians and other mechaniſts, but is now with great addreſs retrieved and improved by Homberg, the younger Lemery, s'Graveſande, and particularly Boerhaave. See the article FIRE.

HEAT, in geography. The diverſity of the heat of climates and ſeaſons ariſes from the different angles under which the ſun's rays ſtrike on the earth's ſurface.

It is ſhewn in mechanics, that a moving body ſtriking perpendicularly on another, acts on it with all its force; and that a body ſtriking obliquely acts with the leſs force, the more it deviates from the perpendicular. Now fire moving in right lines muſt follow the ſame law, and conſequently its action muſt be meaſured by the ſine of the angle of incidence: and hence fire, ſtriking on any obſtacle in a direction parallel thereto, has no ſenſible effect, by reaſon the ratio is almoſt infinite, that is nothing.

Hence Dr. Halley gives a mathematical computation of the effect of the ſun under different climates and ſeaſons, going on this principle, that the ſimple action of the ſun, as all other impulſes, is more or leſs forcible, according to the ſines of the angles of incidence, or to the perpendicular let fall on the plane: whence the vertical ray being put for radius, the force of the ſun on the horizontal ſurface of the earth will be to that, as the ſine of the ſun's altitude at any other time. Hence it follows, that the time of the continuance of the ſun's ſhining being taken for a baſis, and the ſines of the ſun's altitudes erected thereon as perpendiculars, and a curve drawn through the extremities of thoſe perpendiculars, the area comprized therein will be proportional to the collection of the heat of all the ſun's beams in that ſpace of time.

Hence it will alſo follow, that under the pole the collection of all the heat of a tropical day is proportionate to a rectangle of the ſine of 23 degrees and a half into 24 hours, or the circumference of a circle; that is, the ſine of 23° and $\frac{1}{2}$ being nearly $\frac{4}{10}$ of radius, as $\frac{8}{10}$ into 12 hours: or the polar heat is equal to that of the ſun continuing 12 hours above the horizon at 53° height, than which the ſun is not five hours more elevated under the equinoctial.

But whereas the nature of heat is to remain in the ſubject, after the luminary is removed, and particularly in the air; under the equinoctial, the 12 hours abſence of the ſun does but little diminiſh the motion impreſſed by the paſt action of his rays, before he riſes again: but under the pole, the long abſence of the ſun for ſix months, wherein extreme cold obtains, hath ſo chilled the air, that it cannot, before the ſun has got far towards it, be any ways ſenſible of his preſence, his beams being obſtructed by thick clouds and perpetual fogs. Add to this, that the different degrees of heat and cold in different places depend, in a great meaſure, upon the accident of ſituation with regard to mountains, vallies, &c. the firſt greatly helping to chill the air by the winds that blow over them, and which come in eddies through the adjoining levels. Mountains ſometimes have the effect of a burning mirrour on the adjacent plane, and the ſame effect is ſometimes produced from the concave or convex parts of clouds, either by refraction or reflection. And ſome take theſe to be ſufficient to produce thunder, lightning, &c.

A ſtony, ſandy, or chalky ſoil reflects moſt of the rays into the air again and retains but few, whereby a conſiderable acceſſion of heat is made to the air; as, on the contrary, black earths abſorb moſt of the rays and return few into the air.

The following table gives the heat to every 10° of lat. to the equinoctial and tropical ſun, whereby an eſtimate may be made of the intermediate degrees.

Lat.	Sun in ♈ ♎	Sun in ♋	Sun in ♑
0	20000	18341	18341
11	19696	20290	15834
20	18797	21737	13166
30	17321	22651	10124
40	15321	23048	6944
50	12855	22991	3798
60	10000	22773	1075
70	6840	23543	000
80	3473	24673	000
90	0000	25055	000

Hence are deducible the following corollaries: 1. That the equinoctial heat, when the ſun is vertical, is as twice the ſquare of the radius, which is a ſtandard to be compared with in all other caſes. 2. That, under the equinoctial, the heat is as the ſine of the ſun's declination. 3. That in the frigid zones, when the ſun does not ſet, the heat is as the circumference of a circle into the ſine of the altitude at 6: and conſequently, that in the ſame latitude, theſe aggregates of warmth are as the ſines of the ſun's declination; and at the ſame declination of the ſun

ſun, they are as the ſines of the latitudes into the ſines of the declination. 4. That the equinoctial day's heat is every-where as the co-ſine of the lat. 5. In all places where the ſun ſets, the difference between the ſummer and winter heats, when the declinations are contrary, is equal to a circle multiplied into the ſine of the altitude at ſix in the ſummer parallel; and conſequently thoſe diſferences are the ſines of lat. into the ſines of declin. 6. From the table it appears that the tropical ſun under the equinoctial has of all others the leaſt force: under the pole it is greater than any other day's heat whatever, being to that of the equinoctial as 5 to 4.

Thus all the actions of the ſun throughout the year, and that part of heat which ariſeth ſimple from the preſence of the ſun may be brought to a geometrical certainty. The heat of the ſun, for any ſmall portion of time, is always as a rectangle contained under the ſine of the angle of incidence of the ray that produces it.

HEAT, in the animal œconomy, known by the ſeveral names of natural heat, vital heat, innate heat, and animal heat, is commonly ſuppoſed to be that generated by the attrition of the parts of the blood, occaſioned by its circulatory motion, eſpecially in the arteries.

To what organs, or operations, the heat of the human body, and other animal bodies, is owing, is hitherto extremely doubtful. The opinions that at preſent prevail are, 1. That the heat of animal bodies is owing to the attrition betwixt the arteries and the blood. 2. That the lungs are the fountain of this heat. 3. That the attrition of the parts of the ſolids on one another produce it. 4. That it is owing to the mechanical attrition of the particles of our fluids. To which opinions Dr. Stevenſon of Edinburgh, adds a 5, viz. That whole proceſs by which our aliment and juices are conſtantly undergoing ſome alteration.

HEAVEN, *Cœlum*, that orb over our heads where the heavenly bodies revolve. Philoſophers, divines, and aſtronomers, lay down divers heavens, as the higheſt or empyrean heaven, the æthereal or ſtarry heaven, and the planetary heaven.

HEAVEN, among divines, called the empyrean, is the abode of God, and bleſſed ſpirits, ſuch as angels, and the ſouls of the righteous deceaſed. This in Scripture is frequently called the kingdom of heaven, the heaven of heavens, the third heaven, paradiſe, the new Jeruſalem, &c. This heaven is conceived as a place where the Deity is pleaſed to afford a more immediate view of himſelf than in the other parts of the univerſe, where he is likewiſe preſent. This makes the beatific viſion. The inſpired writers, particularly Iſaiah and St. John the divine, give us very magnificent deſcriptions of heaven, its ſtructure, apparatus, and attendance. Euſebius charges Plato with borrowing his deſcription of heaven, *in Dial. de Anima*, from the Scriptures, ſo near is the reſemblance.

The ancient Romans had a kind of heaven in their theology, called Elyſium or Elyſian fields, as the Mahometans have their paradiſe, which is very groſs, agreeable to the genius of their religion.

HEAVEN, in aſtronomy, called the æthereal and ſtarry heaven, is that immenſe region where the ſtars, planets, and comets are ranged. It is vulgarly called the firmament, though the original word uſed by Moſes, when ſpeaking of the ſecond day's creation, properly ſignifies no more than expanſe, a term adapted to the impreſſion which the heavens make on our ſenſes; whence in other parts of Scripture the heaven is compared to a curtain or tent to dwell in.

Deſcartes, Kircher, &c. have eaſily demonſtrated this heaven not to be ſolid, but fluid, though they ſtill ſuppoſe it full, without any vacuity, and cantoned out into ſo many vortices.

Sir Iſaac Newton has abundantly ſhewn the heavens to be void of all reſiſtance, and conſequently almoſt all matter, from the planets perſiſting in their motions without any ſenſible diminution of their velocity, and the comets paſſing freely in all directions.

The ancient aſtronomers aſſumed as many heavens as they obſerved different motions therein; all which they ſuppoſed ſolid and ſpherical. Thus, there were ſeven heavens for the ſeven planets; the eighth was for the fixed ſtars, which they called firmament: Ptolemy adds a ninth, which he called the primum mobile. K. Alphonſus added two cryſtalline heavens to account for ſome irregularities in the heavenly motions; and, laſtly, an empyrean heaven was drawn over the whole for the reſidence of the Deity.

The cryſtalline heavens were ſuppoſed to have no ſtars fixed in them; they encompaſſed the inferior, ſtarry, and planetary heavens, communicating their motion thereto. The firſt ſerved to account for that ſlow motion of the fixed ſtars, whereby they advance a degree eaſtward in ſeventy years: whence the preceſſion of the equinoxes. The ſecond was to ſolve the phænomena of libration or trepidation.

Eudoxus ſuppoſed twenty-three heavens, Calippus thirty, Regiomontanus thirty-three, Ariſtotle forty-ſeven, and Fracaſtor ſeventy.

The aſtronomers did not much concern themſelves about the reality of theſe heavens, provided they ſerved to account for any of the celeſtial motions, and agreed with phænomena.

HEAVING, among ſeamen, the act of turning a windlaſs or capſtern by the help of long bars thruſt into holes or mortices cut in the bodies of them. See the articles WINDLASS and CAPSTERN.

HEAVING *a-head*, drawing the ſhip a-head by heaving in the cable, and thereby making her advance towards the anchor or other place where the cable or rope which draws her onward is faſtened.

HEAVING-DOWN, the ſame with careening. See CAREENING.

HEBDOMARY, a ſolemnity of the ancient Greeks, in honour of Apollo, in which the Athenians ſung hymns to that god, and carried in their hands branches of laurel. The word ſignifies the ſeventh day, this ſolemnity being obſerved on the ſeventh day of every lunar month.

HEBRAISM, an idiom or peculiar manner of expreſſion in the Hebrew language.

HEBREW, or HEBREW-LANGUAGE, that ſpoken by the ancient Jews, and wherein the Old Teſtament is wrote.

This appears to be the moſt ancient of all the languages in the world, at leaſt we know of none older: and ſome learned men are of opinion that this is the language in which God ſpoke to Adam in Paradiſe, and in which the ſaints will ſpeak in heaven.

The books of the Old Teſtament are the only pieces to be found, in all antiquity, written in pure Hebrew; and the language of many of theſe is extremely ſublime: it appears perfectly regular, and particularly ſo in its conjugations; indeed, properly ſpeaking, it has but one conjugation, but this is varied in each ſeven or eight different ways, which has the effect of ſo many different conjugations, and affords a great variety of expreſſions to repreſent by a ſingle word the different modifications of a verb, and many ideas which in the modern, and in many of the ancient and learned languages, cannot be expreſſed without a periphraſis.

The primitive words, which are called roots, have ſeldom more than three letters or two ſyllables.

In this language there are twenty-two letters, only five of which are uſually reckoned vowels, which are the ſame with ours, viz. *a*, *e*, *i*, *o*, *u*; but then each vowel is divided into two, a long and a ſhort, the ſound of the former being ſomewhat grave and long, and that of the latter ſhort and acute: it muſt however be remarked, that the two laſt vowels have ſounds that differ in other reſpects beſides quantity, and a greater or leſs elevation. To theſe ten or twelve vowels may be added others called ſemi-vowels, which ſerve to connect the conſonants, and to make the eaſier tranſitions from one to another. The number of accents in this language are, indeed, prodigious: of theſe there are near forty, the uſe of ſome of which, notwithſtanding all the enquiries of the learned, are not yet perfectly known. We know, in general, that they ſerve to diſtinguiſh the ſentences like the points called commas, ſemicolons, &c. in our language; to determine the quantity of the ſyllables, and to mark the tone with which they are to be ſpoke or ſung.

HEBREWS, or *Epiſtle to the* HEBREWS, a canonical book of the New Teſtament.

Though

Though St. Paul did not prefix his name to this Epiſtle, the concurrent teſtimony of the beſt authors, ancient and modern, afford ſuch evidence of his being the author of it, that the objections to the contrary are of little or no weight. His mentioning himſelf in it, as lately a priſoner in Italy, and his promiſe to viſit the Hebrews, together with Timothy, who had been releaſed from impriſonment, both denote the writer, and the time of his writing this Epiſtle, that it was juſt after the deliverance of St. Paul from his firſt trial at Rome.

The Hebrews, to whom this Epiſtle was wrote, were the believing Jews of Paleſtine, and its deſign was to convince them, and, by their means, all the Jewiſh converts, whereſoever diſperſed, of the inſufficiency and aboliſhment of the ceremonial and ritual law. In order to which he undertakes to ſhew, firſt, the ſuperior excellency of Chriſt's perſon above that of Moſes: ſecondly, the ſuperiority of Chriſt's prieſthood above the levitical: thirdly, the mere figurative nature, and utter inſufficiency of the legal ceremonies and ſacrifices: and, fourthly, that to forſake the Moſaical law, was not, as the Jews boldly aſſerted, to apoſtatize from God, but was their indiſpenſible duty and obligation. Theſe particulars are intermixed with proper inferences and exhortations, all tending to ſhew the Jewiſh Chriſtians the unreaſonableneſs, folly, and danger of relapſing into Judaiſm.

HECATOMB, *Hecatombe*, in antiquity, a ſacrifice of an hundred oxen, at as many altars, and by as many prieſts.

The word is Greek, εκατομβη, and derived from εκατον, an hundred, and βους, an ox, as conſiſting of an hundred bullocks; others from εκατον, an hundred, and πους, a foot, as if the ſacrifice might conſiſt only of twenty-five quadrupeds.

Pythagoras we are told ſacrificed a hecatomb to the muſes, for joy of diſcovering the demonſtration of the 47th Prop. of Euclid's firſt book.

HECKLE. See HATCHEL.

HECKLING *of Hemp and Flax*. See HEMP and FLAX.

HECTIC, or HECTIC FEVER. See *Slow* FEVER.

HEDERA, ivy, in botany. See IVY.

HEDERA TERRESTRIS, ground ivy, a genus of plants called by Linnæus glechoma. See GLECHOMA and GROUND IVY.

HEDGE, in agriculture, a fence incloſing a field or garden, made of buſhes, boughs, &c. interwoven together.

The word is Saxon, *hegge*, or *hege*, which literally ſignifies circumference or incloſure.

For quickſet hedges, hawthorn is allowed to be the beſt of all the Engliſh ſhrubs. The beſt method of raiſing this for uſe, is to put the haws into the ground as ſoon as ripe, and cover them with earth; and by the ſpring twelvemonth, the young ſhoots will be fit to tranſplant from the ſeed-plot into hedge-rows. The crab-tree is a common mixture with the hawthorn in hedges; but grows faſter than the hawthorn, and requires cutting to keep the hedge even. The young hawthorns raiſed from ſeed always thrive better than thoſe picked up wild in the fields. *Moreton's Northampt.*

The great conſideration, in making quick-ſet hedges, is to bring the plants from a worſe ſoil than that in which it is intended to ſet them. They muſt be about the thickneſs of one's thumb, well rooted and ſtrong, and muſt be planted about four or five inches out of the ground. If there be a ditch to the hedge, it ſhould be three feet wide at the top, one at the bottom, and two deep; and, if wider, then deeper in proportion.

If the bank be without a ditch, the plants ſhould be ſet in two rows at a foot diſtance below one another. The turf is to be laid with the graſs ſide downward on that ſide of the ditch on which the bank is deſigned to be made, and ſome of the beſt mould muſt be laid upon it to bed the quick; then the quick is to be laid upon it a foot aſunder, ſo that the end of it may be inclining upwards; and at equal diſtances of thirty feet, plant an aſh, oak, crab, or elm, to grow with the quick. When the firſt row of quick is laid, it muſt be covered with mould, and the turf laid upon it as before, and ſome more mould upon that; ſo that when the bank is a foot high, another row of ſets may be laid againſt the ſpaces of the lower quick. Theſe muſt be then covered as the former, and the bank is to be then topped with the bottom of the ditch, and a dry or dead hedge laid, to ſhade the under plantation. There ſhould then be ſtakes driven into the looſe earth quite down to the firm ground, at about two feet and a half diſtance from each other; oak ſtakes are accounted the beſt of all for uſe, and, the next to this, thoſe of black-thorn or ſallow. Small buſhes are to be laid below, but not too thick, only to cover the quick from being injured, as it ſhoots. *Miller's Gard. Dict.*

HEEL, in anatomy, the hind-part of the foot. See FOOT and CALCANEUM.

HEEL *of a Horſe*, the lower hinder part of the foot, comprehended between the quarters, and oppoſite to the toe.

The heel of a horſe ſhould be high and large, and one ſide of it ſhould not riſe higher than the other upon the paſtern. To recover the heels of a horſe that is hoof-bound, you ſhould take out his ſole, and keep his heels very wide, by which they will be reſtored in a month.

HEEL *of a Maſt*, the foot or lower end of it.

HEEL *of a Ship*, the hindmoſt or aftmoſt part of a ſhip's keel.

HEELING, in the ſea-language, ſtooping or inclining to one ſide, either by the preſſure of ſail at ſea, or to clean the ſhip's bottom, &c. See the article CAREEN and BOOT-TOP.

HEGIRA, in chronology, a celebrated epocha among the Arabs and Mahometans.

The word is Arabic, *hagirah*, which ſignifies flight.

The event which gave occaſion to this epocha was Mahomet's flight from Mecca; the magiſtrates of this city, fearing this impoſtor might raiſe a ſedition, expelled him on the 15th or 16th of July, in the year 622, being the fourteenth year of his aſſuming the character of prophet, and under the reign of the emperor Heraclius.

There is an earlier Hegira in the ſame year, when Mahomet and his diſciples relinquiſhed Medina. Both theſe hegira's the Mahometans call hegiratan.

HEIGHT, *Altitudo*, in geometry. See the article ALTITUDE.

HEIR, *Hæres*, in law, ſignifies a perſon who ſucceeds another by deſcent to lands, tenements, hereditamens, being an eſtate of inheritance, or an eſtate in fee; becauſe nothing paſſes by right of inheritance but in fee.

HEIR-APPARENT is a perſon ſo called in the lifetime of his anceſtor, at whoſe death he is heir at law.

HEIRESS, a female heir to one who has an eſtate in lands, &c. Stealing an heireſs, and marrying her againſt her will, was declared felony by 3 Hen. VII.

HEIR-LOOME is a word that comprehends in it divers pieces of furniture; as the firſt bed, and other things, which by the cuſtom of ſome places have belonged to a houſe for ſeveral deſcents. Theſe are never inventoried after the death of the owners as chattles; and therefore do not go to the executor or adminiſtrator, but to the heir along with the houſe, by cuſtom, and not by common law.

HALENIUM, ELECAMPANE, in botany, &c. is ranked by Linnæus among the ſtar-worts. See ELECAMPANE.

HELEPOLIS, in the ancient art of war, a machine for battering down the walls of a place beſieged, the invention of which is aſcribed to Demetrius, the Poliorcete.

Diodorus Siculus ſays, that each ſide of the helepolis was four hundred and five cubits broad, and ninety in height; that it had nine ſtages, and was carried on four ſtrong ſolid wheels eight cubits in diameter; that it was armed with large battering rams, and had two roofs capable of ſupporting them; that in the loweſt ſtages there were different ſorts of engines for caſting ſtones; and in the middle they had large catapultas for lancing arrows, and ſmaller in thoſe above, with a number of expert men for working all theſe machines.

HELIACAL, in aſtronomy, a term applied to the riſing or ſetting of the ſtars, or, more ſtrictly ſpeaking, to their emerſion out of and immerſion into the rays and ſuperior ſplendor of the ſun.

A ſtar is ſaid to riſe heliacally, when, after being in conjunction with the ſun, and ſo inviſible, it gets at ſuch a diſtance as to be ſeen before the ſun riſe; and it ſets heliacally, when it approaches ſo near the ſun as to be hid by his rays: ſo that ſtrictly theſe are only an apparition and occultation.

The heliacal riſing of the moon happens when ſhe is ſeventy degrees diſtant from the ſun; for the other planets twenty degrees diſtance is required; and for the ſtars more or leſs, according to their magnitude.

To find by the globe the time of the year when any known ſtar or planet will riſe or ſet heliacal: rectify the globe, and bring the ſtar or planet to the eaſt part of the horizon; then ſee what degree of the ecliptic is elevated above the weſtern horizon, according to the reſpective arch of viſion; then the oppoſite degree on the horizon, ſo found, compared with the calendar, will ſhew you the day of its riſing; and for its ſetting bring the ſtar or planet to the weſt-ſide of the horizon; obſerve to the eaſt what degree is elevated equal to the known arch of viſion; then, by the oppoſite degree, will be found the day of its ſetting.

HELIANTHEMUM, ſmall ſun-flower, in botany, is called by Linnæus ciſtus. See CISTUS.

HELIANTHUS, the great ſun-flower, in botany, a genus of plants, the compound flower of which is radiated, with a multitude of cylindraceous hermaphrodite flowers on the diſc, and a few very long ligulated female ones: the ſtamina are five filaments; and the ſeeds are ſingle, and contained in the cup. The flowers are yellow, and often more than a foot in diameter.

HELICE, in aſtronomy, the ſame with urſa major. See URSA.

HELICTERES, the ſcrew tree, in botany, a genus of plants, the flower of which conſiſts of five oblong petals, equal in breadth; and the fruit is compoſed of five unilocular capſules, containing a great many kidney-ſhaped ſeeds, and twiſted ſpirally about one another.

HELIOCENTRIC *Place of a Planet*, that place or point in the ecliptic wherein a planet would appear to a ſpectator placed in the center of the ſun.

The word is Greek, and compounded of ηλιος, the ſun, and κεντρον, a center.

The heliocentric place is the ſame with the longitude of a planet viewed from the ſun.

HELIOCENTRIC *Latitude of a Planet*, the latitude it would appear in at any time to a ſpectator placed in the ſun.

HELIOCOMETES, a phænomenon ſometimes obſerved about ſun-ſetting; being a large luminous tail, or column of light, proceeding from the body of the ſun, and dragging after it, not unlike the tail of a comet; whence the name.

HELIOSCOPE, in optics, a ſort of teleſcope, peculiarly adapted for obſerving the ſpots, eclipſes, &c. of the ſun.

The word is Greek, and compounded of ηλιος, the ſun, and σκοπεω, to view.

There are various apparatus's of this kind. Dr. Hook recommends four reflecting glaſſes placed in the tube, whereby the force of the rays will be ſo weakened, as only to ſtrike the eye with a 256th part of their force; and this he prefers to all others.

M. Huygens only blackens the inſide of the eye glaſs of the teleſcope, by holding it over the flame or ſmoke of a lamp, &c. or rather he blackens a piece of plain glaſs, and holds it between the eye and the object glaſs; or, which is beſt of all, he claps the ſmoked glaſs to another with a rim of thick paper between to keep the black from rubbing off, and fits the two into a frame, to be applied between the eye and the eye-glaſs. But the beſt method of viewing this luminary is by the ſolar teleſcope. See *Solar* TELESCOPE.

HELIOSTATA, in optics, an ingenious inſtrument invented by the learned Dr. s'Graveſande; ſo called from its uſe, which is to fix, as it were, the rays of the ſun in a horizontal direction a-croſs the dark chamber, all the while it is in uſe.

The word is formed from the Greek, ηλιος, the ſun, and ϛατιζω, to ſtop or fix.

This inſtrument is an automaton, or piece of clock-work, whoſe parts are as follows. A A (plate LXXIII, *fig.* 5.) is a frame, about which a metalline ſpeculum S is ſuſpended, moveable about its axis, by means of two ſmall ſcrews *a*, *a*. This frame is fixed to the piece C, which being hollow is moveable upon the cylindric ſhaft P. This pillar is fixed on a triangular baſe or foot ſet perpendicular, by the three ſcrews B, B, B.

On the back part of the ſpeculum is fixed a long cylindric wire, or tail D, in a perpendicular poſition. By this it is connected to the ſecond part of the helioſtata, which is a common thirty-four hour clock, repreſented at H; the plane of which clock is ſet parallel to that of the equator in any given place. This clock is ſuſtained on the column F G, in which it is moveable up and down by a thin lamina or plate that enters it as a caſe, and fixed to a proper height by two ſcrews *d*, *d*, at the ſide. The whole is truly adjuſted to a perpendicular ſituation by means of the three ſcrews I, I, I, in the tripod L, L, M, and the plummet Q, whoſe capſis muſt anſwer to the point *o* beneath.

The axis of the wheel which moves the index N O, over the hour circle, is ſomewhat large, and perforated with a cylindric cavity approaching a little to a conical figure; and receives the ſhank of the ſaid index N O very cloſe and tight, that by its motion the index may be carried round. In the extremity O of the index is a ſmall cylindric piece, with a cylindric perforation to receive the tail *t* of the fork T, yet ſo as to admit a free motion therein. In each ſide of the fork are ſeveral holes exactly oppoſite to each other, in which go the ſcrews *r*, *r*, upon whoſe ſmooth cylindric ends moves the tubular piece R.

When the machine is to be fixed for uſe, another part is made uſe of to adjuſt it; which is called the poſitor, and is denoted by the letters V X Y Z, *fig.* 6.

The cylinder C is removed with a ſpeculum from the foot P, and the braſs column V X put on in its ſtead, and adheres more ſtrictly to the pin *e*, that it may keep its poſition while the machine is conſtituted.

On the top of the column, about X as a center, moves the lever Y Z, ſo that it may be any how inclined to the horizon, and keep its poſition. The arm Y X may be of any length at pleaſure; but the arm X Z is of a peculiar conſtruction, and of a determinate length. To this arm, which extends no farther than *y*, is a ſliding-piece Z *x*, ſharp-pointed at Z. By this the arm X Z is determined to a given length, the piece Z *x* being fixed by the ſcrews *zz*. Upon this arm is drawn the ſhort line *v x*, by which it may be lengthened in the whole, and is $\frac{8}{100}$ of the whole length X Z, when ſhorteſt. The reaſon is, this arm is always to increaſe and decreaſe in proportion to the ſecant of the ſun's declination to the radius X Z, when ſhorteſt; but the radius is to the ſecant of 23° 30′, the ſun's greateſt declination, as 10000000 to 10904411, or as 100 to 109. Now the reaſon of this conſtruction of the arm X Z, is to find for any given day the diſtance of the center of the ſpeculum S from the top *l* of the ſtyle *l* N, which muſt ever be equal to the ſecant of the ſun's declination; for it muſt always be equal to the diſtance of the top of the ſaid ſtyle, *l*, from the center of the cylinder R in the fork T, and that is always equal to the ſaid ſecant of declination.

For ſince the ſtyle *l* N and the fork T are in a poſition parallel to each other, therefore the middle hole in the ſides of the fork being, as they muſt be, of the ſame height above the end of the index O, as is the height of the ſtyle N *l*, it is evident that on an equinoctial day the ſun's rays will paſs directly through the perforation of the piece R, if it be put in a poſition parallel to the plane of the ecliptic, or that of the clock; and alſo that the top of the ſhadow of the ſaid ſtyle will fall exactly on the ſaid hole.

In this caſe the top of the ſtyle is at the leaſt diſtance from the central point of R, and therefore may be repreſented by radius; while in any other poſition above or below, the diſtance will increaſe in proportion to the ſecant of the angle which the rays make with this firſt or middle ray, that paſs by the top of the ſtyle, and through the hole R.

Now it may be demonſtrated, that on any day of the

year, if the clock and its pedeſtal be ſo fixed that the line of XII be exactly in the meridian, and that the poſition of R in the fork be ſuch that the ſun's rays go directly through it, and the ſhadow of the ſtyle's top fall juſt upon the hole; moreover, if the diſtance of the center of the ſpeculum S from the top of the ſtyle *l* be made equal, by the poſitor, to the diſtance of the central point of R therefrom; and, laſtly, the tail of the ſpeculum D E paſſing through R; then if the clock be put into motion, the index N O ſhall carry about the tail of the ſpeculum, in ſuch a manner, that at all times of that day, when the ſun can come upon the ſpeculum, it will reflect the rays conſtantly in one and the ſame poſition and direction all the time without variation.

The machine thus conſtituted, is placed in a box or caſe, and ſet in a window with one ſide open, expoſed to the ſun, and all the other parts cloſe; ſo that when the room is made dark, and the ſolar microſcope fixed to the fore-part of the box in which the helioſtata is placed, juſt againſt the center of the ſpeculum to receive the reflected horizontal beam, all the experiments of the darkened room are then performed as uſual.

This is a very ingenious conſtruction of a ſolar microſcope-apparatus, but we fear too expenſive and troubleſome for common uſe. However, it is eaſy to ſee that this machine is capable of being greatly reduced; ſince it may be made to anſwer the end very well without a clock, and the ſpeculum may be glaſs inſtead of metal, and all fixed in one pedeſtal. See the article MICROSCOPE.

HELIOPTROPE, in natural hiſtory, a hard bluiſh-green jaſper, with red variegations. See the article JASPER.

HELIX, in geometry, the ſame with a ſpiral line.

The word is Greek, ἕλιξ, a wreath, or winding, and derived from εἱλεω, or ἑλισσω, to environ.

HELIX, in architecture. Some diſtinguiſh between it and ſpiral. Daviler ſays a ſtaircaſe is helical, when the ſteps wind round a cylindrical newel; whereas the ſpiral winds round a cone, continually approaching nearer its axis. Helix alſo denotes, in architecture, the caulicules or little volutes under the flower of the Corinthian capital, called likewiſe urillæ.

HELIX, in anatomy, the external circle or border of the ear, in contradiſtinction to the inner protuberance correſponding thereto, called the anthelix. See EAR.

HELL, *Gehenna*, *Tartara*, *Hades*, *Infernus*, &c. the place of divine puniſhment after death, in contradiſtinction to heaven. See the article HEAVEN.

As all religions have ſuppoſed a future ſtate of exiſtence after this life, ſo all have their hell or place of torment, in which the wicked are ſuppoſed to be puniſhed. The hell of the ancient heathens was divided into two manſions, the one called Elyſium, on the right hand, pleaſant and delightful, appointed for the ſouls of good men; the other called Tartara, on the left, a region of miſery and torment, appointed for the wicked. The latter was only hell in the preſent reſtrained ſenſe of the word. See the article ELYSIUM.

Of all the poets of antiquity, Virgil is the moſt particular in his deſcription of hell; having carried his hero thither, and given him a full view of theſe infernal regions: for an account of which we muſt refer the reader to the ſixth Æneid of that poet, where the many dreadful apparitions, as gorgons, harpies, chimæras, and the like, are ſtrongly painted, and a deſcription of Charon, the old ferryman of hell, his buſineſs, together with the office of Minos and Radamanthus, two of the judges of hell, are very lively repreſented. The opening of the adamantine gate diſcovers to Æneas the inmoſt receſſes of Tartara, or hell, which according to the poet is twice as deep as the earth is diſtant from the ſkies. Here Æneas ſees various perſons condemned to puniſhment, as alſo the different kinds and forms of torture, which are ſo numerous, that the poet concludes, *non mihi ſi linguæ centum*, &c.

"Had I an hundred mouths, an hundred tongues,
"And throats of braſs inſpir'd with iron lungs;
"I could not half theſe horrid crimes repeat,
"Nor half the puniſhments theſe crimes have met."
Dryden.

The philoſophers were of opinion, that the infernal regions were at an equal diſtance from all the parts of the earth; nevertheleſs it was the opinion of ſome, that there were certain paſſages which led thither, as the river Lethe, near the Syrtes, and the Acheruſian cave in Epirus. At Hermione it was thought, that there was a very ſhort way to hell; for which reaſon, the people of that country never put the fare into the mouths of the dead to pay their paſſage. Ulyſſes, according to Homer, went by ſea to the country of the Cimmerians, in order to go thither; and Æneas went by the lake of the cave of Avernus.

The Jews placed hell in the center of the earth, and believed it to be ſituated under waters and mountains. According to them there are three paſſages leading to it: the firſt is in the wilderneſs, and by that Korah, Dathan, and Abiram, deſcended into hell; the ſecond is in the ſea, becauſe Jonah, who was thrown into the ſea, cried to God out of the belly of hell; the third is in Jeruſalem, becauſe it is ſaid, "The fire of the Lord is in Zion, and his furnace is in Jeruſalem." They likewiſe acknowledged ſeven degrees of pain in hell, becauſe they find this place called by ſeven different names in Scripture. Though they believed that infidels, and perſons eminently wicked, will continue for ever in hell; yet they maintained, that every Jew who is not infected with ſome hereſy, and has not acted contrary to the points mentioned by the Rabbins, will not be puniſhed therein for any other crimes above a year at moſt.

The Mahometans believe the eternity of rewards and puniſhments in another life. In the Koran it is ſaid, that hell has ſeven gates, the firſt for the Muſſulmans, the ſecond for the Chriſtians, the third for the Jews, the fourth for the Sabians, the fifth for the Magians, the ſixth for the Pagans, and the ſeventh for the hypocrites of all religions.

Among Chriſtians, there are two controverted queſtions in regard to hell; the one concerns locality, the other the duration of its torments. The locality of hell, and the reality of its fire, began firſt to be controverted by Origen. That father interpreting the Scripture account metaphorically, makes hell to conſiſt not in external puniſhments, but in a conſciouſneſs or ſenſe of guilt, and a remembrance of paſt pleaſures.

Among the moderns, Mr. Whiſton advanced a new hypotheſis. According to him, the comets are ſo many bells appointed in their orbits alternately to carry the damned into the confines of the ſun, there to be ſcorched by its violent heat, and then to return with them beyond the orb of Saturn, there to ſtarve in theſe cold and diſmal regions. Another modern author, not ſatisfied with any hypotheſis hitherto advanced, aſſigns the ſun to be the local hell. As to the ſecond queſtion, viz. the duration of hell torments, we have Origen again at the head of thoſe who deny that they are eternal; it being that father's opinion, that not only men, but devils, after a due courſe of puniſhment ſuitable to their reſpective crimes, ſhall be pardoned and reſtored to heaven. The chief principle upon which Origen built his opinion, was the nature of puniſhment, which he took to be emendatory, applied only as phyſic for the recovery of a patient's health. The chief objection to the eternity of hell torments among modern writers, is the diſproportion between temporary crimes and eternal puniſhments. Thoſe who maintain the affirmative, ground their opinions on the Scripture accounts, which repreſent the pains of hell under the figure of a worm which never dies, and a fire which is not quenched; as alſo upon the words, "Theſe ſhall go away into everlaſting puniſhment, but "the righteous into life eternal."

HELLEBORE, *Helleborus*, in botany, a medicinal plant which the ancients reputed as a ſpecific for the cure of melancholy and madneſs, &c. There are two kinds of it, white and black hellebore.

White HELLEBORE, *Helleborus Albus*, ſneeze-wort, a plant with large oval ribbed leaves, crumpled and plaited as it were, ſet alternately on a round firm ſtalk, and embracing it by a tubulous baſis: in their boſoms, towards the top, appear cluſters of hexapetalous greeniſh-white flowers, followed each by three flat pods containing many triangular ſeeds: the root is ſhort and thick, with many

merous fibres hanging from it, externally of a brown colour, internally white. It is common on mountainous places in Germany, Switzerland, and ſome other parts of Europe.

White hellebore root has, when freſh, a diſagreeable ſmell; but as brought into the ſhops, ſcarcely any: its taſte is nauſeous, bitteriſh, acrid, very penetrating and durable. The juice of the freſh root, in taſte extremely acrid, is ſaid, when mixed with the blood, to act as a poiſon. The powder of the dry root is ſometimes mixed with external applications for deſtroying cutaneous inſects: ſnuffed up the noſe, in ſmall quantity, it proves a violent ſternutatory, and in this intention is ſometimes uſed in lethargic and other diſorders.

Black HELLEBORE, *Helleborus Niger*, or Chriſtmas-flower, a low plant, without any other ſtalk than the pedicles of the leaves and flowers, which are pretty thick, and generally ſtreaked with red or purple: the leaf is divided, quite to the pedicle, into ſix, ſeven, or more, ſmooth, firm ſegments, indented from about the middle to the extremity: the flower is large, naked, pentapetalous, of a pale roſe colour, with numerous ſtamina in the middle, which are followed by five or ſix pods full of ſhining blackiſh ſeeds, the petala continuing, and changing greeniſh: the root conſiſts of numerous fibres, hanging generally from a knotty head, externally of a black colour, internally white. It is perennial, grows wild in the mountainous parts of Germany; and flowers in our gardens in January.

Black hellebore root, in doſes of from ten grains to half a dram, proves a very ſtrong, though not very violent, cathartic. The hellebore of the ancients, which was never ventured on without extreme caution and as a laſt reſource, appears to have been a different ſpecies from ours, much larger and of more violent operation, called by Tournefort *helleborus niger orientalis, ampliſſimo, caule præalto, flore purpuraſcente*, which is ſtill ſaid to be found in plenty about Mount Olympus, and in the iſland of Anticyra, celebrated of old for the production of this reputed antimaniacal drug. In the preſent practice, this root or its preparations are uſed ſometimes as a purgative in hydropic and other caſes where the ſtronger cathartics are required, but oftener in ſmall doſes as an attenuant and deobſtruent. It is found particularly ſerviceable againſt obſtinate ſuppreſſions of the menſtrual purgations, in plethoric habits and ſanguine conſtitutions, where chalybeates are ineffectual or injurious.

The extract made with water is the beſt and ſafeſt preparation of this root when deſigned for a cathartic; as it contains both the purgative and diuretic parts of the hellebore, and as the irritating power of its active matter is conſiderably abated by the boiling: it may be given from eight or ten grains to a ſcruple or more, but is uſed oftener in conjunction with other materials of ſimilar intention than by itſelf. A tincture made in proof ſpirit appears the moſt eligible preparation for the purpoſes of an alterative or deobſtruent: four ounces of the root may be digeſted in a quart of the ſpirit, with the addition of thirty or forty grains of cochineal, to render the colour more ſightly; and the filtered tincture given to the quantity of a tea ſpoonful, twice a day, in warm water, or any other convenient vehicle.

HELLENISM, a ſort of Græciſm; a phraſe peculiarly adapted to the genius of the Greek tongue.

Helleniſm is diſtinguiſhed from Græciſm, in that the former is not applied to authors who have wrote in Greek, but to thoſe who, writing in ſome other language, uſe terms peculiar to the Greek.

HELLENISTIC, or HELLENISTIC LANGUAGE, that ſpoken among the Helleniſts.

The critics are divided as to their language. Several of them, among which are Druſius and Scaliger, take it to be the language uſed among the Græcian Jews: in this language the tranſlation of the Seventy was wrote, and the books of the New Teſtament compoſed: it was only thus denominated to ſhew that it was Greek mixed with Hebraiſms and Syriaciſms.

HELM, in the marine, an engine of wood hung on the outſide of a ſhip behind, upon certain googings bolted to the ſtern-poſt, upon which it revolves, and by its motion directs the courſe of the ſhip at ſea.

The helm is compoſed of two or three parts, viz. the rudder, the tiller, and the wheel; this laſt part however is ſeldom uſed but in men of war, and the largeſt merchant-ſhips.

The rudder is that part of the helm which is hung on the outſide of the ſtern-poſt, as before deſcribed: in the top of the rudder there is a mortice cut, into which is firmly bolted the tiller, which is a piece of timber thruſt into the rudder to turn it; and, laſtly, the wheel is employed to move the tiller with greater facility from one ſide to the other, in directing the ſhip.

HELMET, an ancient defenſive armour worn by horſemen, both in war and in tournaments. It covered both the head and face, only leaving an aperture in the front ſecured by bars, which was called the viſor.

It is ſtill uſed in heraldry by way of creſt over the ſhield or coat of arms, in order to expreſs the different degrees of nobility, by the different manner in which it is borne. Thus a helmet in profile is given to gentlemen and eſquires: to a knight, the helmet ſtanding forward, and the beaver a little open: the helmet in profile and open, with bars, belongs to all noblemen under the degree of a duke: and the helmet forward and open, with many bars, is aſſigned to kings, princes, and dukes.

HELVE, a term uſed among country people for the handle of a hatchet, pick-ax, mattock, or the like.

HELXINE, buck-wheat. See the article BUCK-WHEAT.

HEMERODROMI, in Grecian antiquity, centinels and guards appointed for the ſecurity and preſervation of cities and other places.

HEMICRANIA, in medicine, a ſpecies of head-ach, wherein only one half or ſide of the head is affected. See HEAD-ACH.

HEMICYCLE, in architecture, is defined by Daviler to be an arch forming a perfect ſemicircle. See the articles ARCH and BRIDGE.

To conſtruct ſuch an arch of hewn ſtone, they divide hemicycle into a certain number of equal parts, and faſhion an equal number of vouſoirs, which will complete the arch: however, that there may be no joint in the middle, where the key-ſtone ſhould be, they always take care that the number of vouſoirs be an odd one.

HEMICYCLIUM, in antiquity, a part of the orcheſtra in the ancient theatres.

HEMICYCLIUM alſo ſignified a kind of ſun-dial; being a concave ſemicircle, the upper cuſp of which looked to the north. On the middle of the hemicyclium ſtood a ſtyle, whereof the point that correſponded to the center of the hemicycle, repreſented the center of the earth; and its ſhadow, being projected on the concavity of the hemicycle, which repreſented the ſpace between the two tropics, pointed out not only the declination of the ſun, and the day of the month, but likewiſe the hour of the day.

HEMINA, in Roman antiquity, a liquid meaſure which, according to Arbuthnot, was equal to half a wine-pint Engliſh meaſure; its contents being 2,818 ſolid inches. See the article MEASURE.

HEMISPHERE, *Hæmiſpherium*, in geometry, the half of a globe or ſphere, when divided into two by a plane paſſing through its center.

The word is Greek, and compounded of *ημισυς*, half, and *σφαιρα*, a ſphere.

The center of gravity of a hemiſphere is $\frac{5}{8}$ of the radius diſtant from the vertex. It is proved in optics, that a glaſs hemiſphere unites the parallel rays at the diſtance of a diameter and one third of a diameter from the pole of a glaſs.

HEMISPHERE, in aſtronomy, particularly denotes one half of the mundane ſphere. The equator divides the ſphere into two equal parts, called the northern and ſouthern hemiſpheres, having the north and ſouth poles in their reſpective zeniths. The horizon alſo divides the ſphere into two hemiſpheres, the upper and lower, having the zenith and nadir in their reſpective vertices.

HEMISPHERE alſo denotes a projection of half the terreſtrial globe or half the celeſtial ſphere on a plane, and is frequently called planiſphere.

HEMISPHEROIDAL, in geometry, an appellation given

given to whatever approaches to the figure of an hemiſphere, but is not exactly ſo.

HEMISTICH, ημιστιχον, in poetry, denotes half a verſe, or a verſe not completed.

Of this there are frequent examples in Virgil's Æneid; but whether they were left unfiniſhed by deſign or not, is diſputed among the learned: ſuch are, *Ferro accincta vocat*, Æ. II. v 614. And, *Italiam non ſponte ſequor*, Æ. IV. v. 361.

In reading common Engliſh verſes, a ſhort pauſe is required at the end of each hemiſtich, or half verſe.

HEMITONE, in the ancient muſic, what we now call a half note or ſemitone.

HEMITRITÆUS, in medicine, a kind of fever denoting the ſame as ſemi-tertian, returning twice every day.

The word is Greek, and compounded of ημισυς, half, and τριταιος, third or tertian.

HEMLOCK. See CICUTA.

HEMP, *Cannabis*, in botany, a very uſeful plant for making cordage and all things of that kind.

The ſtalks of hemp grow to be five or ſix feet high, angular, and covered with a ſtrong tough bark; and cloathed with many digitated leaves, each compoſed of five, ſix, or ſeven parts, long and narrow, ſharp pointed and ſerrated about the edges, the middlemoſt being longeſt, ſet together upon one foot-ſtalk; they are green above and hoary underneath, and rough in handling. The flowers, in that they call the male, grow towards the top of the ſtalk in bunches, ſmall and ſtaminous, which periſh without bringing any ſeed, which is produced by the female without any previous flowers.

Hemp is a uſeful plant, purchaſed at a dear rate from foreigners, when it might be cultivated among ourſelves, to the great benefit of the nation in general. It delights in warm, ſandy, or ſomewhat gravelly ſoil; but it muſt be ſomewhat rich, and of a good depth. The beſt ſeed is that which is brighteſt, and retains its colour and ſubſtance in rubbing. Three buſhels will ſow an acre; but the richer the land is, the thicker it muſt be ſown, and the poorer it is, the thinner. The time of ſowing it, is from the latter end of March, to the end of April, according as the ſpring falls out; but the earlier it is ſown the better. If it be a dry ſeaſon, great care muſt be taken to preſerve it from birds.

The firſt ſeaſon for gathering it is about Lammas, when a good part of it will be ripe; that is, the light ſummer hemp which bears no ſeed, and is called fimble-hemp. When it is ripe the ſtalks grow white, and the leaves fall downwards, turning yellow at the top; it muſt then be pulled up, dried, bound up in bundles as big as may be graſped in both hands, and laid by for uſe. Care muſt be taken not to break what is left ſtanding, becauſe it is to grow till near Michaelmas before it will be fit to gather: this is uſually called karle-hemp. When it is gathered, lay it in the ſun three or four days to dry, and then ſtack or houſe it till the ſeed be threſhed out.

An acre of hemp, in the beſt land, commonly yields about two or three quarters of ſeed, which, with the hemp unwrought, is often worth from 5 to 8 l. but if wrought, from 10 to 12 l. but the fimble-hemp is not worth above half as much as the other.

As to the method of preparing it, after the ſeeds are threſhed out of the heads, and the ſtalks are laid up in bundles and ſteeped in a ſtanding water, the cleaner it is the better; they are faſtened to poles, and left to ſoak about fifteen days; and when the ſubſtance of the ſtalk is almoſt rotten, the bundles are taken out and well dried. But flax, inſtead of being ſteeped in water, is uſually expoſed alternately to the moiſt air of the night, and the heat of the ſun, by which means it receives a finer colour.

When hemp and flax are well penetrated and afterwards completely dried, they are bruiſed by handfuls on a block, with a kind of mallet; all the bullen, which is the inward ſubſtance of the ſtem, flies off in ſhivers, by the force of the blows, and nothing remains in the hands of the beater but the thin bark in large threads, through the whole length of the ſtem. This parcel of threads is afterwards hung on a perpendicular board, and bruiſed with a wooden beetle, in order to ſhake out all the little ſtraws that may happen to remain of the bullen. All the groſs parts are now ſeparated from the ſtem, and the threads of the bark receive their perfection from the comb or hatchel. See HATCHEL.

The refuſe of this combing, which conſiſts of all the threads which are too thick, is called tow, for the uſe of which ſee the article TOW.

Hemp and flax are the materials of a variety of profitable manufactures; for beſides linnen, great quantities of ticken of all fineneſſes, ſail-cloth, incle, tape, ſacking, girtwip, cordage, twine, nets, and many other things are made of them: and they furniſh multitudes of other manufactures, which employ the poor, and bring, by their exports, profit to the nation. But as we are under the neceſſity of importing very large quantities of hemp from foreign countries, the production of this article among ourſelves, and in our plantations, cannot be too plentifully cultivated, nor too highly encouraged.

For the laws relating to hemp and flax, ſee the article FLAX.

HEN, *Gallina*, in ornithology, though uſed in a general ſenſe to ſignify any female bird, is more particularly reſtrained to thoſe of the order of gallinæ.

HEN-BANE, a plant called by botaniſts hyoſciamus. See HYOSCIAMUS.

HEN-MOULD, among farmers, denotes a black ſpungy ſoil, fitter for grazing than for corn.

In ſome places, indeed, they give the name of hen-mould to a rich black earth mixed with whitiſh ſtreaks, which is exceeding fertile.

HENOTICON, in church-hiſtory, a decree or edict of the emperor Zeno, made at Conſtantinople, in the year 482, by which he pretended to reconcile all parties under one faith. It is generally agreed that Peter, patriarch of Alexandria, and Acacius, patriarch of Conſtantinople, were the authors of this decree, and that their deſign was to compliment the emperor with a right of preſcribing regulations in matters of faith. The emperor, by this decree, arrogated to himſelf the right of being head of the church. Pope Simplicius, however, in the year 483, condemned the henoticon, and cited Acacius, the chief promoter of it, to appear before him at Rome; but it was not entirely ſuppreſſed till the year 518.

HENTING, among farmers, a method of ſowing immediately before the plough, by which, it is pretended, a great deal of charge is ſaved. See PLOWING.

HENTING-FURROWS, thoſe turned from each other at the bottom, in plowing ridges. See the article PLOWING.

HEPAR, the liver, in anatomy. See LIVER.

HEPATIC, in medicine and anatomy, any thing belonging to the liver.

HEPATIC ALOES. See ALOES.

HEPATIC VEIN. See BASILICA.

HEPATICA, noble liverwort, in botany, a low plant without any other ſtalk than the pedicles of the leaves and flowers; the leaf is cut, not very deep, into three lobes, entire about the edges; the flower is commonly blue, ſometimes reddiſh or white, hexapetalous, ſet in a three-leaved cup, with numerous ſtamina in the middle, which are followed by a cluſter of whitiſh ſeeds. It is perennial, grows wild on gravelly ſhady grounds in Germany and other parts of Europe, and flowers in our gardens in March or ſooner.

This herb is a mild reſtringent and corroborant; to which intentions, infuſions of it have been drank as tea, or the powder of the dry leaves given to the quantity of half a ſpoonful at a time.

HEPATICA, liverwort, in botany, a ſpecies of moſs conſiſting of numerous obtuſely laciniated leaves, lying over one another, marked on the ſurface with white tubercles reticularly diſpoſed through the green ſubſtance of the leaf, ſhooting out underneath fine capillary roots from the extremities of the leaves iſſue clear whitiſh pedicles, bearing globular bodies, which when ripe contain black minute ſeeds like duſt. It is perennial, grows in moiſt ſtony places, and runs up to ſeed in March or April.

This moſs is recommended as an aperient, reſolvent and purifier of the blood. From the penetrating but mild pungency and bitteriſhneſs of its taſte, ſinking in

were into the tongue, it promiſes to be a plant of no inconſiderable virtue, though in this country at preſent diſregarded.

HEPATITIS, in medicine, an inflammation of the liver, with an impoſthume of that organ. It bears a near reſemblance to the pleuriſy, only its ſymptoms are not ſo intenſe. It commonly either kills the patient or ſuppurates gradually, or degenerates into a ſchirrhus. See LIVER.

HEPHÆSTIA, in Grecian antiquity, an Athenian feſtival in honour of Vulcan, the chief ceremony of which was a race with torches.

HEPTACHORD, in the ancient poetry, ſignified verſes that were ſung or played on ſeven chords, that is, on ſeven different notes. In this ſenſe it was applied to the lyre, when it had but ſeven ſtrings.

One of the intervals is alſo called an heptachord, as containing the ſame number of degrees between the extremes.

HEPTAGON, in geometry, a figure conſiſting of ſeven ſides and as many angles.

The word is Greek, and compounded of ἑπτα, ſeven, and γωνια, an angle.

If the ſides be all equal, it is called a regular heptagon.

HEPTAGONAL NUMBERS, are a ſort of polygonal numbers, wherein the difference of the terms of the correſponding arithmetical progreſſion is 5.

One of the properties of theſe numbers is, that, if they be multiplied by 40, and 9 be added to the product, the ſum is a ſquare number.

HEPTAMERIS, in muſic, the ſeventh part of a meris, being, according to M. Sauveur, the forty-third part of the octave. See the article OCTAVE.

HEPTANDRIA, in botany, a claſs of plants with hermaphrodite flowers, and ſeven male parts or ſtamina in each.

The word is formed of the Greek ἑπτα, ſeven, and ανηρ, male.

Of this claſs are the horſe-cheſnut, finitelis, &c.

HEPTANGULAR, in geometry, an appellation given to figures which have ſeven angles.

HEPTARCHY, a government conſiſting of ſeven perſons, or a country divided into ſeven kingdoms.

The word is Greek, and formed of ἑπτα, ſeven, and αρχη, rule.

The Saxon heptarchy included the ſouthern and northern parts of England, which was cantoned into ſeven petty kingdoms, as thoſe of Kent, South-Saxons, Weſt-Saxons, Eaſt-Saxons, Northumberland, the Eaſt-Angles, and Mercia. The heptarchy was formed by degrees from the year 457, when the kingdom of Kent was firſt erected, and terminated in 805, when king Egbert re-united them into a monarchy.

HEPTATEUCH, in literature, a volume conſiſting of ſeven books.

The work is Greek, and compounded of ἑπτα, ſeven, and τευχος, a book or work.

Heptateuch chiefly denotes the five books of Moſes called the Pentateuch, together with the two following books, Joſhua and Judges.

HERACLEIA, an ancient feſtival, celebrated in honour of Hercules by ſeveral ſtates of Greece.

HERACLEONITES, a ſect of Chriſtians, the followers of Heracleon, who refined upon the Gnoſtic divinity, and maintained that the world was not the immediate production of the Son of God, but that he was only the occaſional cauſe of its being created by the Demiurgus. The Heracleonites denied the authority of the prophecies of the Old Teſtament, maintaining that they were mere random ſounds in the air; and that St. John the Baptiſt was the only true voice that directed to the Meſſiah.

HERACLIDÆ, or *Return of the* HERACLIDÆ *into Peloponneſus*, in chronology, a famous epocha that conſtitutes the beginning of profane hiſtory; all the time preceding that period being accounted fabulous.

This return happened in the year of the world 2862, an hundred years after they were expelled, and eighty after the deſtruction of Troy.

HERAIA, an ancient Greek feſtival obſerved at Argos and ſome other places, in honour of Juno.

This name was alſo given to a ſolemn day of mourning kept at Corinth for Medea's children, who were buried in the temple of Juno Aſtræa.

HERALD, an officer at arms, whoſe buſineſs it is to declare war, to proclaim peace, to marſhal all the ſolemnities at the coronation, chriſtening, marriage, and funeral of princes, to blazon and examine coats of arms, &c.

Heralds were formerly held in much greater eſteem than they are at preſent, and were created and chriſtened by the king, who pouring a gold-cup of wine on their head, gave them the herald-name; but this is now done by the earl-marſhal. They could not arrive at the dignity of herald without having been ſeven years purſuivant; nor could they quit the office of herald, but to be made king at arms. See POURSUIVANT.

The three chief heralds are called Kings at Arms, the principal of which is Garter; the next is called Clarencieux, and the third Norroy; theſe two laſt are called provincial heralds. See KING *at Arms*.

Beſides theſe there are ſix other inferior heralds, viz. York, Lancaſter, Somerſet, Richmond, Cheſter, and Windſor; to which, on the coming of king Geo. I. to the crown, a new herald was added, ſtyled Hanover herald; and another, ſtyled Gloceſter king at arms.

The kings at arms, the heralds, and four purſuivants are a college or corporation, erected by a charter granted by Richard III. by which they obtained ſeveral privileges, as to be free from ſubſidies, tolls, and all troubleſome offices.

HERALDRY, the art of armoury and blazoning, which comprehends the knowledge of what relates to ſolemn cavalcades and ceremonies at coronations, inſtalments, the creation of peers, nuptials, funerals, &c. and alſo whatever relates to the bearing of arms, aſſigning thoſe that belong to all perſons, regulating their right and precedencies in point of honour, and reſtraining thoſe who have not a juſt claim, from bearing coats of arms that do not belong to them. See BLAZONING, ARMS, SHIELD, BEARING, &c.

HERB, a denomination common to all plants, whoſe ſtalks die every year, after their ſeed is ripe.

The word is derived from the Latin *herba*, which ſignifies the ſame thing.

There are ſome herbs whoſe root periſhes with the ſtem, and others where the root ſurvives the ſtem by ſeveral years. The former are called annuals: thoſe which only bear flowers and fruit the ſecond year, or even the third, and then periſh, are called biſannuals. Herbs whoſe roots do not periſh after they have ſhed their ſeed, are called perennials, and, if they keep their leaves all the year round, they are called ever-greens. Herbs are alſo diſtinguiſhed into kitchen, ſallad, and medicinal herbs.

HERBAGE, in law, ſignifies the paſture provided by nature for the food of cattle; alſo the liberty to feed cattle in the foreſt, or in another perſon's ground.

HERBAL, in literary hiſtory, a book that treats of the claſſes, genera, ſpecies, and virtues of plants.

HERBAL is ſometimes alſo uſed for what is more uſually called hortus ſiccus.

HERBALIST, the author of an herbal, or one who is ſkilled in plants.

HERBIVOROUS ANIMALS, thoſe which feed only on vegetables.

HERCULES, in aſtronomy, one of the conſtellations of the northern hemiſphere. See the article CONSTELLATION.

HERD, a company of eatable cattle of the larger ſort, as cows, oxen, ſwine, deer, &c. alſo of wild beaſts.

HEREDITAMENTS, whatever immoveable things a perſon may have to himſelf and his heirs, by way of inheritance; and which, if not otherwiſe bequeathed, deſcend to him who is next heir, and not to the executor, as chattels do.

This word extends to whatever is inheritable, be it real, perſonal, or mixed; and in conveyances, by the grant of hereditaments, manors, houſes, lands, rents, &c. will paſs.

HEREDITARY, an appellation given to whatever

belongs to a family by right of ſucceſſion, from heir to heir.

HERESY, the crime of obſtinately perſiſting in opinions that are contrary to the fundamentals of religion.

HERETIC, a general name for all ſuch perſons under any religion, but eſpecially the Chriſtian, as profeſs or teach religious opinions contrary to the eſtabliſhed faith, or to what is made the ſtandard of orthodoxy.

HERISSON, in fortification, a beam armed with a great number of iron ſpikes, with their points outwards, and ſupported by a pivot, on which it turns.

Theſe ſerve as a barrier to block up any paſſage, and are frequently placed before the gates, and more eſpecially the wicket-doors of a town or fortreſs, to ſecure thoſe paſſages, which muſt of neceſſity be often opened and ſhut.

HERMÆ, among antiquarians, ſtatues of the god Mercury, made of marble, and ſometimes of braſs, without arms or feet, and ſet up by the Greeks and Romans in the croſs-ways.

HERMÆA, in antiquity, ancient Greek feſtivals, in honour of the god Hermes, or Mercury.

HERMAPHRODITE, one who partakes of both ſexes.

The word is Greek, Ερμαφροδιτος, and compounded of Ερμης, Mercury, and Αφροδιτη, Venus, as being a mixture of Mercury and Venus, that is, of male and female.

Moſt, if not all thoſe reported to be hermaphrodites, are probably no other than mere women, whoſe clitoris is grown to an exorbitant ſize, and whoſe labia pudendorum are become preternaturally tumid.

Among the inſect claſs of animals, indeed, hermaphrodites are very frequent: ſuch are worms, ſnails, leeches, &c.

HERMAPHRODITE FLOWERS, among botaniſts. See FLOWER.

HERMATHENA, among antiquarians, a ſtatue repreſenting Mercury and Minerva both in one.

HERMETIC, or HERMETICAL, an appellation given to whatever belongs to chemiſtry, from Hermes Triſmegiſtus, who is ſuppoſed to have been its inventor.

HERMETICAL PHILOSOPHY, that which undertakes to ſolve all the phænomena of nature from the three chemical principles, ſalt, ſulphur, and mercury. A conſiderable addition was made to the ancient hermetical philoſophy by the modern doctrine of alkali and acid. See ALKALI.

HERMETICAL PHYSIC, the art of healing as founded on the hermetical philoſophy.

HERMETICAL SEAL, a method of ſtopping glaſs-veſſels for chemical operations ſo very accurately, that nothing can eſcape. It is done by heating the neck of the veſſel in the flame of a lamp, till it be ready to melt, and then twiſting it cloſe together with a pair of pincers.

Veſſels may likewiſe be ſealed hermetically, by ſtopping them with a plug of glaſs well luted into the neck of the veſſel; or by inverting another ovum philoſophicum over that wherein the matter is contained.

HERMIT, a devout perſon retired into ſolitude to be more at leiſure for prayer and contemplation.

The word is derived from the Greek, ερημος, a wilderneſs.

HERMODACTYL, in pharmacy, the root of an unknown plant, brought from Turky; of the ſhape of a heart flatted; of a white colour; compact and ſolid, yet eaſy to cut or powder.

This root has a viſcous, ſweetiſh, farinaceous taſte, and no remarkable ſmell. It was ranked by the ancients among the cathartics, but ſuch as we now meet with in the ſhops does not appear to have any purgative virtue. Alpinus relates, that hermodactyls, the ſame with what are ſold in Europe, are eaten by the Egyptian women, to the quantity of ſeveral roots at a time: that they do not move the belly, or produce any ill effect: that they are ſuppoſed to be very nutritious, and contribute to procure the fatneſs and plumpneſs there admired. Thoſe who report them to be a purgative, have probably aſcribed to the hermodactyls, a part of the effects of the ſubſtances which were joined to them; for, being acknowledged ſlow in operation, they have been commonly acuated with aloes and other cathartics; and have long been an entire ſtranger to practice.

HERNANDIA, in botany, the name of a diſtinct genus of plants, the characters of which are theſe: the petals of the flower are multifid, and placed in a circular order; the male and female flowers ſtand on diſtinct plants. There is no pericarpium, but the cup of the flower is very large, ſwelled, and roundiſh; containing a plicated oval nut, with only one cell, and a globoſe nucleus. *Linnæi Gen. Plant.*

We know only one ſpecies of this genus, which is the hernandia, with a large umbilicated ivy-like leaf, commonly called, in the Weſt-Indies, Jack in a box.

HERNIA, in medicine, a tumor formed by the deſcent of the inteſtines or omentum out of their place: it is popularly called a rupture.

The word is Latin, and originally ſignifies a tumor in the ſcrotum.

The preternatural tumors formed at the navel are called omphalocele and exomphalos; thoſe of the ſcrotum oſcheocele; and if in other parts of the belly, they are called ventral. A tumor proceeding from a falling out of the inteſtines, is termed an enterocele; from the omentum, epiplocele; from wind, pneumatocele; from water, hydrocele. They differ alſo as to their ſize; ſome are ſoft, others hard; ſome fixed, ſome moveable, others not without great difficulty, or not at all returned into the abdomen; the laſt are called adheſive ruptures. Sometimes the parts prolapſed are ſo confined, that the wind and fæces can by no means be tranſmitted; theſe are denominated incarcerated ruptures; ſome are free from pain; others very painful, and attended with ſickneſs, vomiting, and many bad ſymptoms.

The cauſes are various, though the immediate cauſe is always ſome violence offered to the abdomen, and principally the navel.

An omphalocele in children is not very dangerous, and for the moſt part eaſily cured. In adults likewiſe there is no great danger, while the parts are capable of being returned; but if the protruſion of the inteſtines through a narrow foramen of the navel cannot be returned, it is a very hazardous caſe; for the blood muſt be prevented from returning out of the protruded inteſtines, and the ſtagnating fluids occaſion inflammation, exceſſive pain and anguiſh, with vomiting, and indeed the iliac paſſion; and likewiſe a mortification of the inteſtines, followed by a painful death. But if the inteſtines can be returned, an omphalocele, as well as any other rupture, is ſooner cured in children than in adults, by the uſe of a proper bandage, and the obſervation of a regular diet and exerciſe.

There are two methods of cure, the one when the inteſtines can, the other, when they cannot be returned. In the firſt caſe, the inteſtines and omentum muſt be returned and bound up tightly to prevent a relapſe. In tender infants, after repreſſion and repoſition, apply a ſmall round plaſter to the navel, laying another over that covered with linen or leather, and over this a ſimple thick compreſs, as in a recent and ſlight diſorder; then faſten the whole with a ſimple roller carried ſeveral times round the body, taking care, when this is opened, that it be immediately bound up.

When the diſorder is inveterate, uſe a double compreſs of a leſs ſize, and upon that lay a leaden plate, then a larger compreſs, and proceed as before: but in children, adults, and old men, apply a truſs ſuitable to the purpoſe, furniſhed with a peculiar plate, and faſtened round the belly; but before you uſe this bandage, you ſhould lay on the navel a ſound ſtrengthening plaſter, and upon that a ſticking plaſter with a compreſs: but if the aperture is ſo narrow that the inteſtines cannot be repelled, and the patient is troubled with a vomiting and acute pains, apply proper clyſters and emollient cataplaſms. If you ſtill find the inteſtines unfit for repoſition, inject the ſmoke of tobacco into the anus, till it give a ſtool, and they are relaxed. If there is an inflammation in the inteſtines, you muſt immediately open a vein, and bleed plentifully; by this, with a gentle preſſure of the hand, the prolapſed parts return into the abdomen: after this, you muſt preſs the

the orifice with your fingers, apply a compreſs, and then a proper linen bandage as before.

If all this prove ineffectual in twenty or twenty-four hours, immediate recourſe muſt be had to the chirurgical operation, which is thus performed: the patient is laid on a bed or table, with his head ſomewhat low, but his belly and buttocks elevated, and is faſtened down to prevent his moving; then the ſkin over the navel is held tranſverſely, and, being drawn tight, an inciſion is carefully made with a knife, till you have uncovered the inteſtines. The beſt inſtrument for this inciſion is Morand's biſtouri gaſtrorapbique, or le Dran's biſtouri herniaire.

Where the inteſtines are thus replaced, the wound, being preſſed by an aſſiſtant, ſhould be bound up. After the firſt dreſſing, the patient muſt keep quiet, and the bandage remain for three or four days, unleſs extraordinary ſymptoms require the contrary; and after the firſt opening, it may be dreſſed every day; and when it is healed, a proper bandage is ſtill neceſſary, but adults and old men muſt wear a truſs all their lives. As to Petit's method of cure, ſee *Garangeot's Operat. Chirurg.*

For the cure of an enterocele without inciſion, one Littlejohn uſed the following method: firſt, he returned the inteſtines into the belly, then applied a corroſive medicine above the os pubis, to the place where the inteſtines deſcended; and he recommends oil of vitriol, in ſuch plenty, that it might ſoon penetrate the ſkin; for the deeper the eſchar, the more effectual the remedy: therefore he orders it to be repeated for three or four days, that the ſkin may be more corroded; and upon every freſh application of the oil, he removed the old eſchar; then he dreſſed the wound with a plaſter of paracelſus and oxycroceum, mixed in equal parts, and ſpread upon leather, and ſecured it with compreſſes and bandage. This plaſter alone, he affirms, ſeparates the eſchar, and cures the ulcer. He ordered any excreſcence of ſpongy fleſh to be eaten off with the lapis infernalis. The patient muſt obſerve a ſpare diet, and refrain from exerciſe till the wound be cured: after which, he lays the rupture plaſter on the cicatrix, and applies a proper bandage, which muſt be worn till the cicatrix be ſtrong enough to prevent a relapſe. King George I. gave five thouſand pounds for this arcanum, which was ſoon after deſpiſed by the Engliſh.

The celebrated method of the prior de Cabrier for curing an enterocele, or any rupture, without bandage or ſection, though it does not prove effectual without containing the former, was purchaſed about the end of the laſt century by Lewis XIV. and then made public for the good of mankind. It is done by ſpirit of ſalt mixed with red wine, and drank for ſeven mornings faſting, the patient remaining for four or ſix hours afterwards without taking either food or drink: but if it ſhould not agree with the ſtomach, then only every other day. For a child, from two years old to ſix, three or four drops in a ſpoonful or two of red wine; from ſix years to ten, mix a dram of the ſpirit with a pint of wine for ſeven doſes. It is to be continued, if neceſſary, for a fortnight longer in the ſame manner. From ten to fourteen years, the quantity of the ſpirit may be increaſed to two drams: from fourteen to eighteen, two drams and a half; and after eighteen, five drams. During four months, after this courſe is begun, a ſteel truſs muſt be worn night and day, exactly fitted to the rupture.

The patient ought never to ſit down, but either ſtand or lie, and neither run nor ride, and take great care to commit no error in diet. Under the truſs the following plaſter is applied to the part, being firſt ſhaved. Take of maſtich half an ounce; labdanum, three drams; hypocyſtis, one dram; three dried Cyprus nuts; of ſealed earth, one dram; black pitch, three ounces; Venice turpentine, one dram; yellow wax, one ounce; dry comfrey-root, half an ounce; make into a plaſter according to art.

HERO, in the ancient mythology, a great and illuſtrious perſon, of a mortal nature, though ſuppoſed by the populace to partake of immortality; and, after his death, placed among the number of the gods.

Heroes were perſons partly of divine and partly of human extraction, being begot between a deity and a mortal, and coincides with what we otherwiſe call a demi-god; ſuch was Hercules, who was the ſon of Jupiter by Alcmena: accordingly Lucian deſcribes a hero to be a medium between a god and man, or rather a compoſition of both.

HERO is alſo uſed in a more extenſive ſenſe for a great, illuſtrious, and extraordinary perſonage; particularly in reſpect of valour, courage, intrepidity, and other military virtues.

F. Bouhours makes this diſtinction between a hero and a great man, that the former is more daring, fierce, and enterprizing; and the latter more prudent, thoughtful, and reſerved. In this ſenſe we ſay, Alexander was a hero, and Julius Cæſar a great man.

HERO *of a Poem, or Romance*, is the principal perſonage, or character therein. See the article CHARACTER.

The hero of the Iliad is Achilles; of the Odyſſee, Ulyſſes; of the Æneid, Æneas; of Taſſo's Jeruſalem, Godfrey of Bulloign; of Milton's Paradiſe Loſt, Adam; though Mr. Dryden will have the Devil to be Milton's hero, in regard he gets the better of Adam, and drives him out of Paradiſe.

Many of the critics find fault with the hero of the Æneid, for being too delicate, wanting the fire, firmneſs, and uncontroulable ſpirit, remarkable in the hero of the Iliad. Piety, tenderneſs, and ſubmiſſion to the gods, are virtues of the middle claſs of mankind; they do not ſtrike enough for a hero who is to be the inſtrument of ſuch notable exploits. In anſwer to this, F. Boſſu obſerves, that Æneas's character was not to be formed on the model either of Achilles or Ulyſſes; nor to be of the ſame kind with them, as the fable and deſign of the Æneid were very different from thoſe of the Iliad and Odyſſee. Virgil's deſign was to perſuade the Romans to receive a new form of government, and a new maſter; who muſt have all the qualities requiſite for the founder of a ſtate, and all the virtues which make a prince beloved.

HEROIC, ſomething belonging to a hero, or heroine: thus,

HEROIC AGE, that age or period of the world wherein the heroes are ſuppoſed to have lived. The heroic age coincides with the epic poem. See EPIC.

HEROIC VERSE, that wherein heroic poems are uſually compoſed; or it is that proper for ſuch poems. In the Greek and Latin, hexameter verſes are uſually denominated heroic verſes, as being alone uſed by Homer, Virgil, &c. See the article HEXAMETER.

Alexandrine verſes of twelve ſyllables were formerly called heroic verſes; but later writers uſe verſes of ten ſyllables.

HEROINE, a woman of an heroic ſpirit, or who makes the principal perſonage in an heroic poem. See HERO and POEM.

HERON, in ornithology, a bird of the ardea-kind, with a hanging creſt.

The common heron is a tall bird, meaſuring more than four feet from the point of the beak to the tip of the toes. Its head is covered with ſhort white feathers; only from the hinder part, there hangs a creſt of very long black feathers; the upper part of its body is of a duſky bluiſh grey, the under part white, and the thighs yellowiſh.

HERPES, in medicine, a bilious puſtule, which breaking out in different manners upon the ſkin, accordingly receives different denominations.

If they appear ſingle, as they frequently do in the face, the baſe is inflamed, and the top pointed; and having diſcharged a drop of matter, the redneſs and pain go off, and they dry away. There is another ſort more corroſive and of greater malignity, when a cluſter of puſtules riſe in a ring, accompanied with ſmart, and ſometimes with great itching; this ſpecies is termed ſerpigo, and vulgarly the tetter, or ring-worm.

Another kind of this diſeaſe appears in large cluſters upon the neck, breaſt, loins, &c. attended with a ſlight fever and inflammation. The heads are white and mattery, which are ſucceeded by a ſmall round ſcab reſembling millet ſeed, whence its name, and vulgarly called ſhingles. See the article ERYSIPELAS.

HERRING, in ichthyology, a ſpecies of clupea, with

the lower jaw longeſt, and without any black ſpots. It is from five to eight inches in length, and between one and two in breadth. However, its ſize is far from being certain; ſince it varies not only on account of age, but according to the ſeas and places where it is caught. The back is of a duſky bluiſh colour, and is more blue in ſpring than at other times; the ſides and the belly are of a ſilvery white; the fin on the back ſtands near the middle, and is of a whitiſh colour, and has nineteen rays; the pectoral fins are whitiſh, ſtand low, and have each eighteen rays; the ventral fins are very ſmall and white; the pinna ani is near the tail, and has eighteen rays; the tail is of a greyiſh colour, forked, and furniſhed with eighteen rays.

HERRING *Fiſhery*. Herrings are chiefly found in the North ſea. They are a fiſh of paſſage, and commonly go in ſhoals, being very fond of following fire or light, and in their paſſage they reſemble a kind of lightning. About the beginning of June, an incredible ſhoal of herrings, probably much larger than the land of Great-Britain and Ireland, come from the north on the ſurface of the ſea; their approach is known by the hovering of ſea fowl in expectation of prey, and by the ſmoothneſs of the water; but where they breed, or what particular place they come from, cannot be eaſily diſcovered. As this great ſhoal paſſes between the ſhores of Greenland and the north cape, it is probably confined, and as it reaches the extremities of Great-Britain, is neceſſarily divided into two parts. For we find one part of the herrings ſteering weſt, or ſouth-weſt, and leaving the iſlands of Shetland and Orkney to the left, paſs on towards Ireland, where being interrupted a ſecond time, ſome keeping the ſhore of Britain, paſs away ſouth down St. George's channel; while the other part, edging off to the ſouth-weſt, coaſt the weſtern ocean, till they reach the ſouth ſhore of Ireland, and then ſteering ſouth-weſt, join the reſt in St. George's channel. The other part of the firſt diviſion made in the north, parting a little to the eaſt and ſouth-eaſt, paſs by Shetland, and then make the point of Buchan-neſs, and the coaſt of Aberdeen, filling as they go, all the bays, firths, creeks, &c. with their innumerable multitudes. Hence they proceed forward, paſs by Dunbar, and rounding the high ſhores of St. Abbe's Head, and Berwick, are ſeen again off Scarborough; and even then not diminiſhed in bulk, till they come to Yarmouth roads, and from thence to the mouth of the Thames, after which, paſſing down the Britiſh Channel, they ſeem to be loſt in the Weſtern ocean.

The vaſt advantage of this fiſhery to our nation is very obvious, when we conſider, that though herrings are found upon the ſhores of North America, they are never ſeen there in ſuch quantities as with us, and that they are not to be met with in conſiderable numbers in any of the ſouthern kingdoms of Europe, as Spain, Portugal, or the ſouth parts of France on the ſide of the ocean, or in the Mediterranean, or on the coaſt of Africa. There are two ſeaſons for fiſhing herrings, the firſt from June to the end of Auguſt, and the ſecond in autumn, when the fogs become very favourable for this kind of fiſhing. The Dutch begin their herring-fiſhing on the 24th of June, and employ no leſs than two thouſand veſſels therein called buſſes, being between forty-five and ſixty tons burden, and carrying three or four ſmall cannon. They never ſtir out of port without a convoy, unleſs there be enough together to make about eighteen or twenty cannon among them, in which caſe they are allowed to go in company. Before they go out, they make a verbal agreement, which has the ſame force as if it were in writing. The regulations of the admiralty of Holland are partly followed by the French, and other nations, and partly improved and augmented with new ones, as, that no fiſher ſhall caſt his net within a hundred fathoms of another boat: that while the nets are caſt, a light ſhall be kept on the hind part of the veſſel: that when a boat is by any accident obliged to leave off fiſhing, the light ſhall be caſt into the ſea: that when the greater part of a fleet leaves off fiſhing, and caſts anchor, the reſt ſhall do the ſame, &c. By the late act of parliament in Great Britain, the regulations are, that every veſſel intitled to the bounty, muſt carry twelve Winchester buſhels of ſalt in new barrels, for every laſt of fiſh ſuch veſſel is capable of holding; and as many more new barrels as ſuch veſſels can carry; and two fleets of tanned nets, that is, a veſſel of ſeventy tons ſhall carry one fleet of fifty nets, each net to be thirty yards full upon its rope, and ſeven fathoms deep; and ſo in proportion for greater or ſmaller veſſels; and be provided with one other fleet of fifty like nets, on board a tender, or left on ſhore in a proper place for the uſe of the ſaid veſſel, &c.

There is nothing particular in the manner of fiſhing. The nets wherein the fiſh are drawn, ſhould regularly have their meſhes an inch ſquare to let all the leſſer fry go through.

Curing and preparing HERRING. The commerce of herring, both white or pickled, and red, is very conſiderable. The white Dutch herrings are the moſt eſteemed, being diſtinguiſhed into four ſorts, according to their ſizes; and the beſt are thoſe that are fat, fleſhy, firm, and white, ſalted the ſame day they are taken with good ſalt, and well barrelled. The Britiſh herrings are little inferior, if not equal to the Dutch; for in ſpite of all their endeavours to conceal the ſecret, their method of curing, laſting, or caſking the herrings, has been diſcovered, and is as follows. After they have hauled in their nets, which they drag in the ſterns of their veſſels backwards and forwards in traverſing the coaſt, they throw them upon the ſhip's deck, which is cleared of every thing for that purpoſe: the crew is ſeparated into ſundry diviſions, and each diviſion has a peculiar taſk: one part opens and guts the herrings, leaving the melts and roes; another cures and ſalts them, by lining or rubbing their inſide with ſalt; the next packs them, and between each row and diviſion they ſprinkle handfuls of ſalt; laſtly, the cooper puts the finiſhing hand to all, by heading the caſks very tight, and ſtowing them in the hold. It is cuſtomary with us to waſh the herrings in freſh water, and ſteep them twelve or fifteen hours, in a ſtrong brine, before we proceed to barrel them.

Red HERRINGS muſt lie twenty-four hours in the brine, inaſmuch as they are to take all their ſalt there, and when they are taken out, they are ſpitted, that is, ſtrung by the head on little wooden ſpits, and then hung in a chimney made for that purpoſe: after which, a fire of bruſh-wood which yields a deal of ſmoke, but no flame, being made under them, they remain there till ſufficiently ſmoked and dried, and are afterwards barrelled up for keeping.

HERSE, in fortification, is a lattice or portcullice, made in the form of a harrow, and ſtuck full of iron-ſpikes.

It is uſually hung by a rope, faſtened to a mouliner, which is cut in caſe of ſurprize, or when the firſt gate is broken with a petard, to the end that it may fall and ſtop up the paſſage of the gate, or other entrance of a fortreſs.

Theſe herſes are alſo often laid in the roads, with the points upwards, to incommode the march both of the horſe and infantry.

HERSILLON, in the military art, a ſort of beam, &c. between ten and twelve feet long, whoſe two ſides are full of ſpikes, to incommode both horſe and foot.

The word is a diminutive of the preceding.

HESPER, *Heſperus*, in aſtronomy, the evening ſtar, Venus being ſo called when ſhe ſets after the ſun.

The word is Greek, Εσπερος, the brother of Atlas, and father of the Heſperides.

HESPERIDES, in the ancient mythology, were the daughters of Heſperus, which were three in number, Ægle, Arethuſa, and Heſperethuſa. They are repreſented by the ancients as having the keeping of certain golden apples on the other ſide the ocean. The poets aſſign them a dragon to watch the fruit: this dragon Hercules ſlew, and and carried off the apples.

HESPERIS, dame violet, in botany, a genus of plants, the corolla of which conſiſts of four cruciform petals, of an oblong figure, of the length of the cup, a little reflex, and ending in ſmall ungues: the fruit is a long pod, plane, compreſſed, ſtriated, bilocular, bivalve, containing ſeveral oval, compreſſed ſeeds.

HETEROCLITE, among grammarians, one of the three variations in irregular nouns, and defined by Ruddiman

Ruddiman a noun that varies in declenſion; as *hoc vas, vaſis*; *hæc vaſa, vaſorum*.

Other grammarians take the word heteroclite in a larger ſenſe, applying it to all irregular nouns. See ANOMALOUS.

The heteroclite nouns properly ſo called, or according to the definition, are only three, viz. *vas*, *jugerum*, and *domus*.

HETERODOX, in polemical theology, any thing contrary to the faith and doctrines of a true church.

HETERODROMUS VECTIS, in mechanics, a lever, wherein the fulcrum, or point of ſuſpenſion, is placed between the power and the weight. See the article LEVER.

HETEROGENEOUS, or HETEROGENEAL, ſomething that conſiſts of parts of diſſimilar kinds, in oppoſition to homogeneous. See HOMOGENEOUS.

HETEROGENEOUS, in mechanics, ſuch bodies whoſe denſity is unequal in different parts of their bulk; or they are ſuch whoſe gravities in different parts are not proportionable to the bulks thereof: whereas bodies equally denſe or ſolid in every part, or whoſe gravity is proportionable to their bulk, are ſaid to be homogeneous.

HETEROGENEOUS LIGHT is, by Sir Iſaac Newton, ſaid to be that which conſiſts of rays of different degrees of refrangibility: thus the common light of the ſun or clouds is heterogeneous; being a mixture of all ſorts of rays.

HETEROGENEOUS NOUNS, one of the three variations in irregular nouns; or ſuch as are of one gender in the ſingular number, and of another in the plural, as *hoc cælum, hi cæli*. Heterogeneous, under which are comprehended mixed nouns, are ſix-fold. 1. Thoſe which are of the maſculine gender in the ſingular number, and neuter in the plural, as *hic tartarus, hæc tartara*. 2. Thoſe which are maſculine in the ſingular number, but maſculine and neuter in the plural, as *hic locus, hi loci, et hæc loca*. 3. Such as are feminine in the ſingular number, but neuter in the plural, as *hæc carabaſus, et hæc carabaſa*. 4. Such nouns as are neuter in the ſingular number, but maſculine in the plural, as *hoc cælum, hi cæli*. 5. Such as are neuter in the ſingular, but neuter and maſculine in the plural, as *hoc raſtrum; hi raſtri, et hæc raſtra*; and, 6. Such as are neuter in the ſingular, but feminine in the plural number, as *hoc epulum, hæ epulæ*.

HETEROGENEOUS NUMBERS, mixed numbers, conſiſting of integers and fractions. See INTEGER and FRACTION.

HETEROGENEOUS QUANTITIES are thoſe which are of ſuch different kinds, as that one of them taken any number of times, never equals or excels the other.

HETEROGENEOUS SURDS are ſuch as have different radical ſigns, as $\sqrt[3]{aa}$, $\sqrt[3]{bb}$, $\sqrt{9}$, $\sqrt{18}$, &c. See SURD.

HETEROSCII, in geography, commonly denotes thoſe inhabitants of the earth in the temperate zones, whoſe ſhadow at noon is always projected the ſame way, either northward or ſouthward.

The word is Greek, and compounded of ἕτερος, different, and σκια, a ſhadow.

Heteroſcii however, ſtrictly, denotes thoſe inhabitants which, during the whole year, have their noon-tide ſhadows projected different ways from each other. Thus the inhabitants of the northern temperate zone are heteroſcii with regard to thoſe of the ſouthern. The inhabitants of one part of the torrid zone are heteroſcii with regard to thoſe of the reſt, and to thoſe of one of the temperate zones, except at the ſolſtices; and even at that time, all of the torrid zone are heteroſcii with regard to thoſe of the temperate zones: but as the people of the torrid zone have their ſhadow now on this, and then on that ſide, they are called amphiſcii. See AMPHISCII.

HETEROUSIANS, a name compoſed of ἕτερος, other, and ουσια, ſubſtance; being given to a ſect of Arians, who did not believe that the Son of God was of a ſubſtance like to that of the Father, which was the opinion of another branch of the Arians, who were from thence called Hemoouſians; but that he was of another ſubſtance, different from that of the Father.

HEXACHORD, in ancient muſic, a concord called by the moderns a ſixth.

HEXAEDRON, *Hexahedron*, in geometry, one of the Platonic or five regular bodies, being a ſolid conſiſting of ſix equal ſides or faces, popularly called a cube.

The word is Greek, and derived from ἑξ, ſix, and ἑδρα, baſe. The ſquare of the ſide of a hexaedron is in a ſubtriple ratio to the ſquare of the diameter of the circumſcribed ſphere. Hence the ſide of the hexaedron is to the ſide of the ſphere it is inſcribed in, as 1 to $\sqrt{3}$, and conſequently incommenſurable thereto.

HEXAGON, in geometry, a figure of ſix ſides, and as many angles.

The word is Greek, and compounded of ἑξ, ſix, and γωνια, an angle.

If the ſides and angles be equal, it is called a regular hexagon. The ſide of a regular hexagon inſcribed in a circle is equal to the radius of that circle; hence a regular hexagon is inſcribed in a circle, by ſetting the radius off ſix times upon the periphery: As 1 to 1.672, ſo is the ſquare of the ſide of any regular hexagon to the area thereof nearly.

To deſcribe a hexagon on a given line AB (plate LXXIII. *fig.* 7.) draw an equilateral triangle ABC, and the vertex C will be the center of a circle, which will circumſcribe the hexagon required.

HEXAMETER, in the Greek and Latin poetry, a verſe conſiſting of ſix feet.

The word is Greek, and compounded of ἑξ, ſix, and μετρον, meaſure.

The firſt four feet of a hexameter may be either dactyls or ſpondees; but the laſt foot ſhould in ſtrictneſs be a ſpondee, and the laſt but one a dactyl, as in Homer and Virgil.

Hexameters are divided into heroic, which ſhould be grave and majeſtic; and into ſatyrical, which may be more negligent, as thoſe of Horace. Epic poems conſiſt of hexameters alone; elegies and epiſtles ordinarily conſiſt of hexameters and pentameters alternately.

The modern languages are not at all fit for this kind of verſe, whoſe cadence depends altogether on long and ſhort ſyllables.

HEXANDRIA, in botany, a claſs of plants with hermaphrodite flowers, and ſix ſtamina, or male parts in each, which are in ſome plants all of the ſame length, and in others are alternately one ſhorter and another longer.

The word is derived from the Greek, ἑξ, ſix, and ανηρ, male.

The plants of this claſs are garlic, hyacinth, meadow ſaffron, &c.

HEXAPLA, in church-hiſtory, a work publiſhed by Origen, containing a part of the Old Teſtament in the original Hebrew, with ſeveral verſions of it in ſix columns; from whence it was called hexapla, or the ſixfold edition.

HEXASTYLE, in architecture, a building with ſix columns in front.

HIATUS properly ſignifies an opening, chaſm, or gap; but it is particularly applied to thoſe verſes where one word ends with a vowel, and the following word begins with one, and thereby occaſion the mouth to be more opened, and the ſound to be very harſh.

The term hiatus is alſo uſed in ſpeaking of manuſcripts, to denote their defects, or the parts that have been loſt or effaced. See MANUSCRIPT.

HICCUP, or HICCOUGH, *Singultus*, in phyſic, a ſpaſmodic, convulſive, interrupted, and uneaſy concuſſion of the diaphragm and ſome of the parts affixed to it, made in inſpiration, and accompanied with a ſonorous exploſion of the air through the mouth.

Hiccups are divided into two ſpecies; the former, when the immediate cauſe of the diſorder is lodged in the diaphragm itſelf; and the latter, when the cauſe reſides in the ſtomach, whoſe vellication is propagated to the diaphragm.

The weaker the nervous ſyſtem, the more readily any perſon is ſeized with this diſorder. Hence infants, children, and old people are more ſubject to the hiccup than others; ſo that they eaſily fall into that tranſitory ſpecies of the diſorder, which is produced by a refrigeration of the ſtomach, eating greedily, or drinking exceſſively of cold liquors, or laughter. But the more remote cauſes

which concur to promote a morbid hiccup, which requires the phyſician's aid, eaſily exert their influence on ſuch perſons, and are as follows:

This diſorder then is readily produced by a cold moiſture, eſpecially when the patient is hot.

Aliments either of a bad quality, or uſed in too large a quantity, produce an hiccup.

Whatever aliments are either too acrid of themſelves, or from various cauſes degenerate within the ſtomach into acrid and viſcid ſordes, capable of vellicating its coats, produce a more or leſs violent hiccup.

Acrid and corrupted humors, impregnated with many ſaline parts, and acting on the diaphragm, excite the quickeſt and generally fatal exagitations of it.

An acute hiccup is the concomitant of ſuch diſorders as have a quick and ſpeedy termination, of which the moſt conſiderable are inflammations of the more noble parts of the viſcera.

An hiccup generally accompanies continual, malignant, and exanthematous fevers, when various remote cauſes concur to its production.

To the acute hiccups of a dubious event, we muſt alſo refer thoſe which ſucceed inanition, or too large an excretion of the humours.

A chronical hiccup ſometimes riſes from a peccant ſtate of the blood and humours, and from the faults or bad conformation of the bony parts ſurrounding the breaſt.

Every hiccup does not require a cure; but a morbid hiccup calls for the aſſiſtance of the phyſician, as hath been already obſerved, who is principally to follow three intentions of cure; the firſt is to mitigate and allay the preternatural, ſpaſmodic, and convulſive motions; the ſecond is to remove the material cauſes; and the third is to reſtore the parts affected and weakened.

The firſt intention is anſwered by gentle antiſpaſmodic and anodyne ſubſtances, as amber, cinnamon, ſaffron, and caſtor. An ounce and a half of the oil of ſweet almonds, mixed with a few drops of the diſtilled oil of dill, is by ſome thought a ſpecific for the hiccup.

But the phyſician is chiefly to purſue the ſecond intention, which is to remove the material cauſes. The peccant matter is therefore to be duly concocted, and then to be eliminated either by vomit or ſtool; the former is anſwered by four or ſix grains of the powder of ſquills, mixed with three grains of purified nitre; and the latter by preparations of manna and rhubarb.

The celebrated Sydenham tells us that he has cured people in years of this diſorder, by giving them two drams of diaſcordium at a doſe, when the ſeeds of dill and other celebrated ſpecifics have proved ineffectual.

HIDE, the ſkin of beaſts, but particularly applied to thoſe of large cattle, as bullocks, cows, horſes, &c. See SKIN.

HIDE *of Land* was ſuch a quantity of land as might be plowed with one plough within the compaſs of a year, or ſo much as would maintain a family; ſome call it ſixty, ſome eighty, and ſome an hundred acres.

The diſtribution of this kingdom by hides of land is very ancient, mention being made of it in the laws of king Ina. Henry I. had three ſhillings for every hide of land, in order to raiſe a dowry for his daughter: this tax was called hidage.

HIDE-BOUND, among farriers, a diſtemper in horſes when the ſkin ſticks ſo faſt to the back and ribs, that the hand cannot ſeparate the one from the other without great difficulty; his body is at the ſame time lean, his back-bones ſtand up, his guts are for the moſt part deficient in moiſture, and his dung dry and more offenſive than common.

If a horſe become hide-bound by hard riding and ill keeping, he may be cured by good keeping. If it be the effect of a fever, or ſome other diſeaſe, if that be cured which is the cauſe, the effect will ceaſe; but if he has no fever upon him, and he is hide-bound only from lowneſs of blood and ſpirits, give him boiled barley, white-water, or the like, and when his fleſh is raiſed, harden it with good oats, beans, and moderate exerciſe.

HIERACHIUM, hawkweed, in botany, a genus of plants, the compound flower of which is imbricated and uniform, conſiſting of a great number of equal hermaphrodite cotolluläe, which are linear, truncated, and quinquedentated: the ſtamina are five very ſhort capillary filaments: the ſeeds are ſolitary, obtuſely quadragonal, and winged with down.

HIERACITES, *Hieracitæ*, in church-hiſtory, Chriſtian heretics in the third century, ſo called from their leader Hierax, a philoſopher of Egypt; who taught that Melchiſedec was the Holy Ghoſt, denied the reſurrection, and condemned marriage: he likewiſe held, that no one could be ſaved who died before he arrived at years of diſcretion. The diſciples of Hierax taught that the word, or Son of God, was contained in the Father, as a little veſſel is contained in a great one; from whence they had the name Metangimoniſts, from the Greek word μεταγγιμοι, which ſignifies contained in a veſſel.

HIERARCHY, among divines, denotes the ſubordination of angels. See the article ANGEL.

Some of the rabbins reckon four, others ten, orders or ranks of angels; and give them different names, according to their different degrees of power and knowledge. Dionyſius the Areopagite, the jeſuit Celert, and many others, have gone ſo far as to ſettle a kind of ceremonial or rule for the precedency of angels, as ſeraphim, cherubim, thrones, dominions, principalities, &c.

HIERARCHY likewiſe denotes the ſubordination of the clergy, eccleſiaſtical polity, or the conſtitution and government of the Chriſtian church, conſidered as a ſociety.

HIEROGLYPHICS, in antiquity, myſtical characters, or ſymbols, in uſe among the Egyptians, and that as well in their writing as inſcriptions; being the figures of various animals, the parts of human bodies, and mechanical inſtruments.

But beſides the hieroglyphics in common uſe among the people, the prieſts had certain myſtical characters, in which they wrapped up and concealed their doctrines from the vulgar. It is ſaid, that theſe ſomething reſembled the Chineſe characters, and that they were the invention of Hermes. Sir John Marſham conjectures, that the uſe of theſe hieroglyphical figures of animals, introduced the ſtrange worſhip paid them by that nation; for as their figures were made choice of, according to the reſpective qualities of each animal, to expreſs the qualities and dignity of the perſons repreſented by them, who were generally their gods, princes, and great men, and being placed in their temples, as the images of their deities; hence they came to pay a ſuperſtitious veneration to the animals themſelves.

HIEROGRAMMATISTS, ἱερογραμματεῖς, i. e. holy regiſters, were an order of prieſts among the ancient Egyptians, who preſided over learning and religion.

They had the care of the hieroglyphics, and were the expoſitors of religious doctrines and opinions.

HIGH, *Altus*, a term of relation, importing one thing's being ſuperior or above another: thus we ſay, a high mountain, the high court of parliament, high relievo, &c.

HIGH, in muſic, is ſometimes uſed in the ſame ſenſe with loud, and ſometimes in the ſame ſenſe with acute.

HIGH-WATER, the ſtate of the tide when higheſt, or the time juſt before it begins to ebb. See the article TIDE.

HIGH-WAY, a free paſſage for the king's ſubjects, on which account it is called the king's high-way, though the freehold of the ſoil belong to the lord of the manor, or the owner of the land. Thoſe ways that lead from one town to another, and ſuch as are driſt or carr-ways, and are for all travellers in great roads, or that communicate with them, are high-ways only; and as to their reparation, are under the care of ſurveyors.

HIGHNESS, a title given to princes. Before king James I. the kings of England had no other title but that of highneſs; which was alſo the caſe of the kings of Spain before Charles V.

At preſent all the ſons of crowned heads are ſtiled royal highneſs, as the electors of Germany are electoral highneſs.

HIS TESTIBUS, a phraſe anciently added in the end of a deed, written in the ſame hand with the deed; upon which the witneſſes were called, the deed

read, and their names entered. See the article WITNESS.

His teſtibus, in ſubject deeds, continued till, and in, the reign of Henry VIII.

HILARIA, an ancient Roman feſtival, obſerved on the eighth of the calends of April, or the 25th day of March, in honour of the goddeſs Cybele. It was ſo called from the various expreſſions of joy and mirth on this occaſion.

HILARY-TERM, among lawyers. See TERM.

HILL, in the natural hiſtory of the earth. See MOUNTAIN.

Hills are of great uſe in a garden, as,

1. They ſerve as ſcreens to keep off the cold and nipping blaſts of the northern and eaſtern winds.

2. The long ridges and chains of lofty mountains, being generally found to run from eaſt to weſt, ſerve to ſtop the evagation of thoſe vapours towards the poles, without which they would all run from the hot countries, and leave them deſtitute of rain.

3. They condenſe thoſe vapours, like alembic heads, into clouds; and ſo, by a kind of external diſtillation, give origin to ſprings and rivers; and, by amaſſing, cooling, and conſtipating them, turn them into rain, and by that means render the fervid regions of the torrid zone habitable.

4. They ſerve for the production of a great number of vegetables and minerals, which are not found in other places.

It hath been found by experiment and calculation, that hills, though they meaſure twice as much as the plain ground they ſtand upon, yet the produce of the one can be no more than the other; and therefore, in purchaſing land, the hills ought not to be bought for more than their ſuperficial meaſure, i. e. to pay no more for two acres upon the ſide of an hill, than for one upon the plain, if the ſoil be equally rich.

It is true, that thoſe lands that are hilly and mountainous, are very different, as to their valuable contents, from what are found in flat and plain ground, whether they be planted, ſown, or built upon; as for example:

Suppoſe an hill contains four equal ſides, which meet in a point at the top; yet the contents of theſe four ſides can produce no more grain, or bear no more trees, than the plain ground on which the hill ſtands, or than the baſe of it; and yet by the meaſure of the ſides there may be double the number of acres, rods, and poles, which they meaſure on the baſe or ground-plot.

For as long as all plants preſerve their upright method of growing, hilly ground can bear no more plants in number than the plain at the baſe.

Again, as to building on an hill, the two ſides of an hill will bear no more than the ſame number of houſes that can ſtand in the line at the baſe.

And as to rails, or park-paling over an hill, though the meaſure be near double over the hill to the line at the bottom, yet both may be incloſed by the ſame number of pales of the ſame breadth. *Miller's Gard. Dict.*

HIN, a Hebrew meaſure of capacity for things liquid, containing the ſixth part of an epha, or one gallon two pints, or two thouſand five hundred and thirty-three ſolid inches, Engliſh meaſure.

HIND, a female ſtag in the third year of its age.

HIND CALF, a male hart, or hind, in the firſt year. She fawns in April or May.

HIND, or HINE, a huſbandman's ſervant. Thus a perſon who overſees the reſt, is called the maſter hine.

HINGES, in building, thoſe iron joints, whereby doors, tables, &c. open, ſhut, or fold, &c. Of theſe there are various ſpecies.

HIP, dog-roſe, a ſpecies of wild briar, with ſingle pentapetalous flowers, of a whitiſh colour, mixed with various ſhades of red. It is one of the largeſt plants of the roſe kind; grows wild in hedges; and flowers, as the garden ſorts, in June.

The flowers of this ſpecies, of an agreeable but weak ſmell, and in taſte bitteriſh and roughiſh, are ſaid to have a greater degree of laxative virtue than thoſe of the damaſk roſe, together with a mild corroborating or reſtringent quality. The fruit, the only part of the dog-roſe made uſe of in medicine among us, is agreeably dulcoacid, and ſtands recommended as a cooling reſtringent, in bilious fluxes, ſharpneſs of urine, and hot indiſpoſitions of the ſtomach: the freſh pulp is made in the ſhops into a conſerve, by mixing three ounces of it with five of fine ſugar. The pulp ſhould be ſeparated with great care from the rough prickly matter which incloſes the ſeeds; a ſmall quantity of which, retained in the conſerve, is apt to occaſion an uneaſineſs at the ſtomach, pruritus about the anus, and ſometimes vomiting.

HIP-GOUT, *Sciatica*. See the articles GOUT and SCIATICA.

HIP-MOULD is by ſome uſed for the back of the hip, but others underſtand it to mean the prototype or pattern, commonly made of a thin piece of wainſcot, by which the back and ſides of the hip are ſet out.

HIP-ROOF, among carpenters, called alſo Italian roof, is a roof which has neither gable-head, ſhread-head, nor jerken-head, by which is meant ſuch heads as are both gable and hip at the ſame end; for it is a gable or upright as high as the collar-beam, and then there are two ſhort hips, which ſhut up with their tops to the tops of a pair of rafters, which country carpenters call ſinglars. A hip-roof has rafters as long, and with the angles of the foot, &c. at the ends of buildings, as it has at the ſides; and the feet of the rafters at the ends of ſuch buildings as have hip-roofs, ſtand on the ſame plane, viz. parallel with the horizon, and at the ſame height from the foundation, with rafters on the ſides of the roof.

HIPPEUS, in phyſiology, a kind of comet, ſo called from its reſemblance to a horſe. See the article COMET.

HIPPOCAMPUS, the ſea-horſe, in ichthyology, the ſquare-bodied ſyngnathus, with no fin at the tail. It is five inches long, and where thickeſt, about an inch in diameter; the head is long, ſlender, and compreſſed, forming a kind of ſnout; the body is of a quadrangular figure, but the diviſions are not equal, and in the thickeſt part it is hexangular or heptangular.

It is a very ſingular and rare fiſh; the tail of which uſually curls up in the drying, and its head being bent down, gives it a rude reſemblance to a horſe; whence the name.

HIPPOCENTAUR, in antiquity, a fabulous animal, half man half horſe.

What gave riſe to the fable of hippocentaurs, was this. The Theſſalians are ſaid to have been the firſt inventors of the art of breaking horſes; and being firſt ſeen on horſeback, they ſeemed to make but one body with the horſes; whence the origin of the fable.

HIPPOCRAS, an infuſion of aromatic powders in wine, which is afterwards edulcorated with ſugar and honey; being ſo called becauſe that, when the infuſion is finiſhed, it is ſtrained through Hippocrates's ſleeve.

It is prepared of various aromatics and other ingredients, according to the different intentions to be anſwered.

HIPPOCRATES's SLEEVE, a kind of filtre or ſtraining bag formed by joining the oppoſite angles of a ſquare piece of flannel in form of a pyramid, and uſed to ſtrain ſyrups, decoctions, &c. for clarification.

HIPPODROME, in antiquity, the courſe where horſe-races were performed.

HIPPOPOTAMUS, the river horſe, a genus of quadrupeds, of the order of the jumenta, the characters of which are theſe: the fore-teeth of the upper jaw are four, and placed in pairs; thoſe of the lower jaw are prominent, and the intermediate ones are protended forward: the canine teeth are ſingle, and obliquely truncated; the teats are only two, and placed near the groin.

The hippopotamus is a native of Africa, paſſing a great part of its time under water, in the rivers of the Nile and Niger; but comes on ſhore to ſleep and breed. It is a large unwieldy animal, as big as an ox.

HIRCUS, in anatomy, a part of the auricle or outer ear, being that eminence next the temples. See the article EAR.

HIRCUS, a goat, in aſtronomy, a ſtar of the firſt magnitude, the ſame with capella. See CAPELLA.

HIRCUS is alſo a name uſed by ſome writers for a comet encompaſſed, as it were, with a mane, ſeemingly rough and hairy.

HIRUDO, the leech, in zoology, a well known naked inſect, with a flatted but not jointed body, and broader at the end than elſewhere, and the ſkin ſoft and gloſſy.

The common leech grows to two or three inches in length, and is of a blackiſh colour, variegated with yellow.

HISPID LEAF, among botaniſts, one whoſe ſurface is covered with more thick and rigid hairs than the piloſe leaves are.

HISPID STALK, among botaniſts, a ſtalk roughly hairy.

HISSING LETTERS, among grammarians, are S, X, and Z, ſo called on account of their harſh ſound.

HISTORICAL, ſomething that relates to hiſtory: thus we ſay, hiſtorical truth, hiſtorical ſtyle, hiſtorical narration of facts, &c. See the article HISTORY.

HISTORIOGRAPHER, a profeſſed hiſtorian, or writer of hiſtory.

HISTORY, an account, properly ſpeaking, of paſt tranſactions, narrated with ſuch important circumſtances as are proper to be tranſmitted to poſterity, and that in a regular continued ſeries.

Hiſtory is, of all others, the moſt difficult province. In other ſubjects there is a greater latitude for the writer's imagination; but, in hiſtory, he is confined to the occurrences he relates; and theſe, as they are not alike entertaining, require force and judgment in the narration to make them all agreeable. The richeſt fields of hiſtory are ſcenes of action and commotion, where nations are agitated by wars abroad, or factions at home. The moſt delicate part of an hiſtorian, which requires the deepeſt penetration, and ſoundeſt judgment, are the councils of ſtates and princes, the ſprings of action, the characters of men, the intereſt of parties, their different views, &c. Hiſtory will not admit thoſe decorations other ſubjects are capable of: the paſſions are not to be moved with any thing but the truth of the narration. All the force and beauty muſt lie in the order and expreſſion. To relate every event with perſpicuity, in ſuch words as beſt expreſs the nature of the ſubject, is the chief commendation of an hiſtorian's ſtyle. The colours facts are painted in, the ſtrength and ſignificancy of the ſeveral actions, the regular confuſion of a battle, the diſtractions of a tumult ſo ſenſibly depicted, that in reading we ſeem to ſee them; this is the art and perfection of an hiſtorical ſtyle. An hiſtorian muſt not only write impartially, but nobly. He that ſpeaks to the whole world, and to all ages, that is the inſtructor of mankind, that pronounces the deſtiny of ſo many great men, and fixes their character with poſteritity, what ſtrength of genius can be ſufficient for ſo important an enterprize? He muſt be capable of forming great and noble conceptions of things, and giving ſuch an exalted turn to his narration, as may truly comport with the dignity of his ſubject.

During the firſt ages, we have little or no hiſtory of the tranſactions of mankind, but that of Moſes, whoſe account is chiefly confined to the riſe, religion, laws, and government of the Jews. It is preſumed he wrote the principal part of his hiſtory about the year of the world 2550, and had good opportunities of knowing the truth of his relations. He gives a regular account of the Jewiſh affairs, from the creation to the year 2550: from this period the ſacred hiſtory is carried on by different writers, and continued down in the books of Joſhua, Judges, Ruth, Samuel, Kings, Chronicles, Ezra, and Nehemiah, to the year of the world 3581.

As to prophane hiſtory, till almoſt the time where the Scripture records end, we have little remains of it, but what are either broken and confuſed, or fabulous: for, from the creation to the flood, we have no credible account of things, but that of Moſes; and from the flood to the reign of Cyrus, the remains of antiquity are ſo broken and confuſed, that we have little prophane hiſtory of credit during this long and dark period. As to the Chaldean Hiſtory of Beroſus, and the Egyptian of Manetho, they were both wrote ſince Herodotus, and we have only ſome fragments of them preſerved by Joſephus, Euſebius, &c. As to Sanchoniathon, who has given us the Phœnician hiſtory, though he pretends to be much more ancient, yet his great antiquity has been juſtly queſtioned by Scaliger, and his very exiſtence by Mr. Dodwell.

The Greeks, as they have not been noted for their veracity in any reſpect, ſo their integrity in this particular has been always ſo queſtionable, that *Græcia mendax* has been ſtigmatized in hiſtory. We have no tolerable account from them before the Olympiads; the times before theſe were the fabulous ages; and when the hiſtorical commences, our accounts are not much better; for, not having had originally any public annals, and amongſt their ancient authors the poets having the firſt ſtroke, we may eaſily imagine what accounts are to be expected from thoſe, who are either to follow uncertain traditions, or the poets. Accordingly their firſt accounts were very looſe, and rather poems than hiſtories, which they have been charged with by the Romans, and particularly Quintilian compares the liberty they took to a poetic licenſe: but Joſephus tells them their accounts of things are all novel; that they have no author more ancient than Homer; that Hellanicus differs from Acuſilaus; he corrects Heſiod, and Hellanicus Ephorus; he again is corrected by Timæus, as he is by others, and Herodotus by all, who has been ſtyled the father of hiſtory, though he might with equal juſtice be called the parent of fable.

The hiſtorians from whom the Grecian and Roman hiſtory may be collected, are Thucydides, Diodorus Siculus, Lucian, Juſtin, Xenophon, Cteſias, Polybius, Dionyſius Halicarnaſſeus, Philo, Apion, Cornelius Nepos, Q. Curtius, Plutarch, Ælian, Arrian, Appian, Diogenes Laertius, Dio Caſſius, Herodian, Eunappus, Zoſimus, and Photius.

As to the Roman Hiſtory, it at firſt only conſiſted of ſimple notes drawn up by the pontifex maximus, who regularly ſet down every year whatever paſſed of conſiderable moment in the ſtate, either in war or peace; and this cuſtom, eſtabliſhed very early at Rome, ſubſiſted till the year A. U. C. 629, or 631. Theſe memoirs were called the great annals. Hiſtory now began to quit this antique garb, and to appear in public with more decency. The poets were the firſt who conceived a deſign of improving and adorning it. Nævius compoſed a poem on the firſt Punic war, and Ennius wrote the annals of Rome in heroic verſe. Hiſtory at length aſſumed a regular form, and appeared in proſe. Q. Fabius Victor is the moſt ancient of the Latin hiſtorians; he lived in the time of the ſecond Punic war. The hiſtorians whoſe writings are come down to us are Salluſt, Livy, Cæſar, Paterculus, Tacitus, Q. Curtius, Suetonius, Lucius Florus, Juſtin, Aurelius Victor, Ammianus Marcellinus, and Eutropius. Authors of the lives of the Roman emperors, from Adrian to Carinus, are Spartianus, Lampridius, Vulcatius, Capitolinus, Pollio, and Vopiſcus, who all lived in the reign of Dioclefian. If we have regard to only one condition of hiſtory, namely, its truth, we ſhall find that moſt of the above authors are faulty in that particular.

Le Moyne only allows four hiſtorians among the Romans, and not ſo many among the Greeks, and all of them ſhort of perfection; and as to the moderns, he is yet more ſcrupulous in admitting them into account.

There are ſome works in Engliſh very uſeful for the underſtanding of ancient hiſtory, as Hind's Hiſtory of Greece, Potter's Greek Antiquities, Lewis's Hebrew Antiquities, Kennet and Danet's Roman Antiquities, Prideaux and Shuckford's Connexions, Echard's Roman Hiſtory, Tranſlation of Joſephus, Rollin's Ancient Hiſtory, Univerſal Hiſtory, Bundy's Tranſlation of the Roman Hiſtory, Nicholſon's Hiſtorical Library, Kearne's *Diſſertatio Hiſtoricus*, and Rawlinſon's Method of Studying Hiſtory; the two laſt particularly will give the reader a general view of univerſal hiſtory, and direct to the beſt editions of almoſt all the hiſtorians extant.

As to the hiſtorical accounts of thoſe nations that grew out of the ruins of the Roman empire, which included the greateſt part of the known world, the beſt hiſtories in that way are Salmon's Modern Hiſtory, Sir Walter Raleigh's Hiſtory of the World, Mezeray's and Daniel's Hiſtory of France, Le Clerc's Hiſtory of the United Provinces, Mariana's Hiſtory of Spain, Meieus's Hiſtory of Flanders, Heuterus's Hiſtory of Burgundy, Bonfinius's Hiſtory of Hungary, Cromerius's Hiſtory of Poland, Aventinus's Hiſtory of Bavaria, Le Quien's Hiſtory of Portugal,

Vertot's Revolutions of Portugal and Sweden, &c. The Germans and Italians abound with particular memoirs of their different ſtates and governments, but have no complete body of hiſtory. The only hiſtorians that have given us a large and comprehenſive view of the Hiſtory of England, are Echard, Rapin, Hume, and Smollett.

Beſides theſe four, we have alſo the particular hiſtories of ſeveral prince's reigns, as Sir Francis Bacon's Hiſtory of Henry VII. Clarendon's Hiſtory of the Rebellion, Sir William Temple's Introduction to the Hiſtory of England. There is alſo Camden's Britannia, Tyrrel's Hiſtory of England, Buchanan's and Duff's Hiſtory of Scotland, Sir James Ware and Cox's Hiſtory of Ireland, &c.

Thuanus and biſhop Burnet, &c. have written the hiſtory of their own times.

The great diſadvantage our moſt celebrated hiſtorians ſeem to labour under, is too tedious an interruption by the inſertion of laws, ſtatutes, and records in the body of their narration, at leaſt in making too copious a recital of them; whereas they had better have been mentioned only in general, and thrown by themſelves into an appendix.

Hiſtory is diſtinguiſhed with regard to its matter and its form; with regard to its matter, it is either ſacred or natural, civil, perſonal, or ſingular.

Method of ſtudying HISTORY. Perſons who read hiſtory merely for amuſement, or having in view ſome particular branch of learning, attend only to certain branches of hiſtory, are not confined to that order and connection, which is abſolutely requiſite for obtaining a proper knowledge of hiſtory; the moſt regular, as well as ſucceſsful way of ſtudying which, is to begin with an epitome of univerſal hiſtory, and afterwards apply to the hiſtory of particular nations and commonwealths: for the ſtudy of particular hiſtories preſuppoſes, or to ſpeak more properly, is only extending the knowledge of particular parts of univerſal hiſtory. Unleſs this be our plan, we ſhall only fill the memory with ſome events, which may be done without applying to hiſtory, or pretending to the knowledge of it.

HISTORY, in painting, denotes a picture compoſed of divers figures, or perſons, repreſenting ſome tranſaction, either real or feigned. See PAINTING.

Natural HISTORY. See NATURAL.

HISTRIO, in the ancient drama, ſignified an actor or comedian, but more eſpecially a pantomime, who exhibited his part by geſtures and dancing. See the article DRAMA.

HITCH, among ſailors, a certain knot or nooſe caſt upon a rope to faſten it to a poſt, ſhip, wharf, &c.

HITHE, or HYTHE, in our old writers, denotes a port, wharf, or ſmall haven, to embark, or land wares at; as Queenhithe, &c.

HIVE, *Alveare*, in country affairs, a convenient receptacle for bees. See BEE.

HIVING *of Bees*, the placing a ſwarm of bees in a hive, in order to have the profit of their labours.

When the ſwarm of bees has left an old hive, and is placed in form of a cluſter hanging down from the branches of ſome ſhrub or looſe buſh, the hiving is extremely eaſy, and may be done in half an hour after the time of their being ſtill, and calm in the cluſter; or it may be let alone till an hour or two before ſun-ſet, provided that the ſun do not ſhine too vehemently upon the place where they are, for that would diſquiet them, and force them to riſe; and in that caſe they uſually take a long flight before they ſettle again, and are very often loſt; this however may at any time be prevented, by placing an artificial ſcreen before them, compoſed either of a coarſe cloth, or of a few branches of trees well covered with leaves.

Thoſe authors who ſpeak largely of the œconomy of bees, give the new queen a ſet of officers, whoſe buſineſs it is to ſettle the proper places of reſort; and they pretend that theſe bees go out of the hive a day or two before the ſwarm iſſues out, in order to fix upon a proper place. This however appears but a romantic conjecture; and we uſually find the bees buſied in ſearch of a place, while the whole ſwarm is in the air; nor is it much to their credit, that they chooſe ſuch places as they do; for they uſually fix in ſuch as they can by no means ſubſiſt in.

It is commonly the branch of ſome ſhrub or tree that they ſettle upon; and we always find that they mean this as their ſettled habitation; for, however ſoon after they are hived, the rudiments and beginning of combs are found on it. It is true, they always leave thoſe places, if left to themſelves, in five or ſix days; but this is not till they find them ſo inconvenient that they cannot keep them, either from their being too much ſcorched by the ſun, or expoſed to winds and rain. The quantity of wax and honey left in theſe places, when they have quitted them, abundantly proves however that they meant them for fixed abodes.

When they are placed in a hive, they very ſoon find themſelves much better lodged than in the place they had provided for themſelves, and they uſually ſtay in it, and begin to work the next morning.

It might appear a very difficult taſk to get ſo large a number of bees into a hive, but it is much leſs ſo than it appears to be. They will often take poſſeſſion of the hive of their own accord, when it is hung over them; but the ſhorteſt way is to hold the hive under the branch where they are, and then ſweep them down into it. This may be done with the branch of a tree with leaves on it, or with the hand armed with a ſtrong glove, and the face covered. But there are country fellows who will go without any ſort of defence, and with their naked hand ſweep them carefully off the bough into the hive, which they hold in the other hand underneath.

It is not to be expected that the whole ſwarm will be thus ſwept peaceably into the hive; many will fly away, and many cluſters will fall beſide the hive to the ground. All this however creates no difficulty, for, the hive being turned bottom upwards, and ſet on the ground near the tree, with its edges a little raiſed above the ſurface, thoſe bees which fell in cluſters to the ground, will ſoon ſcrawl to their companions in the hive, and ſoon after thoſe which flew off, will deſcend and follow their example. If it happen however that ſome bees will obſtinately keep to the place where they at firſt fixed themſelves, the branch is to be rubbed over with the juice of ſuch plants as theſe creatures hate the ſmell of; ſuch are elder, rue, and ſome others. And if this does not ſucceed, there muſt be linen rags burnt under them, the ſmoke of which will ſoon drive them off, and make them join their companions, who find themſelves more at eaſe in the hive.

As it is neceſſary to render the places diſagreeable to the bees from which they are to be taken into the hive, ſo many people think it very proper to prepare the hive for their reception, by ſcenting it with ſuch things as they love the ſmell of. To this purpoſe they rub the inſide of it with baum and bean flowers, and daub a little honey in ſome parts of it. This however does not ſeem neceſſary, thoſe hives having been found to ſucceed full as well, where it was not done, as thoſe where it was.

If it be about noon that the ſwarm is taken into the hive, it muſt not be removed from the place before evening; and in the mean time it muſt be ſheltered from the too violent heat of the ſun, by the ſhade of the trees; or, if that be not ſufficient, a ſort of ſcreen muſt be made for it, either of a coarſe cloth properly ſupported, or of branches of trees with their leaves on. In this manner it muſt remain till ſun-ſet, and then the hive muſt be gently lifted up, and carried to the place where it is to remain, and the next morning the bees will be ſeen as buſy at their work in it, as the old ſwarm in their hive.

It ſometimes happens that the ſwarm is not placed ſo favourably as in the inſtance before-mentioned; they often hang themſelves in a long cluſter from the young ſhoots, or ſmall branches of high trees; and in this caſe many different expedients are to be uſed to hive them, according to the circumſtances of their poſition. The common method is for one man to climb the tree with a long ſtaff in his hand, and another to mount a ladder placed againſt the tree, and hold the hive under the ſwarm, while the other ſweeps them into it with his ſtaff; and when the bough on which they hang is ſo far from the body of the tree, that this is impracticable by the ladder, the hive is to be fixed to the end of a long pole, and by that means ſuſpended under the ſwarm while they are

ſwept into it. When all this is impracticable, by reaſon of the great height of the branch on which the ſwarm hangs, a large cloth is to be ſpread on ſome of the lower branches, and the whole ſwarm ſwept down in a cluſter upon it: this is then to be thrown carefully to the ground, and another perſon is to be ready there, to whelm the hive over the greater part of the cluſter, and the reſt will uſually ſoon creep into it, and join them. If they are ſlow in doing this, they are to be driven in by burning linen rags about the places where they fly, the diſagreeable ſmell of which will ſend them towards the hive, where finding their companions not incommoded with it, they will naturally remain.

Another method of getting a ſwarm from a branch of a high tree, is to cut off the branch with a ſaw, as gently and with as little diſturbance to the bees as poſſible. In this caſe, when the branch is off, a man may carefully deſcend with it, and the bees will not quit their hold, but will be all carried where he pleaſes with it, and may by that means be very eaſily put into the hive.

Sometimes the bees which go out in a ſwarm, fix upon a hole in a wall, or a hollow trunk of a tree, for the aſſembling themſelves in.

This is a much better choice for them than the branch of a tree, but it is much worſe for the perſon who is to hive them, for they are very difficult to be got out of theſe places. The common way of the country people is to attack theſe ſwarms in the middle of a cold night, and they then enlarge the opening from without, and, placing the hive under it, ſcoop the bees out of their neſt with a ladle, and put them into the hive.

It uſually happens that there are more than one young female in the hive, at the time when the ſwarm goes out; and it is not uncommon for two of them to go out with the ſwarm. In this caſe the ſwarm conſtantly divides into two bodies, and on whatever branch it fixes, there are ſeen two cluſters of bees, one placed near the other. Each of theſe is a complete ſwarm and has its female, but one of them is often much more numerous than the other; and as the bees always love to live in large communities, the bees of the ſmaller cluſter become tired of their condition, and by degrees join the larger; ſo that this is ſeen to increaſe, and the other to decreaſe in ſize every moment, till at length there remains no more of the ſmaller ſwarm than a few faithful creatures, forming a ſort of guard about the female. In this caſe it is in vain for them to think of forming a community by themſelves; and they finally, with the female, join the other ſwarm; ſo that the new ſwarm has two females. *Reaumur's Hiſt. Inſ.*

HOACHE, in natural hiſtory, a kind of earth approaching to the nature of chalk, but harder, and feeling like ſope; whence ſome think that it is either the ſame with our ſope-rock of Cornwall, or very like it. The Chineſe diſſolve it in water, till the liquor is of the conſiſtence of cream, and then varniſh their china-ware with it.

HOARSENESS, *Raucedo*, a preternatural roughneſs of the voice. The part affected is the aſpera arteria, particularly the larynx. This is a ſort of catarrhous indiſpoſition ariſing from a too great acrimony, thinneſs, or ſaltneſs of the lymph. Spermaceti, decoct. rapar. and rob. paſſular. are approved remedies in this diſorder.

HOASE, among ſailors, a piece of canvas ſewed together at the ſides, and made into the form of a tube, to convey water from one place to another; this is more particularly uſed in the hold or lower-apartments of the ſhip to fill the caſks which are already ſecurely ſtowed.

HOD, a well known inſtrument uſed by labourers to carry bricks, mortar, &c. in, at the building, or repairing of houſes, &c.

HOE, in country affairs, a tool made like a cooper's addz, to cut up weeds in gardens, fields, &c. This tool is commonly called the hand-hoe: for other ſorts of hoes ſee the next article.

This inſtrument is of great uſe, and ſhould be more employed in hacking and clearing the ſeveral corners, cracks and patches of land, in ſpare times of the year, which would be of no ſmall advantage thereto.

HOEING, according to Tull, is the breaking or dividing the ſoil by tillage, while the corn, or other plants, are growing thereon. It differs from common tillage, which is always performed before the corn or plants are ſown or planted, or in the time of performing it; and it is much more beneficial to the crops than any other tillage. This ſort of tillage is performed various ways, and by means of different inſtruments. Land which, before the tillage, would have yielded little, tho' the more it is tilled before ſowing, the more plenty of corn it yields, yet, if tilled only before the ſowing, will always have ſome weeds, and they will partake of the advantage of the tillage as well as the corn. This is one reaſon for an after tillage, ſuch as that by hoeing. But there is another conſideration that yet more requires it; this is, that as ſoon as the ploughman has done his buſineſs, by ploughing and hoeing the land, after ſowing, the ſoil, of its own accord, begins to undo it all again by tending towards its original texture and ſpecific gravity again; the altering of which was the only buſineſs of all the former tillage. The breaking the particles of the earth, and making in it new pores, and new particles, or new ſuperficies, is the great buſineſs of the plough and harrow; but, as ſoon as their uſe is over, the earth begins to coaleſce again into its own form, the particles unite together, and the artificial pores in a great meaſure cloſe up. The ſeed is nouriſhed in a worſe ground than it was firſt put into, and the more the plant grows up, and requires a larger ſupply of food, the worſe the paſture becomes. While nouriſhment is thus denied the growing plants, they are at the ſame time choaked with weeds, which, being of a hardier nature than they, will grow with leſs ſupplies, and therefore thrive more vigorouſly, and rob them of a great part of the little food the land before allowed them.

Farmers in all ages have been acquainted, in ſome degree, with the uſe of tillage and dung to crops of uſeful plants; but they have ſo ill managed the time of giving theſe aſſiſtances to nature, that there is no doubt but one third part of the nouriſhment raiſed by dung and tillage, if it were given to plants and corn at many proper ſeaſons, and proportioned to the different times of their exigencies, would be of more benefit to the crop than the whole is, when applied all together at the time of ſowing.

Nature, by what ſhe does in the animal œconomy, ſeems to point out to us ſomething like the remedying this by hoeing; for when the teeth, as the plough, have tilled that ſoil or maſs which is earth-altered; and when the ſaliva and the juices of the ſtomach have ſerved to divide and attenuate it, as the ſalts of dung and other manure do land; after all this, the bile and pancreatic juices are ordained to farther attenuate it, at the very time when it is ready to be exhauſted by the numerous mouths of the lacteals, ſituate in the inteſtines. This laſt operation of theſe juices ſeems analogous to the meliorating the ſoil by hoeing, after the plants are grown, and are becomin fit for uſe.

Tranſplanting is nearly allied in its nature to hoeing, but it is much inferior. The nature of this will not admit of its being a general thing; and even if it would, hoeing is better: for by tranſplanting, the plants can only be kept up to a certain period, after which they will not bear it; but hoeing may be uſed to them with advantage, to their utmoſt ſtanding, and make them vigorous all the while.

The roots of a plant are all neceſſarily broken off in tranſplanting, and it requires ſome time for it to ſtrike a whole ſet of new ones; and if the earth about it is not kept thoroughly moiſtened all this time, the new formed roots will not be able to ſhoot, and the plant will ſtarve in the midſt of plenty: but, on the contrary, in hoeing, the ſame advantage of a new paſture for the plant is obtained, by the breaking the particles of the earth, and at the ſame time no more of the roots are broken off than can eaſily be ſupplied, and the reſt remaining in their places, the plant continues growing without that ſtop or decay, which muſt happen on tranſplanting, and which it recovers only by degrees. It is obſerved, that ſome plants are the worſe for tranſplanting: lucerne and ſaintfoin are never ſo good after tranſplanting, as when they are left in their native places, at the ſame diſtances; and finochia, removed, is never ſo good and tender as when it is not.

This laſt plant receives ſuch a check from tranſplanting in its infancy, that it has afterwards a diſeaſe like the rickets, which cauſes knots and ſwellings in it, that ſpoil it as a delicacy. All the tap-rooted plants ſuffer by tranſplanting; for it is neceſſary in this to cut off the long-main root, which afterwards, however good the ſoil may be, never arrives at the length it otherwiſe would have had, and which was neceſſary for the ſucceſs of the plant.

One great benefit of hoeing is, that it keeps plants moiſt in dry weather, the advantage of which to their growth is eaſily ſeen. This good office it performs on a double account. Firſt, as they are better nouriſhed by hoeing, they require leſs moiſture, and conſequently carry off leſs; for thoſe plants which receive the greateſt increaſe, having moſt terreſtrial nouriſhment, carry off the leaſt water, in proportion to their augment, as is proved by Woodward's experiments. Thus barley or oats, being ſown on a piece of ground well divided by tillage and dung, will come up and grow well without rains, when the ſame grains ſown on another part of the ſame land, not thus dunged or tilled, will ſcarce come up at all without rains, or if they do, will wait wholly for the rains for their growth and increaſe.

The hoe alſo, particularly the horſe-hoe, for the other does not go deep enough, procures moiſture for the roots from the dews which fall moſt in dry weather; and theſe dews ſeem to be the moſt enriching of all moiſture, as it contains in it a fine black earth, which will ſubſide from it in ſtanding, and which ſeems fine enough to be the proper pabulum, or food for plants.

A demonſtration that the tilled earth receives an advantage from theſe dews, which the untilled does not, is this; dig a hole in any piece of land, of ſuch a depth as the plough uſually goes to; fill this with powdered earth, and, after a day or two, examine the place, and the bottom part of this earth, and bottom of the hole, will be found moiſt, while all the reſt of the ground, at the ſame depth, is dry. Or, if a field be tilled in lands, and one ſhould be made fine by frequent deep ploughings, while another is left rough by inſufficient tillage, and the whole ſhould be then ploughed a-croſs in dry weather, which has continued long, every fine land will be turned up moiſt, and every rough land as dry as powder from top to bottom.

Although hard ground, when thoroughly ſoaked with rain, will continue wet longer than fine tilled land adding to it, yet, this water ſerves rather to chill than nouriſh the plants ſtanding in it, and to keep out the kindly benefits of the atmoſphere; it leaves the ground much harder alſo than before, when it is finally exhaled from it; and when, at length, the earth is then hardened, it can receive no benefit from any thing leſs than a large of rain, which ſeldom falls till the ſeaſon of vegetation is over.

A fine hoed ground is not ſo long ſoaked with rain, ſo the dews never ſuffer it to become perfectly dry. This differs from the flouriſhing ſtate of plants in hoed ground, while others near them, but in ground not hoed, are ſtarved for want of nouriſhment. The common opinion againſt this, but obſervation proves it to be true againſt the common opinion. The vulgar are guided by this, however, and will not hoe their ground in dry weather for fear of letting in the drought, as they call it; whereas this is the only method of keeping away the drought, and without either this, or watering, they muſt fail in theſe ſeaſons. *Tull's Horſe-Hoeing Huſbandry.*

HOG, *ſus*, in zoology, a genus of quadrupeds, of the order of the jumenta, the characters of which are theſe: The fore teeth are four in number, and are converging: thoſe of the lower jaw are eight, and are patulous: The dog teeth of the upper jaw are two, and very ſhort; those of the under jaw are ſingle, and exerted: the crown of the head is carinated, and the hoof is divided. See the article SWINE.

Beſides the common hog, there are ſeveral other ſpecies, as, 1. The American hog, with the back briſtly behind, and with a naked tail. 2. The muſk-hog, with a cyſt, placed on the back, in which is ſecreted a perfumed juice: its tail is naked. The babyrouſſa, with two teeth ſtanding on the forehead.

Hog's dung is, by Mortimer, reckoned one of the richeſt manures we are acquainted with, and the next in value to that of ſheep's dung, and is found to be equal in virtue to twice the quantity of any other dung, except this. The ancients ſeem to have been diſpleaſed with it, on account of its breeding weeds; but this is only accuſing it of being too rich, for any dung will do this when laid too thick. It is an excellent manure for paſture-grounds, and excels all other kinds of dung for trees. The farmers who uſe this dung for their lands, generally take care to ſave it, by well paving the ſtyes, and encreaſe the quantity by throwing in bean-ſtalks, ſtubble, and many other things of a like nature; and by good management of this kind many farmers have procured fifty or ſixty loads of excellent manure a year, out of a ſmall ſtye. The very beſt way of uſing this dung, is to mix it with horſe dung; and for this reaſon it is beſt to have the ſtye near the ſtable, that the two cleanſings may be mixed in one heap, and uſed together.

They have in many parts of Staffordſhire a poor light, ſhallow land, on which they ſow a kind of white pea: the land is neither able to bear this, nor any thing elſe, to advantage for their reaping; but when the peas are ripe, they turn in as many hogs as the quantity of peas will fatten, ſuffering them to live at large, and remain there day and night; in conſequence of this, the land will produce good crops of hay for ſeveral years afterwards; or if too poor for that, it will at worſt raiſe graſs enough to make it a good paſture-ground.

HOGSHEAD, in commerce, a meaſure of capacity, containing ſixty-three gallons.

HOISING, in the ſea-language, the act of drawing up any weighty body by the help of a tackle or complication of pullies.

HOKE-DAY, the Tueſday after Eaſter-week; which was the day on which the Engliſh conquered and expelled the Danes: this was therefore kept as a day of rejoicing, and a duty, called Hoke-Tueſday-Money, was paid to the landlord, for giving his tenants and bondmen leave to celebrate it.

HOLD, in ſhip-building, all that part of a ſhip's inſide which reaches from end to end, from the lower-deck to the floor or bottom; and contains the cargo, proviſions, &c.

HOLD-FAST, a large piece of iron, in the ſhape of the letter S, fixed into a wall, to ſtrengthen it. Alſo a tool uſed by joiners, carvers, &c. which goes through their benches, to hold faſt ſuch work as cannot be finiſhed by its being held in the hand.

HOLIBUT, the name of a very large flat fiſh, reſembling the flounder, but longer in proportion to its breadth.

HOLLAND, one of the United Provinces: it is about one hundred miles long, from north to ſouth, and ſcarce thirty miles broad; but enjoys the greateſt trade of any province in the world, and in point of ſtrength and riches is equal to the other ſix United Provinces. It is ſituated one hundred miles eaſt of England, and is bounded on the north and weſt by the German ſea, and on the ſouth by the provinces of Zealand and Utrecht.

HOLLAND, in commerce, a fine and cloſe kind of linnen, ſo called from its being firſt manufactured in Holland. See the article LINNEN.

HOLLOW, in architecture, a concave moulding, about a quarter of a circle, called by ſome a caſement, and by others an abacus.

HOLLOW-SQUARE, in the military art, a body of foot drawn up, with an empty ſpace in the middle for colours, drums, and baggage.

HOLLOW-TOWER, according to Hanis, is a rounding made of the remainder of two briſures, to join the curtain to the orillon, where the ſmall ſhot are played, that they may not be ſo much expoſed to the view of the enemy.

HOLLY, in botany. See the article AQUIFOLIUM.

HOLLY *Hedges* are a very beautiful evergreen and ſtrong fence, but liable to periſh in hard winters. It has been ſuppoſed, that the ſeverity of the cold, in theſe ſeaſons, was the occaſion of this; but a cloſer obſervation has ſhewn, that the miſchief is owing to the field mice,

mice, which in very ſevere ſeaſons, when they can get nothing elſe, diſbark the roots of theſe ſhrubs.

The method of preſerving theſe hedges, in ſuch ſeaſons, is found to be by clearing away the weeds which are a harbour to theſe little animals, and placing traps and boxes in proper places, with a paſte made of butter and rats-bane, daubed over their inſides, and holes made in their ſides no bigger than what the mice or rats, if there be any there, can creep into; and thus the vermin are deſtroyed, and the miſchiefs which might attend rats-bane being expoſed, are prevented.

Knee HOLLY, a name given to butchers broom.

Sea HOLLY, a plant more uſually called eryorgium. See ERYORGIUM.

HOLOCAUST, a burnt-offering, or ſacrifice, wholly conſumed by fire; of this kind was the daily ſacrifice in the Jewiſh church. This was done by way of acknowledgement, that the perſon offering and all that belonged to him, were the effects of the divine bounty. The heathens, who alſo offered holocauſts, probably conſidered them in the ſame light: and the diſpoſing of ſacrifices this way was the general cuſtom, till Prometheus introduced the cuſtom of burning only a part, and retaining the remainder for his own table.

HOLOGRAPH, in the civil law, an inſtrument entirely in the hand-writing of the perſon who ſigns it.

The word is Greek, and compounded of ολος, whole, and γραφω, to write.

HOLOMETER, a mathematical inſtrument for taking all ſorts of meaſures, both on the earth and in the heavens; it is the ſame with the pantometer.

The word is Greek, and compounded of ολος, whole, and μετρεω, to meaſure.

HOLY-GHOST, one of the perſons of the holy Trinity. See GOD and TRINITY.

Order of the HOLY-GHOST, the principal military order in France, inſtituted by Henry III. in 1569. It conſiſts of an hundred knights, who are to make proof of their nobility for three deſcents. The king is the grand-maſter, or ſovereign, and as ſuch, takes an oath on his coronation-day, to maintain the dignity of the order.

The knights wear a golden-croſs, hung about their necks by a blue ſilk ribband, or collar. But before they receive the order of the Holy-Ghoſt, that of St. Michael is conferred as a neceſſary degree; and for this reaſon their arms are ſurrounded with a double collar.

HOLY-THURSDAY, the ſame with aſcenſion-day. See ASCENSION.

HOLY-DAYS, the ſame with feſtivals. See the article FESTIVALS.

HOLY-ROOD-DAY, a feſtival otherwiſe called the exaltation of the croſs. See the article CROSS.

HOMAGE, in law, is the ſubmiſſion, loyalty, and ſervice which a tenant promiſed to his lord, when he was firſt admitted to the land which he held of the lord in fee: alſo that owing to a king, or to any ſuperior.

HOMAGE-JURY, a jury in a court baron, conſiſting of tenants that do homage to the lord of the fee.

This jury makes enquiry into, and preſentments of, defaults and deaths of tenants, and of admittances and ſurrenders into the lord's court.

HOMESOKEN, a privilege enjoyed by every perſon, in his own houſe or home, which ought not to be invaded.

HOMICIDE, in common law, the killing a man.

The word is Latin, *homicidium*, and derived from *homo*, a man, and *cædo*, to ſlay.

It is divided into voluntary and caſual. Caſual is either merely caſual, or mixed; the former is when a perſon kills another by pure miſchance, being about his lawful occaſions: it is accounted mixed, when there is negligence or ſome unwarrantable circumſtance attending the action. Voluntary homicide, that which is deliberate; and is either with a precedent malice, or without: the former is a felonious killing, with malice prepenſe, any perſon in the realm, who is under his majeſty's protection.

HOMILY, in eccleſiaſtical writers, a ſermon, or diſcourſe, upon ſome point of religion, delivered in a plain manner, ſo as to be eaſily underſtood by the common people.

At the time of the Reformation there were ſeveral of theſe homilies made and printed, and ordered to be read in ſuch churches as were not provided with a ſufficiently learned miniſter, in order to prevent unſound doctrine being taught in remote country places.

In the primitive church, homily rather meant a conference or converſation by way of queſtion and anſwer, which made part of the office of a biſhop, till the fifth century, when the learned prieſts were allowed to preach, catechize, &c. in the ſame manner as the biſhops uſed to do.

There are ſtill extant ſeveral fine homilies, compoſed by the ancient fathers, particularly St. Chryſoſtom and St. Gregory.

HOMODROMUS VECTIS, that kind of lever, in which the weight is in the middle, between the power and the fulcrum, or the power in the middle between the weight and the fulcrum. See LEVER.

HOMOGENEOUS, or HOMOGENEAL, denotes ſuch ſubjects as conſiſt of parts of the ſame nature, in contradiſtinction to heterogeneous, where the parts are of different natures.

The word is Greek, ομογενης, and formed of ομος, like, and γενος, kind.

HOMOGENEAL LIGHT, that whoſe rays are all of the ſame colour, degree of refrangibility and reflexibility. See COLOUR.

HOMOGENEAL NUMBERS, ſuch as are of the ſame kind.

HOMOGENEAL SURDS, ſuch as have one common radical ſign, as $\sqrt{}^2 a \sqrt{}^2 b$, or $\sqrt{}^3 b^3$, or $\sqrt{}^3 b^2$. See the article SURDS.

HOMOGENEUM COMPARATIONIS, in algebra, the known quantity in an equation, the ſame with abſolute number. It is ſo called to diſtinguiſh it from the other terms, which, though homogeneous, are not the quantities to which things are here referred.

HOMOLOGOUS, in geometry, is applied to the correſpondent ſides and angles of ſimilar and equiangular figures, which are ſaid to be homologous, or in proportion to one another.

HOMOLOGOUS THINGS, in logic, thoſe which agree in name, but are of different natures.

HOMONYMOUS, an appellation given to words which have two different ſignifications, being the ſame with equivocal terms.

HONE, a fine kind of whetſtone, uſed for ſetting razors, pen-knives, and the like. See COS.

HONEY, *Mel*, a ſweet vegetable juice, collected by the bee from the flowers of different plants, and depoſited in the cells of the combs; from which it is extracted either by ſpontaneous percolation through a ſieve in a warm place, or by expreſſion. That which runs ſpontaneouſly is purer than the expreſſed; a quantity of waxy and other impurities being forced out along with it by the preſſure, eſpecially when the combs are previouſly heated. The beſt ſort of honey is of a thick conſiſtence, a whitiſh colour, an agreeable ſmell, and very pleaſant taſte: both the colour and flavour are ſaid to differ in every degree according to the plants which the bees collect from.

Honey expoſed to a gentle heat, as that of a water bath, becomes thin, and throws up to the ſurface its waxy impurities, together with the meal or flower ſometimes fraudulently mingled with it, which may thus be ſeparated by diſpumation, ſo as to leave the honey pure. On continuing the heat, there riſes a conſiderable quantity of aqueous fluid, impregnated with the fine flavour of the honey: the inſpiſſated reſiduum, like the honey itſelf, diſſolves both in water and in rectified ſpirit, and promotes the union of oily and reſinous ſubſtances with watery liquors. By treating the inſpiſſated maſs with mouſſe, as practiſed by the ſugar-bakers for purifying ſugar, its unctuous treacly matter, the unctuous parts of the honey may in like manner be ſeparated, and its pure ſweet matter obtained in the form of a ſolid, ſaline, white concrete.

This juice is an uſeful ſweet, for medicinal as well as domeſtic purpoſes; more aperient and detergent than

ſimpler ſweet prepared from the ſugar cane; particularly ſerviceable for promoting expectoration in diſorders of the breaſt, and as an ingredient in cooling and detergent gargariſms. For theſe, and other ſimilar intentions, it is ſometimes mixed with vinegar, in the proportion of a about two pounds to a pint, and the mixture boiled down to the conſiſtence of a ſyrup; ſometimes impregnated with the virtues of different vegetables, by boiling in like manner with their juices or infuſions, till the watery parts of the juice or infuſion have exhaled and left the active matter incorporated with the honey. The boiling of honey, though it diſſipates great part of its odorous matter, and thus proves in ſome caſes injurious to it, is in ſome caſes alſo of advantage: there are particular conſtitutions, with which honey remarkably diſagrees, and in which even very ſmall quantities occaſion gripes, purging, and great diſorder: by boiling, it loſes of that quality by which it produces theſe effects.

HONEY-COMB, a waxen ſtructure full of cells, framed by the bees to depoſit their honey, eggs, &c.

There is ſomething very wonderful in the conſtruction of the cells in the honey-comb. Each cell conſiſts of ſix plane ſides, which are all trapeziums, but equal to each other. The bottom of the cell is contrived with three rhombus's HKDI, DEFI, and FIGH, (pl. LXXIV. *fig.* 1.) ſo diſpoſed as to conſtitute a ſolid angle at I, under the three equal angles DIH, DIF, and HIF; each of which is double the maximum angle of 54° 44′=DIK=DKI. Hence it comes to paſs, that a leſs quantity of ſurface is ſufficient to contain a given quantity of honey, than if the bottom had been flat, in the proportion of 4658 to 5550, as has been found by calculation; that is, nearly $\frac{1}{3}$ of the whole, ſo far as the figure of the ends of the cells extend in each, which fifth part of wax and labour ſaved, amounts to a vaſt deal in the whole comb. And if theſe admirable inſects knew their advantage, they could not more nicely obſerve the rules of the modern geometry. Hence we may obſerve, that though the method of diſcovering the maxima and minima of quantities by fluxions is a part of knowledge which the mathematicians have but lately acquired, and which they eſteem the ſublimity of human ſcience, yet this very thing was imparted to theſe inſects at the firſt creation of things.

The celerity with which a ſwarm of bees received into a hive, where they find themſelves lodged to their minds, bring their works of the combs to perfection, is amazing. There are vaſt numbers at work all at once; and that they may not incommode one another, they do not work upon the firſt comb till it is finiſhed, but when the foundation of that is laid, they go to work upon another, ſo that there are often the beginnings of three or four ſtories made at once, and ſo many ſwarms allotted to the carrying on the work of each. It would be a deſirable thing to ſee the bees at work, in making theſe elegant and regular fabrics; but it is ſcarce poſſible to ſee any thing of this kind diſtinctly, even with the advantage of glaſs-hives; for, as Mr. Reaumur obſerves, no bee ever works ſingly upon this occaſion, but wherever the fabric is erecting, there are numbers together trying to aſſiſt each other, and their motions are ſo ſwift, and ſo hid by their ſtanding before one another, that very little is to be ſeen of them. New bees are every moment going to the place, and old ones going away; and very frequently thoſe which arrive late are diſpatched away immediately after they arrive: there are only ſome very ſhort moments in which the glaſs of the hives can give a view of the creatures regularly employed at their work; for the moment one ſees a bee at work in building, that moment we ſee one either fly off, or elſe another get before her, ſo as to hinder the view: however, it is plain that the bee uſes her teeth in modelling and faſhioning the wax.

HONEY-COMB, in gunnery, a flaw in the metal of a piece of ordnance, when it is ill caſt and ſpongeous.

HONOUR-POINT, in heraldry, is that next above the center of the eſcutcheon, dividing the upper part into two equal portions. See the article POINT.

HOOD, in falconry, a piece of leather, with which the head of a hawk, falcon, &c. is covered.

HOOF, *Ungula*, the horny ſubſtance that covers the feet of divers animals, as oxen, horſes, ſheep, &c.

A horſe's hoof ſhould be of a round, not longiſh figure; and its ſubſtance ſolid, tough, high, ſmooth, without any circles, ſomewhat ſhining, and of a dark colour; for that which is white is commonly brittle; in ſhort, it ought to be of the colour of the hoof of a deer, and the whole foot round, but a little larger below than above, upright, and ſomewhat hollow on the inſide, and ſo diſpoſed that he may tread more on the toe than the heel.

The hoof of a horſe is either perfect or imperfect: an imperfect hoof is one that wants any of the above qualities; and, 1. May be broad and ſpreading out at the ſides and quarters; ſuch a horſe has, for the moſt part, narrow heels, and will ſoon be flat-hoofed; he will neither carry a ſhoe long, nor travel far. 2. Others are rugged or brittle-hoofed, which is a ſign that it is too hot and dry. 3. Some are long, which cauſes the horſe to tread all upon his heels, and by that means to breed wind-galls. 4. There are ſome crooked hoofs, broad on the outſides and narrow within, by which means the horſe is ſplay-foot. 5. Others have flat hoofs, and not hollow within, which give riſe to the inconveniencies above ſpecified in the firſt ſort of imperfect hoofs; but if it be too hollow, it will dry too faſt, and make him hoof bound. 6. When the fruſh is broad, the heels will be weak and ſoft, and the horſe will never tread boldly on the ground. 7. Some have narrow heels; theſe are the tendereſt of all, and the horſe will grow hoof-bound.

Bony HOOF is a round bony ſwelling, growing on the very top of a horſe's hoof, which is always cauſed by ſome blow or bruiſe.

The method of cure is, firſt to digeſt the ſwelling, either with rotten litter, or hay boiled in ſtale urine, or with a plaſter of ſtale wine lees, and wheat flour boiled together, in order to ripen it, and bring it to ſuppuration, or to diſſolve the tumor. If it come to a head, lance it in the loweſt part of the ſoftneſs, with a thin hot iron, to let out the matter; then tent it with turpentine, deer's ſuet, and wax, equal quantities of which ſhould be boiled together; and laying a plaſter of the ſame ſalve over it, to keep in the tent till it be thoroughly well.

HOOF-BOUND, this diſorder is a ſhrinking of the hoof at the top and at the heel, which makes the ſkin ſtare above the hoof, and grow over it.

This diſorder may happen to a horſe, either by keeping him too dry in the ſtable, by ſtreight ſhoeing, or by ſome unnatural heat after foundering.

HOOF-BRITTLE, an infirmity in horſes, proceeding either naturally, from the ſire or dam; or accidentally, from a ſurfeit falling down into the feet; or from the horſe's being formerly foundered.

For the cure, take unwrought wax, turpentine, ſheep's ſuet, and hog's greaſe, of each four ounces; ſallad-oil, a quarter of a pint; and of dog's greaſe, half a pound: boil them all together, and with this mixture, anoint the hoof well for two or three days, eſpecially at the ſetting on of the hair, and ſtop them with cow-dung and dog's greaſe, melted together.

HOOF-SWELLED, a diſorder that ſometimes happens by a prick, or a young horſe's being over-ridden, or too hard wrought, and which, if not ſpeedily removed, will beget a wet ſpavin.

For the cure, take the ſtrongeſt aqua-fortis you can get, and firſt file or draw away the old hoof ſomewhat near, with a file or drawing-iron; then touch what is left of the hoof, three or four dreſſings or more, with the aqua-fortis; and anoint the foot with an ointment made of one pound of hog's-greaſe; patch-greaſe, three quarters of a pound; Venice-turpentine, five ounces; new wax, three ounces; and ſallad-oil, three ounces; all melted together over the fire; and by anointing the coffin of the foot quite up to the top, you will cauſe a new hoof to grow upon it.

HOOK-PINS are bolts made with a ſhoulder at one end, and uſed by carpenters in framing: theſe are drove through the mortices and tenants of the work, prepared for building or wharfing.

HOP, *Lupulus*, in natural hiſtory, a plant of the reptile kind, whoſe flower is a principal ingredient in beer and other malt-liquors.

For the cultivation of hops, a rich, deep, mellow, dry

ſoil, more inclining to ſand than clay, is in general the beſt; and in particular, a black garden mould is excellent. Stiff clays, ſpewy lands, ſuch as are apt to be overflown by floods, hard gravels, ſtony grounds, very ſandy ones, and ſuch as are not at leaſt a foot and an half deep, are altogether improper for hops.

The beſt ſituation for hop-grounds is ſuch as inclines to the ſouth, or lies open to it, ſo that they may have the benefit of the ſun during the greateſt part of the day. It muſt alſo be open, for the air to have a free paſſage and circulation between the plants; and it ſhould be ſo ſheltered to the eaſt, north, and weſt, that neither the froſty winds in the ſpring may cut off the young ſprouts, nor the more ſtormy ones in ſummer and autumn deſtroy the full-grown hops.

The ground and ſituation being choſen, the next buſineſs is to prepare it for the planting. In many parts of England, when the ground is broken up for this purpoſe, the plough goes firſt, and men follow it with the ſpades, with which they dig one ſpit deep in the furrows where the plough has paſſed, throw up the earth thus dug, and ſo continue to plough and dig till the whole is done. Either this tillage, if it be well performed, or the deep ploughings, croſs-ploughings, and harrowings, by which careful huſbandmen prepare their land for corn, will fit this for being ſown with turnip ſeeds in the end of July, or beginning of Auguſt, and if the turnips are hoed twice, ſo as to be left about eight inches aſunder, they will yield a good crop, the weeds will be deſtroyed, and the ground will be rendered looſe and fine. Another good ploughing after the turnips are taken off, will, with the enſuing winter mellowing, render it fit for being planted with hops in the ſpring.

The beſt time to begin the ploughing is in October, in order that the ſoil may be properly prepared to receive the benefits of the winter's froſts, rains, and ſnows; after which, in the beginning of ſpring, it ſhould be well and deeply ploughed again, and well harrowed; and after another ploughing in March, which will be of very great ſervice, it ſhould be harrowed fine; and laid as even as can be.

When the ground is in proper readineſs for planting, ſtretch along a ſtraight ſide of the field, at fifteen or twenty feet diſtance from the hedge, and parallel to it, a line with knots or rags tied in it, as far aſunder as you deſign your hills to be, and ſtick in the ground a ſharp-pointed ſtick at every knot, as marks for the places where the hills are to be made: continue the line in this manner the whole length of the ground, and from this firſt row you may mark out the reſt of the field, either in ſquares, chequer-wiſe, at the intended diſtance of the hills, or in the quincunx form, where the hills of every row lie oppoſite to the middle of the firſt, in a triangular from.

The diſtance of the hills ſhould be, in ſome meaſure, regulated by the nature and goodneſs of the ſoil: but, in every caſe, they ſhould be far enough aſunder to admit the hoe-plough at all times without danger to the plants. If the ſoil be dry and ſhallow, ſix or ſeven feet will be a convenient diſtance: but if it be rich, moiſt, and apt to bear large hops and leaves, it may be right to allow eight or nine feet between the hills.

The moſt proper ſeaſon for planting hops is from the beginning of March to near the middle of April, at the time when they begin to ſhoot. The Kentiſh huſbandmen approve likewiſe of October: but the common ſorts are not to be procured then, unleſs it be from a ground that is to be dug up and deſtroyed; beſides which, there is ſome danger of their rotting in the earth, if the winter ſhould prove very wet.

There are ſeveral ſorts, though the botaniſts allow but one ſpecies, of hops. The moſt eſteemed are, the long white, the oval, and the long ſquare garlic hop. Theſe differ from each other in the colour and ſhape of their bells, or hops, in their degree of bearing, and in their time of ripening. The long white is moſt valued, becauſe it is a great bearer, and produces the moſt beautiful hops; for the beauty of hops conſiſts in their being of a pale bright green colour. The oval hop is beautiful, but does not yield ſo large a crop. There is a ſort of this kind of white hop, called the early, or rath hop, which ripens a week or ten days before the common, and is therefore of advantage to thoſe who would be firſt at market: but it is tenderer than the other, and does not bear near ſo plentifully. The long ſquare garlic hop is the greateſt bearer, more hardy, and ſomewhat later ripe than the former; but by reaſon of its redneſs towards the ſtalk, it is not ſo beautiful to the eye, and therefore is not ſo much eſteemed as the other ſorts.

Few hop grounds are without ſome plants of a ſort of hop which many call the female hop, but very erroneouſly; for the female hop is that which is cultivated for uſe, and this, which others name more properly the wild hop, is the male. Towards the middle of July, it puts out a great number of long looſe bunches of ſmall flowers, not at all like the true hop; and in ſomewhat leſs than a month after, that is to ſay, juſt before the true hop begins to bloſſom, they ripen, and with the leaſt motion of the wind, ſhed a farina, which is wafted all around, and is by ſome, not improbably, thought to be of uſe to impregnate other hops. Thoſe who are of this opinion adviſe therefore to leave one or two hills of them ſtanding in the hop-ground. But the common practice is to mark them at their firſt appearance, and to root them out afterwards, becauſe they do not bear bells or hops, and as they are generally the ſtrongeſt plants, ſets might otherwiſe be taken from them by miſtake.

There is alſo a poor ſtarved hop, called a wild hop, which is not judged to be a diſtinct ſort, but a hop which has degenerated for want of culture.

The planter of hops ought to be extremely careful in the choice of his plants, or ſets, particularly in regard to the kind of the hop: for it is a great trouble and loſs to him when his garden proves to be a mixture of ſeveral ſorts of hops, ripening at different times. He who plants the three ſorts above-mentioned, viz. the early, the long white, and the ſquare hop, in three diſtinct parts of his ground, will have the conveniency of picking them ſucceſſively as they become ripe.

Hop-ſets are cuttings from the roots or branches which grow from the main root or ſtock. They ſhould be procured, if poſſible, from grounds planted with none but the ſort which is deſired; and they ſhould be from five to ſeven or eight inches long, with three or more joints or buds on them, all the old bind and hollow part of the ſet being cut off.

The ground being prepared for planting, as before directed, towards the latter end of February, or in the beginning of March, if the ſoil be light, or late in March if it be ſtrong and moiſt, make, in the places marked out by the ſticks ſtuck in them, holes about twelve or ſixteen inches wide, and of a depth proportioned to the nature of the ground. In general, ten or twelve inches will be a ſufficient depth. If the ground be ſhallow, and you meet with hard clay or gravel, by no means enter into this, for you would then make a baſon to retain water; but, in ſuch caſe, inſtead of going deeper, raiſe up a ſmall hill of good mould. If there is a good depth of rich mellow mould, dig the hole a foot and a half or two feet deep, and you will find the hops thrive the better; for their tap roots naturally run downward.

When all things are ready for planting, fill up the holes with the mould before thrown out of them, if it be naturally good, after having firſt broke it fine with a ſpade: but if the ſame earth be not rich enough, make uſe of fine freſh mould, or of the compoſt provided for this purpoſe. About a peck or two of this will be ſufficient for each hill; but no new dung ſhould be put into the hole on any account.

Then, with a dibble or ſetting ſtick, ſuch as gardeners generally uſe for planting of beans, make five or ſix holes, the depth of your ſets, one in the middle, perpendicular, and the reſt round about, ſloping, and meeting at the top near the center: put your ſets therein, ſo that they may ſtand even with the ſurface of the ground; and then preſs the mould cloſe to them, and cover them with fine mould two or three inches thick. A ſtick ſhould be placed on each ſide of the hill to ſecure it.

The ground being thus planted, all that is to be done in the following ſummer, is to keep the hills and alleys clear from weeds by frequent hoeings; to dig the ground in the month of May, and to carry off all the ſtones that are turned up by digging; to raiſe a ſmall hill about the

plants; to throw ſome fine mould on their roots; and in the latter end of May, or beginning of June, to twiſt all the vines and branches together into a bunch or looſe knot, and lay them thus twiſted on the top of the hill.

Towards the latter end of February, or in the beginning of March, in the ſecond year, when the weather is kindly, open the hills, and with a ſharp knife, cut off the ſhoots of the firſt year to within an inch of the old ſtock, together with all the younger ſuckers that have ſprung from the ſets, and cover the ſtock with fine earth. To keep the knife ſharp, you ſhould have a whetſtone always by you at dreſſing.

In the third and following years, when you dig your hop-ground in February, let the earth be taken away with a ſpade, or hoe, round about the hill, very near them, that you may the more conveniently come at the ſtock to cut it: then in fair weather, towards the beginning of March, if your hops be weak, begin to dreſs them; but if they are ſtrong, and in heart, the middle or latter end of March will be the beſt time; for late dreſſing reſtrains their too early ſpringing, which is the cauſe of many injuries to the hop.

After the hops are dreſſed in the ſecond year, the next buſineſs is to pole them. Poles of only ten or twelve feet long will do then; but in the third year, by which time they come to their full bearing ſtate, they will require poles of full ſize: this, if the ground be rich, and the hop vigorous, will be from ſixteen to twenty feet, or even more; or there will be danger of loſing great part of the crop.

If the hop be weak, and the ground not rich, the poles ſhould not be more than from fourteen to eighteen feet long, for fear of impoveriſhing the root; for the hop will ſoon run itſelf out of heart if over poled; ſo that, as was ſaid before, there is more danger in over-poling than in under-poling: neither can a good crop be expected from an over-poled ground, becauſe the branches which bear the hops grow very little till the buds have over-reached the poles, which they cannot do when the pole is too long. Two ſmall poles are ſufficient for a hill in a young ground.

Towards the latter end of July hops begin to bloſſom, about the beginning of Auguſt they bell, and in forward years, they are ſometimes ripe at the end of Auguſt, or beginning of September. When they begin to change colour, or are eaſily pulled to pieces, when they emit a fragrant ſmell, and when their ſeeds begin to look brown and to grow hard, you may conclude that they are ripe: then pick them with all expedition; for a ſtorm of wind will do them great miſchief at this time; and hops picked green and bright, without bruiſing or diſcolouring, will ſell for a third part more than thoſe that are otherwiſe.

When the poles are drawn up in order to be picked, the vines around them ſhould be cut aſunder at the height of about three or four feet from the ground; for the cutting of them lower, eſpecially while the hops are green, would occaſion ſo great a flowing of the ſap, as would weaken and hurt the root.

The moſt convenient way of picking them is into a long ſquare frame of wood, called a bin. This frame is made of two poles, or pieces of wood, each nine or ten feet long, and three or four inches broad, joined together at about a foot and a half from each end, by two other pieces three feet long; and it is ſupported by four legs three feet and a half high; ſo that there remain in the middle of it a ſpace ſix feet long, three wide, and three and a half deep. In this ſpace is fixed a coarſe linen cloth, or hop-bag, cut open on one ſide, and hung hollow, either by hitching it on tenter-hooks along the inſide of the frame, or by ſtretching it on the outſide with wooden ſkewers, to receive the hops as they are picked. Three men or women, or four boys or girls, may ſtand at each ſide of the frame, and pick two poles at a time.

The hops ſhould be picked as free as poſſible from leaves and ſtalks; for theſe would be of greater prejudice to the ſale, than any ſeeming advantage which might be expected from their weight. The bin ſhould be emptied two or three times a day into a large cloth of coarſe linen, in which the hops ſhould be immediately ſtitched up with ſkewers, and carried directly to the oaſt, or kiln, to be dried; for if they remain long in the bin, or cloth, they will ſweat and be diſcoloured; but if you cannot dry them immediately, and muſt keep them a little while, ſpread them on a floor, and by that means the damage which they will receive in a day or two will not be great.

In drying of hops, firſt lay the hair-cloth very even on the bed or floor of the kiln, and ſpread the green hops thereon, about ſix inches thick, laying them with a rake as ſmooth as poſſible, not thicker in one place than another. Let the kiln be moderately warmed before you lay on the hops; then keep an even and ſteady fire under them, but not too fierce at firſt, for fear of ſcorching them; and let not the fire ſlacken, but rather increaſe it till the hops are nearly dried, leſt the moiſture or ſweat, which the fire has raiſed, fall back and diſcolour the hops. After the hops have lain thus about ſeven, eight, or nine hours, have left off ſweating, and leap up when beaten with a ſtick, then turn them upſide with a broad malt ſhovel, or ſcoop made for that purpoſe, or caſt them up into a heap in the middle, and afterwards ſpread them equally on all ſides. Let them remain in this ſituation for two or three hours more, till every hop, if poſſible, be thoroughly and equally dried; and then with a hair-cloth, remove them to the heap where they are to lie till they are bagged.

Hops break all to powder if they are bagged hot from the kiln. To prevent this, they ſhould be laid in a heap, to ſweat and grow tough; and if they are then covered for a while cloſe with blankets, to keep the air from them, they will bag the better. There is no limited time for their ſweating; that varying according to the weather, three or four days are commonly ſufficient; but it is a certain rule, that when the hops feel moiſt and clammy, and can be ſqueezed in the hand, or trodden cloſe, without breaking, they are then fit for bagging. The harder they are trodden, the better they will keep.

The bags proper for this occaſion are made of coarſe linnen cloth. They are commonly about eleven feet long, and near two yards and a half in circumference, and contain about two hundred and a half weight of hops. The ſmall bags, called pockets, contain about half that weight.

The manner of bagging is thus: make a round or a ſquare hole, but a round one is moſt convenient, about twenty-ſix or thirty inches over, in the floor of the chamber where the hops are laid in heaps after they are ſweated. This hole ſhould be large enough to receive the bag, and for a man to go up and down it with eaſe. Tie with a piece of packthread an handful of hops in each lower corner of the bag, to ſerve as handles for the more eaſy lifting or removing of the bag; and, with packthread, faſten the mouth of the bag to a frame, or hoop, ſomewhat larger than the mouth of the hole, that the hoop may reſt on its edges, and ſtrong enough to bear the weight of the hops when the bag is full, and of the man who treads them. The upper-part of the bag being thus fixed by the hoop, let the reſt of it hang down through the hole; but not ſo near to the lower floor as to touch the ground: then throw into it a buſhel or two of hops; and let a man go into the bag, and with ſhoes that have no heels, tread the hops down on every ſide, as hard as he can, till they lie cloſe. Let more hops be then caſt into the bag, and be trodden down, as before; and continue this till the bag is full. When that is done, untie it from the hoop, let it down, and ſew up its mouth as cloſe as you can, obſerving at the ſame time to tie up ſome hops in the upper-corners, as was done before in the lower.—The harder the hops are preſſed, and the cloſer and thicker the bag is, the longer and better the hops will keep.

HOPPER, a kind of baſket, wherein the ſeed-corn is carried at the time of ſowing. See the article SOWING.

It is alſo uſed for the wooden trough, in a mill, into which the corn is put to be ground. See the article MILL.

HORARY, ſomething relating to an hour. Hence

HORARY, or HOUR-CIRCLE *of a Globe*, is a ſmall brazen circle, fixed upon the brazen meridian, divided into

into twenty four hours, having an index moveable round the axis of the globe, which upon turning the globe fifteen degrees, will ſhew what places have the ſun an hour before or after us. See GLOBE.

HORARY CIRCLES, or LINES, in dialling, are the lines or circles which mark the hours on the ſun-dials. See DIAL.

HORARY MOTION *of the Earth*, the arch it deſcribes in the ſpace of an hour, which is nearly 15 degrees, though not accurately ſo, as the earth moves with different velocities, according to its greater or leſſer diſtance from the ſun. See EARTH.

HORD, in geography, is uſed for a company of wandering people which have no ſettled habitation, but ſtroll about, dwelling in waggons, or under tents, to be ready to ſhift as ſoon as the herbage, fruit, and the preſent province is eaten bare: ſuch are ſeveral tribes of the Tartars, particularly thoſe who inhabit beyond the Wolga, in the kingdom of Aſtracan and Bulgaria.

A hord conſiſts of fifty or ſixty tents, ranged in a circle, leaving an open place in the middle. The inhabitants of each hord uſually form a military company or troop, the eldeſt of which is commonly the captain, and depends on the general or prince of the whole nation.

HORDEOLUM, *Crithe*, or *Barley-Corn*, ſo called from its reſemblance to that grain, in medicine, a tumor that grows in different parts of the eye-lids; it is commonly called a ſtye. When it is ſmall, it comes only on the edge of the eye lids, or very near it between the cilia; but when it is larger, it ſpreads towards the middle of the lid. In their beginning, an inflammation commonly accompanies theſe tumors: when they do not ſuppurate, their matter is concreted, and they become wens, which are ſometimes ſoft, and ſometimes very hard. Sometimes this diſeaſe diſappears a while, and afterwards returns in a few days.

The cure of this diſeaſe is ſuited to the different circumſtances that attend it. If there be an inflammation, the pulp of a roaſted apple applied by way of poultice ſoon diſperſes it, and ſometimes only abates the tumor. If it hardens, it muſt be opened with a lancet, and the hard fleſh conſumed by a liquid cauſtic, and afterwards the plaſter of the abbot de Grace applied.

If the hordeolum comes on the lower eye-lid, it is generally more on the inſide than the outſide, and is cured by the lapis infernalis, or rather by making an inciſion therein, drawing out the tumor and applying a collyrium of ten parts of water to one part of ſpirit of wine.

There are other little tumors on the edges of the eye-lids, which by reaſon of their whiteneſs and hardneſs are called chalazæ; as alſo, another ſort called lithiaſis or gravel-ſtone. All which are cured in the ſame manner. *St. Yves.*

HORDEUM, barley. See BARLEY.

HOREHOUND, *Marubium*, in botany. See MARUBIUM.

HORIZON, in aſtronomy, a great circle of the ſphere, dividing the world into two hemiſpheres, the one upper and viſible, the other lower and inviſible.

The word is Greek, ὁριζων, and derived from ὁριζω, to bound, terminate, or limit.

The horizon is either rational or ſenſible.

Rational, *True*, or *Aſtronomical* HORIZON, called generally the horizon, is a great circle, whoſe plane paſſes through the center of the earth, having the zenith and nadir for the poles thereof. It divides the ſphere into two equal parts, or hemiſpheres.

The meridian and vertical circles all cut the rational horizon at right angles, and into two equal parts.

Senſible, *Viſible*, or *Apparent* HORIZON, is a leſſer circle of the ſphere: this circle divides the viſible part of the ſphere from the inviſible, and has for its poles the zenith and nadir; conſequently the ſenſible horizon is parallel to the rational; and it is cut at right angles, and into two equal parts, by the verticals.

HORIZON, in geography, is a circle paſſing over the earth, and dividing the viſible part of the earth and heavens from that which is inviſible.

The altitude or elevation of any point of the ſphere, is an arch of a vertical circle, intercepted between it and the ſenſible horizon.

This is peculiarly denominated the ſenſible horizon, to diſtinguiſh it from the rational, or true, which paſſes through the center of the earth, as already obſerved.

The earth is ſo ſmall in compariſon of the immenſe largeneſs of the ſphere of the heaven, that the planes of the ſenſible and rational horizon may be taken as coincident; that is, the diſtance of them when meaſured in the ſphere of the heaven, is inſenſible, or however not great enough to be diſcovered by any obſervation. Let ABCD (plate LXXIV *fig.* 2.) repreſent the earth; *z h n o*, the ſphere of the ſtarry heaven: if an inhabitant of the earth ſtands upon the point A, his ſenſible horizon is *s e*, his rational horizon *h o*; the diſtance between the planes of theſe two is the ſemi-diameter A F of the earth, and is meaſured in a great circle upon the ſphere of the heaven, by the angle *e* F *o*, or by the arch *e o*; this arch, in ſo ſmall a circle as *z h n o*, would amount to ſeveral degrees, and conſequently the difference between the ſenſible and rational horizon would be great enough to be eaſily diſcovered by obſervation; but this circle in the figure is abundantly too ſmall to repreſent the ſphere of the heaven, proportional to ſuch an earth as is here ſuppoſed to be of the magnitude A B C D: let us therefore repreſent the ſphere of the heaven by a larger circle Z H N O; here the ſame ſemi-diameter of the earth A F, meaſured in this larger circle, amounts to fewer degrees; for the arch E O contains fewer degrees than the arch *e o*, and the angle E F O is leſs than the angle *e* F *o*; but this angle alſo might amount to ſeveral degrees and minutes, and be large enough to be meaſured by aſtronomical obſervation. From what has been ſaid, it follows, that the larger the ſphere of the heaven is, in proportion to the globe of the earth, the leſs ſenſible is the difference between the ſenſible and rational horizon, as being meaſured by a ſmaller angle, and conſequently, if we ſuppoſe the ſphere of the heaven ſo large that the angle which meaſured the diſtance between the ſenſible and rational horizon is not above a ſingle ſecond, the difference would be too ſmall to be meaſured by any aſtronomical inſtrument, and conſequently inſenſible: and thus, in fact, in the caſe at preſent, the earth, when compared with the ſphere of the fixed ſtars, becomes a point of no ſenſible magnitude.

The viſible horizon is moſt accurately obſerved upon the ſea, and is therefore, ſometimes, called the horizon of the ſea. It may be obſerved by looking through the ſights of a quadrant at the moſt diſtant part of the ſea within view. In making this obſervation, the viſual rays A D and A E (*fig.* 3.) will, by reaſon of the ſpherical ſurface of the ſea, always point a little below the true ſenſible horizon S S, and conſequently below the rational horizon H O, which is parallel to it, and coincident with it: how much the depreſſion of the horizon of the ſea is below the true horizon, is ſeen by the quadrant. It is obvious, that the higher the eye is, the greater is the depreſſion of the horizon of the ſea; this depreſſion is variable; ſo as to be ſometimes a little greater than at other times, though the height of the eye be the ſame in the ſeveral obſervations: this difference is but ſmall, amounting only to a few ſeconds, and is owing to the difference in the air, which at different times refracts the viſual rays more or leſs, according as it is of a greater or leſs denſity. The viſual ray, without refraction, is A E, and E is the moſt diſtant point which could be ſeen; but, by refraction, the ray F G coming from the point G, may be bent at F, ſo as to go on from thence in the right line F A, and then the view is extended as far as G, and the depreſſion of the horizon of the ſea is in the line A F, which points higher than A E, but extends the view farther.

A bare inſpection of the figure is ſufficient to ſhew that, if the refraction were greater, the view would be extended ſtill farther, as far as M, though the depreſſion of the horizon of the ſea would be leſs, as is ſhewn by the line A L M.

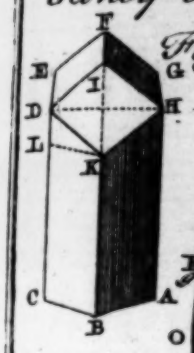
F. Lavel, profeſſor of hydrography at Marſeilles, found that the arch of the circumference of the earth intercepted between the obſervatory to the ſeaward and the horizon, fluctuated between fifteen minutes and thirteen minutes and a half: whence M. Caſſini deduces that the extent of the horizon is ſeven French leagues, of three miles each; and that the obſervatory is 175 feet high.

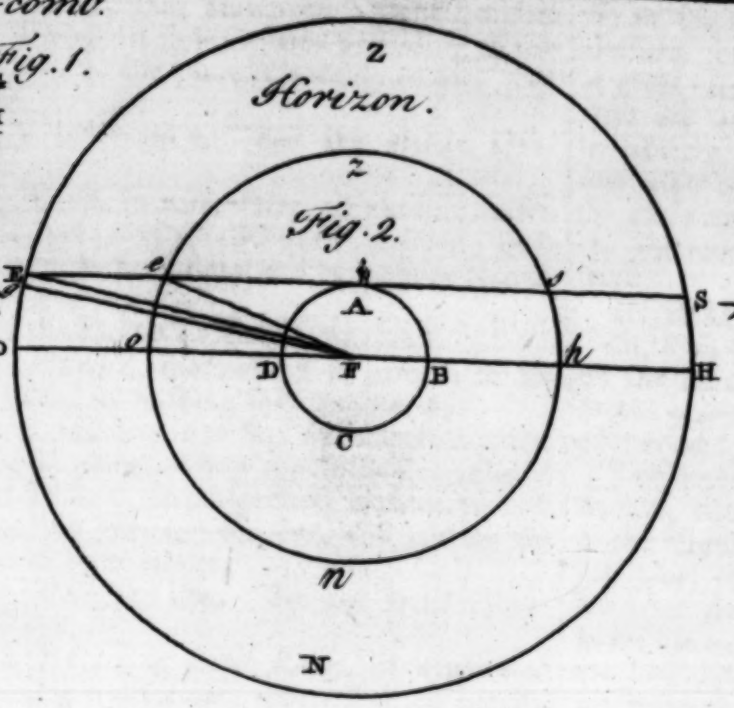
PLATE LXXIV.

Facing Horizon.

Honey-comb.

Fig. 1.





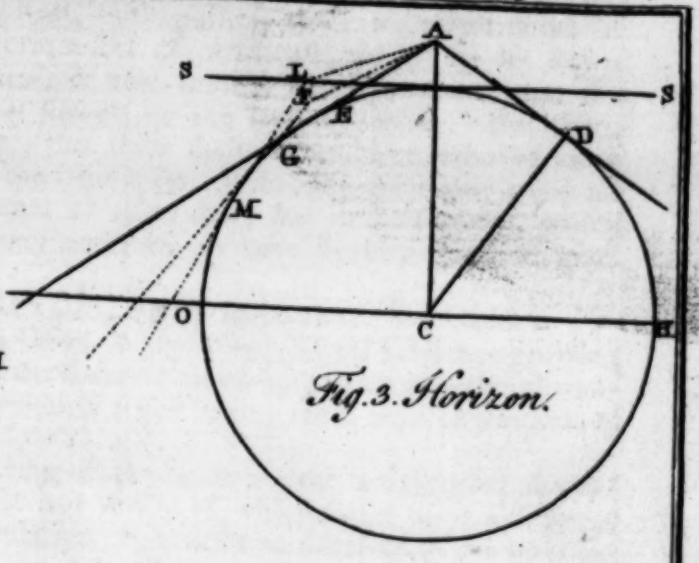


Fig. 3. Horizon.

Fig. 4. Horopter.

Fig. 5. Hydrometer.

Fig. 6.

Fig. 7.

Fig. 10.

Bradford's Hydrostatic Instrument.

Fig. 8.

Fig. 9.

5 JA 59

HORIZONTAL, ſomething relating to the horizon; or that is taken in, or on a level with the horizon: thus we ſay, an horizontal plane, &c.

HORIZONTAL DIAL, that drawn on a plane parallel to the horizon, having its ſtyle elevated according to the altitude of the pole, in the place it is deſigned for. See the article DIAL.

HORIZONTAL DISTANCE. See the article DISTANCE.

HORIZONTAL LINE, in perſpective, a right line drawn through the principal point parallel to the horizon; or it is the interſection of the horizontal and perſpective planes. See the article PERSPECTIVE.

HORIZONTAL PARALLAX. See PARALLAX.

HORIZONTAL PLANE, that which is parallel to the horizon of the place, or nothing inclined thereto.

The buſineſs of levelling is to find whether two points be in the horizontal plane, or how much the deviation is.

HORIZONTAL PLANE, in perſpective, a plane parallel to the horizon paſſing through the eye, and cutting the perſpective plane at right angles.

HORIZONTAL PROJECTION. See the article PROJECTION and MAP.

HORIZONTAL *Range*, or *Level Range*, of a piece of ordnance, is the line it deſcribes, when directed parallel to the horizon.

Dr. Halley has given us the two following uſeful theorems:

1. A ſhot being made on an inclined plane, having the horizontal diſtance of the object it ſtrikes, with the elevation of the piece, and the angle at the gun between the object and the perpendicular, to find the greateſt horizontal range of that piece loaded with the ſame charge of powder, that is, half the latus rectum of all the parabolas made with the ſame impetus.—Take half the angle contained between the object and nadir, and the difference of the given angle of elevation from that half; ſubtract the verſed ſine of that difference from the verſed ſine of the angle made by the object and zenith: the difference of thoſe verſed ſines will be to the ſine of the angle laſt mentioned, as the horizontal diſtance of the object ſtruck to the greateſt range at forty-five degrees.

2. Having the greateſt horizontal range of a gun, the horizontal diſtance and angle of inclination of an object to the perpendicular, to find the two elevations neceſſary to ſtrike that object.—Take half the angle contained between the object and nadir, this half is equal to half the ſum of the two angles of elevation ſought; then ſay, as the horizontal range is to the horizontal diſtance of the object, ſo is the ſine of the angle of inclination to a fourth proportional; which fourth, being ſubtracted from the verſed ſine of the angle formed by the object and zenith, leaves the verſed ſine of half the difference of the angles of elevation, whoſe half ſum was before obtained; therefore, by adding and ſubtracting half the difference of the angles of elevation to and from the ſaid half ſum, the elevations themſelves will be found. See more under the article PROJECTILE.

HORIZONTAL REFRACTION. See the article REFRACTION.

HORIZONTAL SHELTERS, among gardeners, are defences diſpoſed parallel to the horizon, for tender plants, bloſſoms, and fruits, in the ſpring, to defend them againſt blaſts, and pinching nights.

Horizontal ſhelters, ſays Miller, have by ſome perſons been greatly recommended to perſerve fruit-trees, but with how little reaſon, or upon what ſlight experiments, every one that has ever made uſe of them will eaſily judge, eſpecially thoſe which are contrived by placing tiles in the walls, at certain diſtances; nothing being more obvious than that vegetables, when prevented from receiving the advantages of dews, rains, &c. theſe kindly benefits of heaven, grow weak, languid, and at laſt entirely decay: and from numbers of experiments, which have been lately made, we find that trees imbibe great quantities of nouriſhment through the pores of their leaves and branches, whereby they are rendered vigorous and healthy, even in ſuch ſeaſons, and upon ſuch ſoils, where one would think it impoſſible they ſhould receive much nouriſhment from the earth: to deprive them of this advantage, therefore, is no leſs than deſtroying them.

The only ſort of ſhelter Mr. Miller approves of, for fruit-trees, is that made with two leaves of ſlit-deal, joined over each other, and painted; theſe being fixed upon the top of the wall, with pullies, to draw up and down at pleaſure, form a ſort of penthouſe, which are let down in great rains, or cold nights, during the time that the trees are in flower, or the fruit is ſetting. But then, he obſerves, that theſe ſhelters ſhould be removed away ſoon after the fruit is ſet, ſo that the trees may enjoy all the advantages of rain, dew, &c. in the ſummer, which are abſolutely neceſſary to have healthy trees, or good fruit.

HORMINUM, clary, in botany. See CLARY.

HORN, *Cornu*, in phyſiology, a hard ſubſtance growing on the heads of divers animals, particularly the cloven-footed quadrupeds; and ſerving them both as weapons of offence and defence.

The caſting off the horns of deer is a ſingular phænomenon, the true reaſon of which ſeems to be a ſtoppage of the circulation; ſo that being deprived of the nouriſhing juice, they fall off much in the ſame manner as the leaves of trees do in autumn. About ten days after the horns are caſt, the new ones begin to appear: theſe at firſt are ſoft and hairy, but they afterwards grow hard, and the creature rubs off the hair.

HORN is alſo a muſical inſtrument of the wind kind, chiefly uſed in hunting, to animate the hunters and the dogs, and to call the latter together.

The French horn is bent into a circle, and goes two or three times round, growing gradually bigger and wider towards the end, which in ſome horns is nine or ten inches over.

HORN, in architecture, ſometimes denotes a volute. See VOLUTE.

HORNS *of Inſects*, the ſlender oblong bodies projected from the heads of thoſe animals, and otherwiſe called antennæ, or feelers.

HORN-WORK, in fortification, a ſort of out-work, advancing towards the field, to cover a curtain, baſtion, or other place ſuſpected to be weak, as alſo to poſſeſs an eminence, &c.

It conſiſts of two demi-baſtions joined by a curtain; its flanks are uſually parallel, though, ſometimes, they contract towards the place, forming a queue d'yronde, or ſwallow's tail. When the flanks are too long, ſometimes epaulements are made to flank them. The parts next the country are to be defended by a parapet. Two horn-works joined together make a crown-work.

HORNET, *Crabro*, in zoology, a ſpecies of apis with a black thorax, and double black ſpots on the ſegments of the body. See the article APIS.

HOROGRAPHY, the ſame with dialling. See the article DIAL.

HOROLOGIUM, a general name for inſtruments to meaſure the hours, as a watch, clock, dial, &c. See the articles WATCH, CLOCK, &c.

HOROPTER, in optics, a right line drawn through the point where the two optic axes meet, parallel to that which joins the centers of both the eyes; as the line A B (plate LXXIV. *fig.* 4.) which is drawn through the point of concourſe of the optic axes of the eyes D and E, parallel to H I, which connects the centers of the eyes H and I.

The word is Greek, and derived from ὁπτὴρ, beholder, which is formed of ὁπτομαι, to ſee, becauſe it is found by experience to be the limit of diſtinct viſion.

HOROSCOPE, in aſtrology, the point of the heavens riſing above the eaſtern point of the horizon, at any given time when a prediction is to be made of a future event; as the fortune of a perſon then born, the ſucceſs of a deſign, &c.

The word is Greek, and compounded of ὡρα, hour, and σκοπεω, to behold.

It alſo denotes a figure of the twelve houſes, or twelve ſigns of the zodiac, wherein the diſpoſition of the heavens is marked for the time given.

Lunar HOROSCOPE, the point from whence the moon proceeds when the ſun is in the aſcending point of the eaſt.

HORSE, *Equus*, in zoology, a well known quadruped, the characters of which are theſe: the fore-teeth

are ſix in number, the upper ones incurvated, and the inferior prominent: the canine teeth are not exerted, and are on each ſide ſeparated by a ſpace from the teeth: the hoof is undivided, and the teats are two, and placed in the groin.

The horſe is one of the nobleſt quadrupeds we are acquainted with. In ſtrength and natural fierceneſs, he is inferior to few, and yet eaſily tamed. The head is long, and large; the eyes large, and prominent; the ears erect, and beautiful; the neck is long and thick, and elegantly decorated with a mane; the body is rounded and beautifully turned; the legs are ſtrong, without being bulky; and the tail is long, and hairy all the way; the hairs being like thoſe of the mane, only longer, thicker, and more beautiful.

Though the moſt experienced horſemen are not always agreed in ſome points relating to the ſhape, make, and goings of a horſe, yet they almoſt always accord in this, that there ought to be a juſt proportion in all his parts. That even when he is taken to pieces, and examined ſingly in his particular members, though ſome defects may appear, yet when they all bear a juſt correſpondence one to another, and concur in ſuch a manner as to render his action eaſy, juſt, and regular; ſuch a horſe cannot be greatly diſagreeable, but will, for the moſt part, move well, and with a tolerable good grace. On the other hand, ſuppoſe a horſe has ſome parts exquiſitely fine, and others indifferent, which frequently happens, it will mar his beauty, and cauſe him to look diſagreeable, and for the moſt part affect his gait and action.

In order to have a horſe beautiful and finely made, it has been agreed on all hands, that his head ſhould not be long nor too large, rather lean than fleſhy. His ears thin and narrow, and of a becoming length, well ſet on, pointing inwards. His brow or forehead not too broad and flat. His noſe ſomewhat riſing, and of a good turn; his noſtrils wide and thin; his muzzle ſmall; his mouth neither deep nor too ſhallow, with a ſtar or ſnip down his forehead, or a blaze, which is no way unbecoming, unleſs it be too large and diſproportioned.

Horſes that are thus marked, have generally one or more of their feet white, which is alſo very beautiful, and looks lively. His jaws ſhould be thin and ſufficiently wide, not approaching too near together, nor too high upwards towards the onſet, that he may have ſufficient room to carry his head eaſy, and in good place. His eyes well formed, ſprightly, and of a middle ſize. His neck ſhould be arched towards the middle, ariſing by a beautiful gradation out of his breaſt and ſhoulders, the muſcles thereof diſtinct, but no where overcharged with fleſh, growing ſmaller and thinner, as it approaches towards his head. His ſhoulders ſhould be thin from the withers, with a gradual enlargement downwards, that his boſom or breaſt be not too narrow nor too groſs. His fore-legs ſtraight and well placed; his joints lean and bony; his knees not bending, and his paſterns not too long; his feet round and ſmooth, and his ſinews firm and well braced; his carcaſe rather round than flat; his back not too low, and for ſtrength and durableneſs pretty even and ſtraight. His ribs rather home than open, as they approach towards his haunches; his buttocks round, and the muſcles not too fleſhy but diſtinct; his hocks or gambrels neither ſtanding too wide, nor too near together; his hocks ſhould be lean and no ways puffed or fleſhy; his paſterns ſhort, his legs flat and thin, and his tail ſet on in a good place, rather high than low, riſing upon every motion of his body. The more theſe properties concur in any horſe, the more beautiful he muſt be, eſpecially when they correſpond and agree in due proportion, one to another; and the more a horſe is wanting in theſe, the more plain and ordinary he will appear.

A Deſcription of a HORSE-*Mill.*—Plate LXXII. *fig.* 2. exhibits the draught of a horſe-mill, compoſed of the great wheel A, which is ſuppoſed to contain one hundred and twelve cogs, which catch in the trundle-head B of ſeven wallowers. According to this diſpoſition, a horſe harneſſed at the bar C, making one turn, the mill-ſtone will make ſixteen.

In order to ſhew the beſt manner of building a mill, we muſt be determined by reaſon and experience concerning the proportion of its ſeveral parts.

The firſt point is to make the machine as ſimple as poſſible; yet it ſeems neceſſary to make a wheel and trundle-head, to give the mill-ſtone ſufficient velocity to turn round its axis forty times in a minute. The reſiſtance to be overcome muſt therefore be in proportion to the main ſtrength of a horſe, which is equal to one hundred and eighty pounds weight, at the end of a lever twelve feet long, when it acts in a horizontal direction, and the horſe goes about two thouſand fathoms an hour.

Let the radius of the wheel be eight feet, and one hundred and twelve cogs in the periphery, which catching in a trundle-head of ſeven wallowers, the mill-ſtone will make ſixteen turns for one of the wheel; and as the ſame proportion ought to be between the number of cogs and that of the wallowers, as of the radius of the wheel to that of the trundle-head, the radius of the trundle-head ought to be ſix inches.

As to the arm of the lever, at which the horſe is to be harneſſed, if it be too long, the horſe, having a large circumference to deſcribe, will make fewer turns in a minute, and the mill-houſe muſt be larger: it would therefore be proper to fix it at twelve feet, which is moſt convenient, in which caſe the horſe at every turn will deſcribe a circumference of twelve fathoms four-ſevenths; and as he can perform two thouſand of theſe in an hour, he will perform one hundred and ſixty turns in the ſame time, which, being multiplied by ſixteen, is equal to two thouſand five hundred and ſixty, the number of turns which the mill-ſtone makes in an hour at the rate of forty-two per minute.

HORSE-SHOE, in fortification, is a ſmall work ſometimes of a round and ſometimes of an oval figure, incloſed with a parapet, ſometimes raiſed in the moat or ditch, or in low grounds, and ſometimes to cover a gate, or to ſerve as a lodgment for ſoldiers.

HORSE-SHOE-HEAD, a diſeaſe in infants, in which the ſutures of the ſkull lie too open.

This is commonly a ſign of a weak conſtitution, and a ſhort life. The nurſes uſually embrocate the parts affected with brandy or rum, to which ſome add the white of an egg, or palm oil.

HORSE, in a military ſenſe, the ſame with cavalry. See the article CAVALRY.

The light horſe, in an army, are all the regiments of horſe, except the guards.

HORSE, among ſeamen, a rope faſtened to the yards in two places, for the men to tread on and ſecure themſelves by as they go out on the yard-arms to furl, reef, or looſen the ſails.

HORSE is alſo a rope drawn very tight perpendicularly cloſe to the maſt to hoiſt ſome ſail upon, as the try-ſail of a ſnow, the ſquare-ſail of a ſchooner, &c.

HORSE is likewiſe a name given by ſeamen to a ſhort reed thruſt into the bung of a caſk, or keg, to draw off brandy, gin, &c.

HORTICULTURE, the ſame with gardening. See GARDEN and GARDENING.

HORTUS SICCUS, a DRY-GARDEN, an appellation given to a collection of ſpecimens of plants carefully dried and preſerved.

HOSANNA, in the Hebrew ceremonies, a prayer which they rehearſed on the ſeveral days of their feaſt of tabernacles.

The word is Hebrew, and literally ſignifies, *ſave us now*, or, *ſave us we pray*.

HOSE, in commerce. See STOCKING.

HOSEA, a canonical book of the Old Teſtament, ſo called from the prophet of that name, its author, who was the ſon of Beri, and the firſt of the leſſer prophets. He lived in the kingdom of Samaria, and delivered his prophecies under the reign of Jeroboam II. and his ſucceſſors, kings of Iſrael, and under the reigns of Uzziah, Jotham, Ahaz, and Hezekiah, kings of Judah. His principal deſign is to publiſh the groſs idolatries of the people of Iſrael and Judah, to denounce the divine vengeance againſt them, and to foretel the captivity in Aſſyria.

HOSPITAL, a place or building properly endowed or otherwiſe ſupported by charitable contributions, for the reception and ſupport of the poor, aged, infirm, ſick or helpleſs.

Camp-HOSPITALS are either general or regimental. Th

The general hoſpitals are of two kinds, viz. the flying hoſpital, attending the camp at ſome convenient diſtance; and the ſtationary hoſpital, which is fixed at one place. In the choice of both Dr. Pringle thinks it better to have them in towns than villages, as the former will afford larger wards, beſides more of other conveniencies. Theſe wards ſhould be as airy as poſſible. Regimental hoſpitals are of the greateſt importance, and therefore ſhould be ſupplied with blankets and medicines from the public ſtores, with an allowance alſo for nurſes and other neceſſaries. Barns, ſtables, granaries, and other out-houſes, but above all churches, make the beſt hoſpitals from the beginning of June to October.

HOSPITAL-FEVER, a name given to the malignant catarrhal fever, as being frequent in hoſpitals. See the article MALIGNANT FEVER.

HOSPITALLERS, an order of religious knights, now known by the title of knights of Malta. See the article MALTA.

HOSPODAR, a title borne by the princes of Walachia and Moldavia, who receive the inveſtiture of their principalities from the grand ſeignior. He gives them a veſt and ſtandard: they are under his protection, and obliged to ſerve him, and he even ſometimes depoſes them; but in other reſpects they are abſolute ſovereigns within their own dominions.

HOST, *Hoſpes*, denotes either a perſon who entertains another, or the perſon ſo entertained; but it is now generally uſed in the firſt of theſe ſenſes.

HOST, or HOAST, *Hoſtia*, in the church of Rome, a name given to the elements uſed in the euchariſt, or rather to the conſecrated wafer; which they pretend to offer up every day, a new hoſt or ſacrifice, for the ſins of mankind.

HOSTAGE, a perſon given up to an enemy as a ſecurity for the performance of the articles of a treaty.

HOSTILITY denotes a ſtate of war or enmity between two nations.

During a truce all acts of hoſtility are to ceaſe on both ſides.

HOT-BATH. See the article BATH.

HOT-BEDS, in gardening, beds of earth enriched with manure, in order to forward vegetation, when the ſeaſon or climate is not warm enough for the purpoſe.

By means of hot-beds ſkilfully managed the ſeeds of plants brought from any country between the tropics, may be made to flouriſh even under the poles.

Heat and humidity being the great inſtruments of vegetation, to promote the growth of any plants, theſe muſt be duly proportioned, ſo as neither to exceed nor come ſhort of the bounds nature has allotted for it.

The uſual way of making hot-beds, is of horſe litter and graſs mixed together, and left on a heap for eight or ten days to putrefy; and then removed into a bed, and covered up with glaſſes.

For raiſing cauliflowers, cucumbers, melons, radiſhes, and other tender plants and flowers in January or February, Mortimer directs to provide a warm place defended from all the winds by being incloſed with a pale or hedge of reeds or ſtraw, about ſix or ſeven feet high. Within this raiſe a bed two or three feet high, and three feet over, of freſh horſe-dung, about ſeven or eight days old; then tread it down very hard, make it level, and, if you will, edge it round with boards or brick, laying fine rich mould about three or four inches thick on it. When you find by your finger, that the extreme heat of the bed is over, plant your ſeeds at pleaſure, and ſet your forks four or five inches above the bed, to ſupport the frame, and covered with ſtraw or mat to ſecure the ſeeds and plants from cold and wet; only uncover them in a warm day, an hour before noon, and cover them again an hour after. Obſerve to earth up your plants, as they ſhoot up, and when able to bear the cold, tranſplant them.

In Holland they uſe hot-beds made of ſand; and likewiſe of tanner's bark, which, when once rightly prepared, will maintain an equable heat for ſix months.

Bradley propoſes very juſtly a thermometer to be uſed to regulate the heat of the hot-beds. Thus a hot-bed for cucumbers muſt be kept ſo hot as to raiſe the ſpirit in a glaſs to the ſame height as the natural temperature of the weather will raiſe it to about the end of May and June, when cucumbers will grow without artificial heat or ſhelter.

HOT-HOUSE, in ſalt-making, the place where they dry the ſalt, when taken out of the boiling pan: it is ſituated near the furnace, which, by means of funnels or tubes, conveys the heat into it.

HOTCH-POT, in law, is uſed for mixing of lands given in marriage with other lands in fee which fall by deſcent; as where a man poſſeſſed of thirty acres of land has iſſue only two daughters, and after his having given with one of them ten acres in marriage, he dies poſſeſſed of the other twenty: here ſhe that is thus married, in order to gain her ſhare of the reſt of the land, muſt put her part given in marriage in hotch-pot; that is, ſhe muſt refuſe to take the ſole profits of her lands, and cauſe it to be mingled with the other, ſo that an equal diviſion may be made of the whole between her and her ſiſter; by which means, inſtead of only her ten acres, ſhe has fifteen.

HOTTS, or HUTTS, are the pounces and round balls of leather, ſtuffed, and tied to the ſpurs of fighting cocks, to keep them from hurting one another in ſparring.

HOUND, a hunting dog, of which there are ſeveral ſorts, as the grey-hound, gaze-hound, and the blood-hound.

HOUNDS *of the Maſt*, in the ſea-language, thoſe parts of the upper-end or head of a maſt upon which the cheeks are bolted to ſupport the truſſel-trees. See the articles MAST and TRUSSEL-TREES.

HOUR, *Hora*, a meaſure of time, ſome part of a natural day, uſually a twenty-fourth and twelfth, &c. With us it is equal to the twenty-fourth part of the earth's diurnal rotation. Each hour is divided into ſixty minutes, and each minute into ſixty ſeconds, &c. Fifteen degrees of the equator anſwer to an hour.

The word is derived from the Latin *hora*, which ſignifies the ſame thing.

The ancient Hebrews did not divide the day into hours, but into four parts, as morning, high-day or noon, midnight, and morning-watch. In the New Teſtament we find the day divided into twelve hours; but though they were equal to each other, yet they were unequal with reſpect to the different ſeaſons: thus the twelve hours of the longeſt day in ſummer were made longer than thoſe of the ſhorteſt days in winter. Herodotus ſays, that the Greeks learned from the Egyptians the method of dividing the day into twelve parts, the riſe of which cuſtom among the latter was, becauſe their prieſts were wont, twelve times a day, to cry aloud with a howling noiſe to their cynocephalus, and Cicero and Marius Victorinus have taken notice of ſuch a ceremony to Serapis.

Cenſorinus obſerves, that the word hour was not known among the Romans three hundred years after the building of the city, as there is no mention made of it in the twelve tables, as is done in the other laws after that time; before which, the diviſions were only before and after noon. The diviſion of the day and night into twenty-four hours was not known among them before the firſt Punic war. They divided the twelve hours of the day into four parts, as prime, which began at ſix o'clock; third, at nine; ſixth, at twelve; and ninth, at three. They alſo divided the night into four watches, each watch containing three hours.

The Turks not having any clocks, their prieſts, ſtopping their ears with their fingers, proclaim with a very loud voice from the top of their moſques, the cock-crow, break of day, noon-tide, three o'clock, and the twilight. The ſame cuſtom we find prevailed among the Romans, as appears from Martial;

Horas quinque, puer, nondum tibi nunciat.

The aſtronomers of Cathaya, &c. ſtill retain, according to biſhop Beveridge, the diviſion of the day into twelve parts, and give the name of ſome animal to each hour.

Hours are divided into equal and unequal; equal hours are the twenty-fourth part of a day and night preciſely, that is, the time wherein 15° of the equator mount above the horizon; they are alſo called equinoctial hours, as being meaſured on the equinoctial; and aſtronomical,

aſtronomical, becauſe uſed by aſtronomers, and reckoned from noon in a continued ſeries of twenty-four.

HOUSE, *Domus*, a habitation, or place built with conveniencies for dwelling in: thus we ſay, a town-houſe, country-houſe, &c.

HOUSE-BOTE, in law, an allowance of timber out of the lord's woods, for the repairs of a houſe: this is otherwiſe called eſtovers.

HOUSE, in aſtrology, denotes the twelfth part of the heavens.

HOUSE-BREAKING, or ROBBING, is the breaking into and robbing a houſe in the day-time, the ſame crime being termed burglary, when done by night; both are felony, without benefit of clergy.

Green-HOUSE. See the article GREEN-*Houſe*.

HOUSE-LEEK, ſedum, in botany. See the article SEDUM.

HOUSING, among bricklayers, a term uſed for a tile or brick that is warped, or caſt crooked or hollow in burning.

Tiles are apt to be houſing or hollow on the ſtruck ſide, or that which was uppermoſt in the mould, and bricks on the contrary ſide.

HOWKER, in the Dutch marine, a veſſel with two maſts, uſed in the coaſting trade.

HUCKSTER, a perſon who ſells proviſions, or ſmall ware, by retail.

HUE AND CRY, in law, the purſuit of a perſon who has committed felony on the highway.

If the party robbed, or any in the company of a perſon either robbed or murdered, go to the conſtable of the next town, and require him to raiſe hue and cry, and to purſue the offender, deſcribing him, and giving an account as near as he can, of the courſe he ſteered; the conſtable is immediately to call upon the pariſh for aid in ſeeking after the felon, and if he cannot be found within the bounds of that pariſh, then he is to give the next conſtable warning, and he the next, till the offender be apprehended, or at leaſt purſued to the ſea-ſide. If perſons are not ready at the ſummons of the ſheriff, and cry of the county, to engage in the purſuit, they may be fined: and in caſe the inhabitants of any hundred, after hue and cry is made, neglect to purſue the ſame, they ſhall be liable to pay one half of the damages recoverable againſt the hundred in which the robbery was committed.

HUGUENOTS, a name given by way of contempt to the Calviniſts of France.

The name had its riſe in the year 1560; but authors are not agreed as to its origin. The moſt plauſible opinion, however, is that of Paſquier, who obſerves, that at Tours, the place where they were firſt thus denominated, the people had a notion, that an apparition or hobgoblin, called king Hugon, ſtrolled about the ſtreets in the night-time; from whence, as thoſe of the reformed religion met chiefly in the night to pray, &c. they called them Huguenots; that is, the diſciples of king Hugon.

HULK, in the marine, an old ſhip of war properly fitted with a very high maſt, firmly ſupported by various props and ſhrouds to hoiſt in and out the maſts of other men of war occaſionally; alſo an old ſhip of any kind.

HULL, in ſhip-building, the hull or lower-frame of a ſhip excluſive of the ſuperſtructure, viz. the maſts, ſails, and rigging.

HULL-TO, the ſituation of a ſhip lying-to at ſea, without any ſail ſet. See the article TRYING.

HUMAN, in general, is an appellation given to whatever relates to mankind: thus we ſay, the human ſoul, human body, human laws, &c. See the articles SOUL and BODY.

HUMANITY, the peculiar nature of man, whereby he is diſtinguiſhed from all other beings. See the article MAN.

HUMANITIES, in the plural, ſignify grammar, rhetoric, and poetry, known by the name of *literæ humaniores*; for teaching of which, there are profeſſors in the univerſities of Scotland, called humaniſts. See GRAMMAR, RHETORIC, &c.

HUMBLE-BEE, the Engliſh name of ſeveral ſpecies of apis, diſtinguiſhed by their colours, black, tawny, reddiſh, &c. See the article APIS.

HUMECTATION, in pharmacy, the moiſtening or preparing medicines by ſteeping them in water; either to ſoften and relax their ſolid parts, or to prevent the evaporation of their more ſubtile contents.

HUMERUS, in anatomy, the upper part of the arm between the ſcapula and elbow.

The os humeri or brachii, as it is called, is articulated at one end with the ſcapula, and at the other to the ulna and radius. See the articles ARM, BRACHIUM, &c.

As to the motion of the os humeri, it is evidently the moſt free and extenſive of that of any bone in the human body; being furniſhed with ſeveral flexor and extenſor muſcles. See FLEXOR and EXTENSOR.

HUMIDITY, that quality in bodies whereby they are capable of wetting other bodies. This differs very much from fluidity, and ſeems to be merely a relative thing depending upon the congruity of the component particles of the liquor to the pores of ſuch particular bodies, as it is capable of adhering to, penetrating a little into, or wetting.

HUMIDUM RADICALE, or *Radical Moiſture*, among phyſicians, ſeems to amount to no more than the pureſt and moſt delicate part of the nutritious matter in a condition to be aſſimilated.

By too much heat, as in fevers, hectics, &c. this humidity is too haſtily exhauſted and ſpent.

HUMILIS MUSCULUS, one of the depreſſor-muſcles of the eye.

HUMMING-BIRD, *Trochilus*, in ornithology, a genus of birds, of the order of the paſſeres, remarkable for being the ſmalleſt of all known birds. Their beak is of a ſubulated figure, but fine as a thread: it is longer than the head, and not perfectly ſtraight: add to this, that they have a fine tube or pipe, which they can extend beyond the point of the beak. Of this ſingular genus, there are ſeveral elegant ſpecies.

HUMORISTS, *Gli Humoriſti*, a celebrated academy of learned men at Rome, firſt eſtabliſhed by Paul Mancini. The device of this academy is a cloud; which being raiſed on vapours from the ſalt water of the ſea, returns again freſh, with this hemiſtich from Lucretius, *Redit agmine dulci*.

HUMOROSI, the name of another academy at Cortona in Italy, which muſt not be confounded with that of the Humoriſts.

HUMOUR, *Humor*, in a general ſenſe, denotes much the ſame with liquid or fluid. See the article FLUID.

The ancients ſeem to have called the nutritious juices the radical humour; and to have conſtituted as a cauſe of diſeaſes, a diſproportion betwixt the innate heat and radical moiſture or humour. They alſo made four humours in the blood. See the article BLOOD.

HUMOURS *of the Eye*, are the cryſtalline, vitreous, and aqueous; for a deſcription of which, ſee the articles EYE, CRYSTALLINE, &c.

HUMOUR is alſo uſed for the peculiar temper of a perſon, ariſing from the conſtitution and prevalence of this or that humour. See the articles CONSTITUTION and TEMPERAMENT.

HUMOUR, in dramatic poetry, is eſteemed a ſubordinate ſpecies of what is more uſually called manners. See MANNERS.

Every paſſion wears two different faces; one ſerious and ſolemn, fit only for tragedy; and the other merry and ridiculous, called humour, and proper for comedy. The Engliſh poets have excelled thoſe of all other nations in this particular; and, indeed, ours is the only language that has a name for it.

To be always witty only becomes a few characters; ſo that it is neceſſary to call in the aſſiſtance of humour, to prevent the other dramatic perſons from going into the common ſtyle and manner: hence humour may be looked on as the true ſpirit and wit of comedy. See the article WIT.

HUMULUS, the hop, in botany. See the article HOP.

HUNDRED, *Centum*, *Cent*, is ten times ten, or the ſquare of ten. It makes the third place from the right to the left in the table of numeration.

The

The proportion of the profits in commerce is reckoned by the hundred, or ſo much per cent.

HUNDRED, *Hundredum*, *Centuria*, a certain diviſion or part of a ſhire or county.

HUNGARICUS MORBUS, a diſeaſe ſo called from its being firſt obſerved in the imperial army, in 1556.

It is thought to have been a compound fever, partaking of the nature both of the bilious and malignant fevers. See BILIOUS and MALIGNANT-FEVER.

HUNGARY, a kingdom bounded by the Carpathian mountains, which divide it from Poland, on the north; by Tanſilvania and Walachia on the eaſt; by the river Drave, which ſeparates it from Sclavonia, on the ſouth; and by Auſtria and Moravia on the weſt. It is one continued plain of 300 miles long, and is ſituated between 16° and 23° of eaſt lon. and between 45° and 49° of north lat.

HUNGARY-WATER, a diſtilled water, ſo denominated from a queen of Hungary, for whoſe uſe it was firſt prepared.

Quincy gives the following directions for making it. Take of freſh gathered flowers of roſemary, two pounds; rectified ſpirits of wine, two quarts; put them together, and diſtil them immediately in balneo.

Or, Take of freſh tops of roſemary, one pound and a half; proof ſpirit, one gallon; and diſtil in balneo till five pints are obtained.

HUNGER, an uneaſy ſenſation, which creates an appetite or deſire of food. See the article FOOD.

Hunger is by ſome attributed to a ſharp acrimonious humour, which vellicates the coats of the ſtomach; others, who deny the exiſtence of any ſuch liquor, attribute it to the attrition or rubbing of the coats of the ſtomach; and others, again, account for it from the acidity of the blood.

HUNGRY EVIL, among farriers, an exceſſive deſire in horſes to eat, which ſometimes proceeds from catching cold, or from travelling long in froſt and ſnow, or through barren places.

For the cure, give him great ſlices of bread, toaſted and ſteeped in ſack, to comfort his ſtomach; or give him wheat flour in wine or milk, a quart at a time. But there is nothing better than to feed him moderately ſeveral times a day with good bean-bread well baked, or with oats well dried and ſifted.

HUNTING, the exerciſe or diverſion of purſuing four-footed beaſts of game. See the article GAME.

HUOY, a veſſel uſed to load and unload large ſhips, either in the king's or merchants ſervice; alſo a ſmall Dutch ſhip with a main-maſt and mizen maſt.

HURA, the ſand-box tree, in botany, a genus of plants, the male flowers of which are arranged in an imbricated amentum; the antheræ are ſeſſile, and adhere to the amentum; the female flower has neither calyx nor corolla; its ſtyle is funnel-ſhaped, and the fruit is a capſule conſiſting of twelve cells, in each of which is contained a ſingle ſeed.

HURDLES, in fortification, twigs of willows or oſiers interwoven cloſe together, ſuſtained by long ſtakes, and uſually laden with earth.

Hurdles, called alſo clays, are made in the figure of a long ſquare; the length being five or ſix feet, and the breadth three, or three and an half: the cloſer they are woven, the better. They ſerve to render batteries firm, or to conſolidate the paſſage over muddy ditches; or to cover traverſes and lodgments, for the defence of the workmen, againſt the fire-works, or the ſtones that may be thrown againſt them.

HURDLES, in huſbandry, certain frames, made either of ſplit timber, or of hazel-rods, wattled together, to ſerve for gates in incloſures, or to make ſheep-folds, &c.

HURDS, or HORDS, *of Flax*, or *Hemp*, the coarſer parts ſeparated in the dreſſings, from the tear or fine ſtuff.

HURLE-BONE, in a horſe, a bone near the middle of the buttock, very apt to go out of its ſockets with a hurt or ſtrain.

HURRICANE, a furious ſtorm of wind, owing to a contrariety of winds. See the articles WIND and WHIRLWIND.

HUSBAND, *Maritus*, a man joined or contracted with a woman in marriage.

HUSBANDRY, the buſineſs or employment of a farmer, or perſon who cultivates land, &c. See AGRICULTURE.

Huſbandry is divided into two kinds, and diſtinguiſhed by the epithets old and new. The former is that which has been practiſed in all countries from the moſt early times; and the latter that introduced by the ingenious Mr. Tull, and often called the horſe-hoeing huſbandry.

Experience ſhews, that land, though ever ſo well tilled in the autumn, when wheat for example, is ſown, hardens and ſaddens in the winter; its particles, beaten down by heavy rains, and ſunk by their own weight, approach each other daily more and more; the roots of the plants cultivated have conſequently leſs and leſs room to extend themſelves in queſt of their neceſſary food; and the interſtices in the earth become of courſe ſo few and cloſe, that they are not able to pierce through them; whilſt weeds ſpring up, and rob them of their nouriſhment. By this means the earth, reduced to nearly the ſame condition as if it had not been ploughed at all, is unable to aſſiſt the plants ſown in it, in the ſpring, when they ought to ſhoot with the greateſt vigour. They conſequently then ſtand moſt of all in need of the plough, to deſtroy the weeds, to lay freſh earth to their roots in the room of that which they have exhauſted, to break the particles of the ground a-new, ſo as to enable their roots to ſpread, in order to their gathering an ample proviſion of food, which then does them the greateſt ſervice.

In the common huſbandry, the whole attention is to provide a great ſtore of nouriſhment for the wheat at a time when it ſcarcely conſumes any, as it then produces only a few blades; after which it is left to itſelf, at a ſeaſon when it might, and ſhould, be moſt aſſiſted by proper culture: a management as prepoſterous, as it would be to give a child a great deal of food, and diminiſh it gradually as he grows bigger; or, to uſe Mr. Tull's compariſon, to give ſilk-worms, before they are hatched, treble the full ſtock of leaves neceſſary to maintain them till they have finiſhed their ſpinning, and not to allow them any when they really want being fed.

The great advantage of having land in fine tilth before it is ſowed, is univerſally acknowledged: but we muſt not ſtop at thoſe firſt preparations. Plants require a continuation of culture while they grow, and muſt not be forſaken till they have attained their full maturity.

Thoſe who are againſt the frequent ploughings uſed in the new huſbandry, are afraid of drying the earth too much; becauſe, ſay they, the moiſture eſcapes more eaſily from a well looſened ſoil, than from a hard and cloſe earth.

In anſwer to this it will appear from many of the following experiments, that, even in the drieſt weather, land cultivated according to the new method, continues conſtantly moiſter than that which is managed in the old way. Inſtead of a ſtagnant wet, more hurtful, perhaps, than beneficial, to plants; earth made fine to a good depth, is prepared, as the reverend Dr. Eliot expreſſes it, "with open mouth, to drink and retain the dew, which, when it falls upon the land that is untilled, or but poorly tilled, does not ſink far, but is carried off by the next ſun's heat." That dew is one of the greateſt fertilizers of the earth, has been repeatedly proved; and that it will penetrate ſo deep in a fine looſe ſoil, as to keep that moiſt, while the ground around it is parched up, appears, among many demonſtrations, from Mr. Evelyn's experiment of digging a hole, and filling it up with its former mould well pulverized: or, as Mr. Tull obſerves, till a field in lands; make one land very fine by frequent deep ploughings, and let another be rough, by inſufficient tillage, alternately: then plough the whole field croſs wiſe in the drieſt weather, which has continued long; and you will perceive, by the colour of the earth, that every fine land will be turned up moiſt; but every rough land will be dry as powder, from top to bottom.

Another proof of the benefits which ariſe from ſtirring the ground well and often between plants, while they grow, and conſequently a confirmation of the fundamental principle of the horſe-hoeing huſbandry, is thus drawn

by Dr. Eliot, from the common manner of raiſing Indian corn.

"The land, ſays he, being previouſly prepared, planted, and the corn come up, we plough a furrow off from the corn on each ſide, then hoe it, and the next time plough up to the corn; ſo that this tillage is nearly the ſame as is now propoſed for wheat, or whatever we would plant: only by the way, I would obſerve, that the ploughings between the rows, for Indian corn, is ſo ſhallow, that one would be apt to think it intended for nothing more than merely to kill the graſs and weeds; whereas it is found by experience, that, though there be neither graſs nor weeds, the ploughing and hoeing will make the corn grow, and that the more the land is ploughed and hoed, the better and longer it will reſiſt drought, and yield the better crop: nay, what is ſtill more remarkable, if the Indian corn be well tilled, the next crop, whether it be oats or flax, will be proportionably greater and better; ſo that the land muſt have gained ſtrength and richneſs. If it were not ſo, why did not the Indian crop exhauſt and ſpend the ſtrength of the land, eſpecially when we conſider how large that corn is made to grow by good tillage? But we find the contrary; the better the crop of Indian corn, the better the crop will be of oats. There is no ſort of huſbandry, wherein the ſuperior force and virtue of tillage doth ſo evidently appear, as in the raiſing of Indian corn: for if you ſhould plough and harrow the beſt of land, and ſow or plant the corn, and never do any thing more to it, there will be leſs corn than if you ſhould plant poor land, and tend it well: the poor land well ploughed and hoed, ſhall bring a greater crop than the rich land. We hereby ſee the efficacy and advantage of this repeated tillage, which falls in ſucceſſively, according to the exigency and want of the plant in its ſeveral degrees of growth, and keeps the land in a proper ſtate. Why ſhould it not have the ſame effect upon wheat, and every other plant that is ſuſceptible of the like culture?"

If ſeveral rows of wheat are ſown in a poor but well ploughed land, the blades of the corn will turn yellow in the ſpring, eſpecially in dry weather. Let the earth bordering upon theſe rows be ploughed deep, in ſome places near, and in others farther from the rows, and the plants will reſume their proper colour; firſt in the places neareſt to the new ploughed ground, and afterwards gradually in the others, according to their diſtance; which proves that they recover their verdure, in proportion as their roots reach the looſe mould. This holds equally true in all plants; for Mr. Tull declares, that he does not remember ever to have ſeen a poor one contiguous to a well-hoed interval, unleſs overpowered by a too great multitude of other plants, an exception which muſt be equally made if it were a plant that required more or leſs heat or moiſture than the ſoil or climate afforded; and that, on the contrary, he has ſeen plants grow to an amazing ſize, when the earth around them has been frequently tilled. He mentions, among others, a plant of ray-graſs, which chanced to ſtand in a turnip field, where, being hoed as the turnips were, it acquired a bulk at leaſt equal to a thouſand plants of the ſame ſpecies; and a plant of muſtard, which grew higher than he could reach, ſo as to be more like a tree than an herb.

The ſtirring of the earth about the plants whilſt they grow, is productive of ſuch excellent effects, that, in ſome parts of Berkſhire, and in many places in France, they hand-hoe their corn, particularly wheat, and find that the crops amply repay all the charge and trouble of this expenſive operation; which, however, cannot be performed but in well-peopled countries. Every huſbandman will immediately ſee, how much a hoe-plough is preferable for this work, and that, to uſe it rightly, the corn muſt neceſſarily be planted in regular rows, as it is in the new huſbandry.

Our reaſon tells us, that the longeſt lived plants ſtand moſt in need of this culture. Perennials require it more than annuals, and wheat which is ſown in autumn, and does not ripen till nine months after, wants it more than ſpring-corn, which occupies the ground only for a few months. The former has to conquer a ſoil rendered hard during the courſe of the winter; but the other has not that difficulty to ſurmount, though both of them, and indeed all ſorts of plants, are greatly invigorated by the repeated laying of fine freſh earth to their roots. Every one knows the vaſt efficacy of wood land, before its native ſtrength and vigour are exhauſted; and ſuch, in ſome degree, is that which this tillage furniſhes; beſides being conſtantly attended with the advantage of deſtroying weeds. How far this laſt important part of agriculture was well executed by the farcling, or ſarriſon, as Mr. Tull calls it, of the ancients, I ſhall not pretend to ſay, becauſe we have no clear account of the manner in which it was performed; but it does not ſeem to have been in any way equal to the horſe-hoeing huſbandry, which likewiſe, among its many other excellencies, keeps the land from going out of tilth.

We ſhall here add Mr. Duhamel's obſervations on the uſe of dung, as given by that gentleman in his *Elements of Agriculture*.

"It is often, ſays he, more advantageous to increaſe the fertility of land by ploughing, than by dung: 1. Becauſe, in general, only a certain quantity of dung can be had, the product of twenty acres being ſcarcely ſufficient to produce enough for four or five; whereas the particles of the earth may be divided and ſubdivided almoſt to infinity. The help derived from dung is therefore limited; whilſt no bounds can be ſet to the benefits that may accrue from ploughing.

"2. Few plants raiſed in dung ever have the fine flavour of thoſe which grow in a good ſoil moderately dunged. Our kitchen gardens and our other grounds afford daily inſtances of this truth. Pulſe, pot-herbs, and fruit, are ſeldom ſo good in the neighbourhood of great cities, where dung abounds, as in country gardens, where but little of it is uſed. The corn raiſed in thoſe exceſſively dunged lands, yields a great deal of bran, and not much fine flour, and is difficult to keep. Nice horſes will not eat oats of the growth of fields manured with human ordure. But nothing is ſo ſtriking as the difference between the wine of an undunged vineyard, and that of vines which have been greatly dunged.

"3. Dung, which is ſuppoſed to act by fermentation, cauſes indeed an inward diviſion of the particles of the earth, which muſt be very uſeful, as well as the food which it furniſhes to plants: but the plough, beſides dividing thoſe particles, changes their ſituation, and turns the ground upſide down, ſo that the part which was expoſed to the influences of the air and dews, takes the place of another part which is brought from within the earth, up to its ſurface. The conſequence of this is, that well ploughed land is not exhauſted by weeds, and that it admits the moiſture of rains and dews, together with the rays of the ſun, all of which contribute greatly to render it fertile, as has been proved by very many experiments.

"4. Dung attracts inſects, and thoſe inſects gnaw plants. It is well known that the roots of trees planted in dunged ground, are very liable to be damaged by inſects: and this is one of the chief reaſons why florifts baniſh dung from their gardens. Worms, grubs, and other ſuch like vermin, make dreadful havock in their beds of flowers; and I have ſeen meadows where the graſs has been entirely deſtroyed, by their eating its roots.

"I muſt add, that moſt ſorts of dung contain a great many ſeeds which fill the land with weeds.

"5. It is true that dung is equally ſerviceable to light lands, and to ſtrong; but the ſame may be ſaid of ploughing.

"Land is too ſtrong when its particles lie ſo cloſe together, that the roots of plants cannot extend between them, without great difficulty, in queſt of their neceſſary food; for want of which they will remain poor and ſickly: but when the ground has been well looſened by repeated ploughings, and its plants are ſet at greater diſtances from each other, thoſe roots will be able to ſpread freely on all ſides, to pervade every minute chaſm, and to collect ſuch quantities of food as will make the plants grow ſtrong and vigorous. The friendly influences of the atmoſphere will then penetrate to them. What plainly proves the good effects of looſening ſuch ſoils, is, that their fertility is ſometimes increaſed by a mixture of ſand, inſtead of dung

dung. Now ſand does not afford any nutritive ſubſtance; but only hinders the particles of the earth from re uniting too cloſely.

"Ploughing is equally beneficial to light lands, for the very contrary reaſon; though theſe do not require ſo much of it as the other. There is no danger of their being exhauſted by any expoſure to the ſun; but, on the contrary, they acquire an additional degree of fertility by the ſtirring and grinding of their particles, and are thereby the better fitted to receive the moiſture of rains and dews, and the ſalutary influences of the air and ſun; whilſt their inward pores are at the ſame time better adapted to the proper extenſions of the roots of plants, by their being leſſened.

"But, let the benefits ariſing from dung be ever ſo great, let the means of obtaining enough of it be ever ſo eaſy, and let even its defects be corrected as much as can be, ſtill it will not be the leſs true, that frequent ploughing is of infinite ſervice to land.

"For this reaſon it is, that land intended for wheat is ploughed three or four times before the grain is ſowed. Some farmers, who could not dung all their lands, ploughed part of them double the uſual number of times, and reaped greater crops from theſe, than from thoſe which were dunged. The expence of the ploughings extraordinary will be much leſs than the price of the dung neceſſary for the land, if the farmer is obliged to purchaſe it.

"In 1759, M. Delu gave three ploughings to ſome of his fields intended for oats; and though that year was very dry and unfavourable to ſpring corn, his oats kept up well till they were perfectly ripe, and yielded a full crop of excellent grain.

"He gave five ploughings to a piece of wheat-land, which had not been dunged, and at harveſt, had taller and finer corn there, than in the neighbouring grounds which had been dunged and cultivated in the uſual way. In ſhort, the advantage of thorough tillage, while the plants are growing, is ſo great, that, in many places, it has been found amply to repay even the expence of digging between the rows of corn.

"The farmer muſt not think of practiſing the new huſbandry in land which cannot be brought to a fine tilth: for as no remedies are proper for all diſeaſes, ſo no one culture can ſuit every kind of ſoil.

"I have met with very zealous huſbandmen, who have been in a great hurry to procure all the inſtruments proper for the horſe-hoeing huſbandry, before they had examined whether their ground was fit for uſing them. In walking over the fields, I have found them in ſo bad order as to be full of clods, ſtones, and all ſorts of weeds: only the bare ſurface of the land had been ſcratched, by what they called ploughing; and indeed their common inſtruments of tillage were ſo imperfect, that it was hardly poſſible for them to do more. I adviſed them to deſtroy thoſe weeds by good and frequent ploughing, to procure good inſtruments, to looſen the ground to a proper depth, to collect good manures, to drain their land well by trenches and ditches, and, in ſhort, to practiſe the old huſbandry completely, before they attempted the new; for, in fact, all the requiſites in the former muſt be the foundation of the latter.

"To anſwer the ends of this husbandry, the ſeeds muſt be diſtributed ſo ſparingly, that each plant may have room to extend its roots in ſuch manner that they may be able to collect an abundant quantity of food; each plant muſt be enabled to tiller greatly, ſo as to produce a conſiderable number of ſtalks; and each ſtalk muſt be enabled to bear a fine long ear, well filled with grains to its very point.

"To effect the firſt of theſe qualities, the field, after being thoroughly ploughed and well harrowed, muſt be divided by furrows, the ſpaces between which may be of ſuch breadth as ſhall be judged moſt proper; for neither their preciſe width, nor the diſtance between the rows of corn, is yet fully determined. In the middle of theſe ſpaces, which will be diſtinguiſhed by the name of beds, the wheat, or other grain, is to be ſown in one, two, or more rows. An inch will be ſufficient for the diſtance between the grains, length-wiſe of the row; though that may be ſomewhat leſs, if the ground be not very good for wheat; or, on the contrary, ſomewhat more if it be excellent for that grain. By this diſtribution, each plant will find, in the intermediate ſpaces between the beds, and in the beds themſelves, a ſufficient extent of earth wherein to collect its neceſſary food; for thoſe intermediate ſpaces, which I ſhall call alleys, muſt be wide enough to admit of ſtirring the ground in them while the plants grow: but, to anſwer the ſecond and third intentions, it is of conſequence that theſe ſtirrings be performed at proper ſeaſons, becauſe each of them is to produce its particular effect.

"It is eſſentially neceſſary that the rows of corn be ſown very ſtraight; a circumſtance which, though it be attended with ſome trouble, ought not to diſcourage the huſbandman, becauſe the great difficulty will be only the firſt time. After the ground has been once rightly ſown, it will be eaſy to continue in the ſame regular track every following year, without taking the precautions I am now going to obſerve.

"If the field be not very large, a furrow traced with a ſpade or pick-ax, directed by a line ſtretched acroſs the ground, will enable the ploughman to guide the horſe that draws the drill; and he will take care to leave a proper interval between one furrow and another, if three rows are to be ſown.

"If the extent of ground be too great for the above method, poles or ſtakes may be ſtuck, five feet aſunder, at each end of the field, to guide the ploughman, who, with a common plough, will trace ſmall furrows, by the help of which the horſe and drill may be properly directed.

"It will be right, if poſſible, to ſuit the direction of the furrows to the declivity of the land, that the water may drain down to the loweſt part of the field, where a ditch ſhould be dug to carry it off: and it will alſo be neceſſary, to make them lengthwiſe of the field, if convenient, that the leſs ground may be loſt by the ſpace which muſt be left for the plough to turn in.

"After the ſeed is put into the hoppers of the drill, the horſe which draws this inſtrument muſt be made to walk ſlowly in the furrow before traced by way of guide: and in order to drop as nearly as poſſible the intended quantity of ſeed, the outlet of the hopper muſt be proportioned to the ſize of the grain.

"As it will be ſomewhat difficult to manage the drill rightly at firſt, till the husbandman becomes uſed to it; he ſhould look over his field as ſoon as the corn has ſprouted, and then drop by hand a few grains in the places where it may have failed.

"The land ſhould be ſown about the middle of September, or, at fartheſt, by the end of that month: and it will be right always to try the goodneſs of the ſeed before-hand, by ſowing fifty or an hundred grains of it in a fine mould, or moiſt ground, where it will ſoon appear whether they all riſe.

"Land which retains water ſhould be ploughed once in October, when the weather is fine. In doing this, a furrow ſhould be firſt cut in the middle of the alleys, and then it ſhould be filled with the earth on each ſide, even ſo far as to arch it up, and leave only a ſmall furrow on either ſide, cloſe to the beds, to drain off the wet, which would prove very prejudicial to the plants if it were to remain long near their roots. This looſening of the earth will alſo fit it for being mellowed by the winter's froſts; to which, however, care muſt be taken not to expoſe the roots of the corn, by leaving them too bare of mould. The moſt proper time for this ſtirring of the ground is when the plants have ſhot out ſome blades.

"The ſecond horſe-hoeing, which ſhould be given as ſoon as the hard froſts are paſt, that is to ſay, by the end of March, is intended to make the plants tiller; and will have this effect, if, after the earth near the rows has been ſtirred a little, that which was before laid up in the middle of the alleys be returned back to the furrows at their ſides. This earth, having been mellowed during the winter, will afford excellent nouriſhment to the plants now beginning to vegetate apace, and they will ſoon put forth their multiplied ſtalks.

"The third hoeing, which is the ſecond after winter, and is intended to ſtrengthen the ſtalks, ſhould be performed when the ears of the corn begin to appear. This culture, which is looked upon as the leaſt important of

all, and is ſometimes even omitted without any great inconvenience, need not be any thing more than a ſlight ſtirring of the earth, in which it will, however, be right to begin to hollow the alleys.

" The laſt ſtirring of the earth between the rows of corn is one of the moſt important; being that which makes the grains ſwell, and grow full bodied to the very point of the ear. The moſt proper time for this is when the ears begin to bloom: but as the corn is then high, only one furrow can be cut in the middle of the alleys, the earth of which ſhould be laid up to the ſtems of the plants on each ſide. The plough will hardly be able to paſs more than twice in this furrow, which ſhould, however, be made as deep as poſſible, in order to bank up the greater quantity of earth. By this operation, the now fallow alleys are prepared for the next ſowing, for it is in the middle of them that the corn is to be planted the following year; and the now eared wheat is earthed up, to prevent its being lodged; though in general, corn thus cultivated is leſs apt to be beaten down, than that which is raiſed in the common way, becauſe the ſtraw of this, being more expoſed to the air, becomes harder, and acquires a firmer texture, eſpecially toward its bottom. It is for this reaſon that a tuft of corn, which ſtands quite ſingle, is ſcarcely ever beaten down by the weather.

" Theſe repeated hoeings of the earth will certainly be rewarded with a very plentiful crop, unleſs the ſeaſons prove extremely bad.

" When the corn is reaped, all poſſible care ſhould be taken not to trample upon the adjoining ploughed ground.

" It is well known, that vigorous plants do not ripen their ſeeds ſo ſoon as thoſe which have been ſtinted in their growth: for this reaſon, the corn cultivated according to the principles of the new husbandry, ripens later than in the common way, and ſhould therefore be ſown ſomewhat earlier.

" We will now ſuppoſe that the crop is reaped, and that the ſame field is to be ſown again with wheat the next year, and every year after, as it may be; becauſe the rows of corn are placed each time in the middle of the former alleys, which have been ploughed during the whole year without producing any thing. Thus, the only difference between this new method and the old husbandry is, that inſtead of reſting, or fallowing, a whole field, whilſt another whole field is under corn, and each of them is ſeparate from the other; the fallow here is in the ſame field as the corn; being interpoſed by means of alleys, which are the part reſted, between the beds, which are the part cultivated: but there is this great advantage here, that the ſtirring of the earth in the alleys, which are not planted, not only prepares the ſoil admirably for being ſown the next year, but invigorates the plants actually growing in the beds.

" If it be thought proper to dung the alleys, in order to prepare them for the reception of the ſeed, the dung, which ſhould be thoroughly rotten, muſt be laid in the bottom of the deep furrow before made in the middle of them, and there covered with the earth which was thrown up towards the rows of wheat. If the land does not want dunging, this deep furrow is filled up without it; and this ſhould be done immediately after harveſt, that there may be time to give the ground another ſtirring, which need only be a ſlight one, before the ſowing of the rows, which are now to be in the middle of the former alleys; and the alleys of this year will be in the place of the laſt year's ſtubble.

" Though land, cultivated according to the principles of the new husbandry, does not require ſo much dunging as that which is managed in the old way, yet this manure will always help to enrich the ſoil, eſpecially if it be uſed by the manner here directed. By being thoroughly rotten when it is laid in the furrow, and there covered over immediately after harveſt, it will have time to mellow and diffuſe its influence, and not be apt afterwards to choak up the ſhares of the drill: an inconvenience which does not happen with pigeon's dung, which therefore need not be ſtrewed till the ground is ploughed for ſowing."

" It is farther obſerved:

" 1. That if dung be uſed for the ſecond year's crop, very little of it will ſuffice; becauſe it need only be laid in the bottom of the furrows.

" 2. That there can hardly be any occaſion for dung this ſecond year, becauſe, if the earth of the beds in which the wheat grew was good, that of the alleys, of the ſame ſoil, muſt be ſtill better by reaſon of its having been fallowed and well tilled.

" 3. That the ſecond year's wheat is placed in a moſt advantageous ſituation, its roots having a depth of twelve or fifteen inches to extend themſelves in, by means of the furrow which was in the middle of the alley. For this reaſon, corn ought to thrive beſt in thoſe lands which have been longeſt cultivated according to the new huſbandry.

" The earth in the alleys is to be horſe-hoed during the ſecond year, in the ſame manner, and at the ſame ſeaſons, as in the firſt.

" This frequency of hoeing ought not to be objected to; for the labour of the firſt hoeing, to make the furrows on each ſide of the rows, and lay the earth up in the middle of the alleys, cannot be great; and the ſecond only returns that earth into thoſe furrows: the third is only to ſtir the ſurface of the ſoil: the fourth and laſt is to make the deep furrow in the middle of the alleys, and bank up the rows of corn on each ſide, with the earth taken out of it: ſo that neither of theſe operations ever extends to above a third part of the ground, at any one time.

" The whole field might indeed be ploughed up after harveſt: but I would adviſe the husbandman not to touch the ſtubble then, becauſe the rows of that will help him to guide the drill in ſtraight lines, and the yet un-rotten ſtraw might be apt to clog the ſhares of the drill, ſo as to prevent their working properly. However, if the ſtubble be very ſhort, this caution becomes the leſs material, and the whole field may then be ploughed: though ſtill it will be neceſſary to plough it again in October, in order to make drains to carry off the wet.

" It is almoſt needleſs to obſerve, that all the operations of which I have been ſpeaking, muſt often be performed either a little earlier, or ſomewhat later, according as the year is more or leſs forward; and that it will always be neceſſary to wait till the ground is dry enough to be ploughed without danger of its clodding; a circumſtance which varies greatly, according to the nature of the ſoil." *Mills's Huſbandry.*

The editors of the laſt edition of Mr. Tull's Horſe-Hoeing Husbandry give, in their preface to that work, the following comparative calculation of the expence and profit of the old method of culture and the new, drawn up by a gentleman who has practiſed both for ſome years, and who has no attachment to the new husbandry, farther than he has found it anſwer in his trials. They candidly appeal to experience, " whether every article in this calculation is not eſtimated in favour of the common husbandry; whether the expence be not rated lower than moſt farmers find it; and whether the crop be not ſuch as they would rejoice to ſee, but ſeldom do.

" In the new huſbandry, every article is put at its full value, and the crop of each year is computed four buſhels ſhort of the other; though, in ſeveral years experience, it has equalled, and generally exceeded, thoſe of the neighbourhood in the old way."

An Eſtimate of the Expence and Profit of Ten Acres of Land, in Twenty Years.

I. In the Old Way.

	l.	s.	d.	l.	s.	d.
Firſt year for wheat coſts 33l. 5s. viz.						
Firſt ploughing at 6 s. per acre —	3	0	0			
Second and third ditto, at 8s. per acre	4	0	0			
Manure, 30 s. per acre — — —	15	0	0	22	0	0
Two harrowings and ſowings, at 2 s. 6 d. per acre — — — —	1	5	0			
Seed, three buſhels per acre, at 4 s. per buſhel — — — — —	6	0	0			
Weeding, at 2 s. per acre — —	1	0	0			
Reaping, binding, and carrying in, at 6 s. per acre — — — —	3	0	0	11	5	0
Carried forward — —				33	5	0

			l.	s.	d.
Brought forward	—	—	33	0	5
Second year for barley coſts 11l. 6s. 8d.	l.	s. d.			
Once ploughing, at 6s. per acre —	3	0 0			
Harrowing and ſowing, at 1s. 6d. per acre	0	15 0			
Seed, four buſhels per acre, at 2s. per buſhel — — — — — —	4	0 0			
Weeding, at 1s. per acre — —	0	10 0			
Cutting, raking, and carrying, at 3s. 2d. per acre — — — —	1	11 8			
Graſs-ſeeds, at 3s. per acre — —	1	10 0	11	6	8
Third and fourth years lying in graſs coſt nothing,			44	11	8
So that the expence of ten acres in four years comes to 44l. 11s. 8d. and in twenty years to			222	18	4
Firſt year's produce is half a load of wheat per acre, at 7l. per acre — — — —			35	0	0
Second year's produce is two quarters of barley per acre, at 1l. per acre — — —			20	0	0
Third and fourth year's graſs is valued at 1l. 10s. per acre — — — — —			15	0	0
So that the produce of ten acres in four years is			70	0	0
And in twenty years it will be — — —			350	0	0
Deduct the expence — — — — —			222	18	4
And there remains clear profit on ten acres in twenty years by the old way — — —			127	1	8

II. In the New Way.

Firſt year's extraordinary expence is					
For ploughing and manuring the land, the ſame as in the old way — —			22	0	0
Ploughing once more, at 4s. per acre	2	0 0			
Seed, nine gallons per acre, at 4s. per buſhel — — — —	2	5 0			
Drilling, at 7d. per acre — —	0	5 10			
Hand-hoeing and weeding, at 2s. 6d. per acre — — — —	1	5 0			
Horſe-hoeing, ſix times, at 10s. per acre — — — — —	5	0 0			
Reaping, binding, and carrying in, at 6s. per acre — — —	3	0 0			
The ſtanding annual charge on ten acres is — — — — —	13	15 10			
Therefore the expence on ten acres in twenty years is — — —			275	16	8
Add the extraordinaries of the firſt year, and the ſum is — — — — — —			297	16	8
The yearly produce is at leaſt two quarters of wheat per acre, at 1s. 8d. per quarter, which on ten acres in twenty years amounts to			560	0	0
Therefore, all things paid, there remains clear profit on ten acres in twenty years, by the new way — — — — — — —			262	3	4

"So that the profit on ten acres of land in twenty years, in the new way, exceeds that in the old by one hundred and thirty-five pounds one ſhilling and eight-pence, and conſequently is conſiderably more than double thereof: an ample encouragement to practiſe a method whereby ſo great advantage will ariſe from ſo ſmall a quantity of land, in the compaſs of twenty-one years leaſe; one year being allowed, both in the old and new way of preparing the ground.

"It ought withal to be obſerved, that Mr. Tull's huſbandry requires no manure at all, though we have here, to prevent objections, allowed the charge thereof for the firſt year; and moreover, that though the crop of wheat from the drill-plough is here put only at two quarters on an acre, yet Mr. Tull himſelf, by actual experiment and meaſure, found the produce of his drilled wheat crop amount to almoſt four quarters on an acre: and, as he has delivered this fact upon his own knowledge, ſo there is no reaſon to doubt of his veracity, which has never yet been called in queſtion. But that we might not be ſuppoſed to have any prejudice in favour of his ſcheme, we have choſen to take the calculations of others rather than his, having no other view in what we have ſaid, than to promote the cauſe of truth, and the public welfare."

HUSK, the ſame with what botaniſts call the calyx, or cup of a flower. See the article CALYX.

HUSSARS, a kind of irregular cavalry, armed with the ſabre and bayonet, are retained in the ſervice of moſt princes on the continent.

HUSSITES, the diſciples of John Huſs, a Bohemian, and curate of the chapel of Bethlehem at Prague; who, about the year 1414, embraced and defended the opinion of Wickliff of England, for which he was cited before the council of Conſtance, and, refuſing to renounce his ſuppoſed errors, he was condemned to be burnt alive, which ſentence was accordingly executed upon him at Conſtance.

HYACINTH, hyacinthus, in botany, a genus of plants, the flower of which conſiſts of a ſingle campanulated petal, divided into ſix reflex ſegments at the limb: the fruit is a roundiſh capſule, lightly ridged with three corners, and divided into three cells, each of which uſually contains two roundiſh ſeeds.

There is a great variety of theſe beautiful flowers, all of which are propagated by ſeeds, or off-ſets from the old bulbs.

HYACINTH, in natural hiſtory, a genus of pellucid gems, whoſe colour is red, with an admixture of yellow.

HYACINTHIA, an ancient Grecian feſtival, obſerved at Amyclæ in Laconia, in the month Hecatombæon, in memory of the beautiful young Hyacinthus, ſon of Amyclos, king of Sparta.

HYADES, in aſtronomy, ſeven ſtars in the head of the bull, famous among the poets for bringing on rain both at the riſing and ſetting.

The word is Greek, and derived from υω, to rain.

The principal of them is in the left eye, by the Arabs called Aldebaran.

HYDATIS, or HYDATIDES, in medicine, a little tranſparent veſicle, or bladder full of water, which is ſometimes found ſingly, and ſometimes in cluſters, upon the liver, and various other parts, eſpecially in dropſical conſtitutions.

The word is Greek, υδατις, and derived from υδωρ, water.

But hydatis, in a particular ſenſe, implies a diſeaſe of the eye-lid, called alſo aquula, wherein a preternatural pinguious ſubſtance is ſeated under the ſkin of the eye-lid.

St. Yves informs us that there ſometimes comes on the edge of the cartilages of the eye-lids, or on the conjunctiva, an elevation like the bladders that appear on the ſkin after burns. Sometimes a ſeroſity is extravaſated between the conjunctiva and the membrane that covers it, a kind of wrinkle appearing in the movement of the eye.

When this ſwelling ſeizes only part of the conjunctiva, or edge of the eye-lid, prick it dexterouſly with the point of a lancet, and lay it open according to the longitudinal direction of the tumor.

When all the circumference of the globe is filled with water, the conjunctiva becomes red: in this caſe the patient muſt be let blood. When the ſeroſity diminiſhes, let him be purged, and a proper collyrium applied to his eye.

HYDATOIDES, the ſame with the aqueous humour of the eye. See EYE.

HYDATOSCOPY, *Hydatoſcopia*, called alſo HYDROMANCY, in antiquity, a kind of divination, or method of foretelling future events by means of water.

The word is Greek, and formed of υδατ@, the genitive of υδωρ, water, and σκοπεω, to view or conſider.

HYDRA, in aſtronomy, a ſouthern conſtellation imagined to repreſent a water-ſerpent.

The number of ſtars in this conſtellation in Ptolemy's catalogue is twenty-five, and in the Britannic catalogue ſixty-eight.

HYDRAGOGUES, purgative medicines that evacuate a large quantity of watery or ſerous humour.

The word is formed from the Greek, υδραγωγ@, and derived from υδωρ, water, and αγω, to drive, or bring away.

In general all ſudorific, aperient, and diuretic medicines are hydragogues.

HYDRARGYRUM, a name given to mercury or quickſilver. See the article MERCURY.

HYDRAULICS, that part of ſtatics which conſiders

the motion of fluids, with the application thereof, particularly in artificial water-works.

The word is Greek, υδραυλις, an organ, and formed of υδωρ, water, and αυλος, a pipe, as, at the firſt invention of organs, a fall of water was employed to produce a wind to ſound them, the inventor being unacquainted with the method of applying bellows thereto.

HYDRELÆUM, in pharmacy, a mixture of oil and water, which Galen reckons refrigerating.

The word is Greek, and compounded of υδωρ, water, and ελαιον, oil.

Taken inwardly, it provokes vomiting; and, externally, it is anodyne, and promotes ſuppuration.

HYDRENTEROCELE, in ſurgery, a kind of tumor or hernia, where there is a dropſy of the ſcrotum, complicated with a deſcent of the inteſtine.

The word is Greek, and compounded of υδωρ, water, εντερον, an inteſtine, and κηλη, a tumor.

HYDROCANISTERIUM, an engine which ſpouts water in great quantities, and to conſiderable heights, in order to extinguiſh accidental fires in houſes. See ENGINE.

HYDROCELE, *Hernia*, in ſurgery, a ſwelling or dropſy in the ſcrotum. See HERNIA.

HYDROCEPHALUS, in ſurgery, a preternatural tumor of the head ariſing from preternatural lymph.

The word is Greek, and compounded of υδωρ, water, and κεφαλη, the head.

It is of two ſorts, internal and external; internal, when the water is collected within the bones of the cranium; external, when retained between the ſkin and cranium. The firſt kind is rarely ſeen but in new-born infants, who are generally in great danger: for, upon an inciſion, the lymph is no ſooner diſcharged, than the infant dies, as experience has too often convinced us. If the diſtemper be recent, it will be more adviſeable to repeat gentle purges, whilſt a large compreſs dipped in lime-water, ſpirit of lavender, or Hungary-water, is applied outwardly.

Though an external hydrocephalus be not without danger, it is more eaſily cured than the other; and this is to be attempted by internal and external remedies, ſuch as cathartics, diaphoretics, diuretics, attenuating and corroborating medicines for internal uſe; and externally apply digeſtive aromatic bags made with marjoram, origanum, mother of thyme, pennyroyal, chamomile, &c. warm to the head, and ſecured by a proper bandage.

Further it is proper to apply an errhine or cephalic ſnuff, and chew tobacco, to diſcharge the lymph from the head. Laſtly, ſome foment with the fumes of burning ſpirits of wine: but if all theſe fail, firſt by bliſters behind the ears and on the neck; and if this fail, cup the parts. Longitudinal ſcarifications much better promote the diſcharge: after this, the wounds muſt be dreſſed with lint ſpread with a digeſtive ointment; and to keep them open, add ſometimes a little red precipitate. Having thus removed the diſorder, the wounds ſhould be healed with a vulnerary balſam, and the patient kept to proper internal medicines, and a regular diet.

HYDROCHARIS, the little water-lilly, in botany, a genus of plants, the male flower of which has a ſpatha, and is compoſed of three large, plain, and roundiſh petals; the female flower is like the male one, only without any ſpatha: the fruit is a coriaceous and roundiſh capſule, conſiſting of ſix cells, in which are contained a great number of very ſmall and roundiſh ſeeds.

HYDROCOTYLE, marſh-penny-wort, in botany, a genus of plants, the univerſal corolla of which is uniform in figure, though not in ſituation; and the ſingle corollæ are formed of five ovato acute, patent petals: the fruit is orbicular, erect, and compoſed of two compreſſed and ſemi-orbicular ſeeds.

This plant is common with us in damp places, and is ſuſpected of hurting ſheep that feed on it; whence it is ſometimes called white-rot.

HYDROGRAPHY, that part of geography which conſiders the ſea as it is navigable.

The word is Greek, and derived from υδωρ, water, and γραφω, to deſcribe.

It teaches how to meaſure the ſea; gives an account of its tides, counter-tides, currents, ſoundings, bays, &c. as alſo its rocks, ſhelves, ſands, promontories, harbours, diſtances from port to port, with every thing remarkable out at ſea, or on the coaſt.

HYDROMANCY, the art of foretelling future events by means of water; the ſame as hydatoſcopy.

The word is Greek, and formed of υδωρ, the water, and μαντεια, divination.

The other kinds of divination relative to fire, air, and earth, are denominated pyromancy, aeromancy, and geomancy.

HYDROMEL, *Hydromeli*, among phyſicians, water impregnated with honey, either before or after fermentation: that made by fermentation is called vinous hydromel, or mead, and is eſteemed good for the gravel. See HONEY.

The word is Greek, and compounded of υδωρ, water, and μελι, honey.

HYDROMETER, an inſtrument to meaſure the gravity, denſity, velocity, force, &c. of water and other fluids. See the articles WATER and FLUID.

The hydrometer is one of the moſt uſeful inſtruments of the philoſophic kind; for though the hydroſtatical ballance be the moſt general inſtrument for finding the ſpecific gravities of all ſorts of bodies, yet the hydrometer is beſt ſuited to find thoſe of fluids in particular, both as to eaſe and expedition.

This inſtrument ſhould be made of copper, ſince ivory imbibes ſpirituous liquors, and thereby alters its gravity; and glaſs is apt to break. The moſt ſimple kind, uſed for finding the ſtrength of ſpirits, conſiſts of a copper-ball B*b* (plate LXXIV. *fig.* 5.) with a braſs-wire, A B, $\frac{1}{4}$ of an inch thick, ſoldered into it. The upper part of this wire being filed flat on one ſide, is marked proof at *m*, becauſe it ſinks exactly to this mark in proof-ſpirits. There are other two marks at A and B, to ſhew whether the liquor be $\frac{1}{10}$ above or below proof, according as the hydrometer ſinks to A or emerges to B, when a braſs weight as C or K has been ſcrewed on at the bottom *c*. There are alſo weights to be ſcrewed on, for ſhewing the ſpecific gravities of fluids quite to common water. The round part of the wire above the ball, may be marked ſo as to repreſent river-water when it ſinks to R W, (*fig.* 6.) the weight which fits the inſtrument for river-water being ſcrewed on at *c*: alſo when put into ſpring-water, mineral-water, ſea-water, and water of ſalt-ſprings, it will emerge or riſe gradually to the marks S P, M I, S E, S A; and, on the contrary, when put into Briſtol-water, rain-water, port-wine, and mountain-wine, it will ſucceſſively ſink to the marks *br*, *ra*, *po*, *mo*.

Another kind, which ſerves to diſtinguiſh the ſpecific differences of fluids to great nicety, conſiſts of a large hollow ball B, (*fig.* 7.) with a ſmaller ball *b* under it, partly filled with quick ſilver or ſmall ſhot, and ſcrewed on to the lower part of the former, in order to render it but little ſpecifically lighter than water: it has alſo a ſmall ſhort neck at C, into which is ſcrewed the graduated braſs-wire A C, which by its weight cauſes the body of the inſtrument to deſcend in the fluid, with part of the ſtem.

When this inſtrument is ſwimming in the liquor, contained in the jar I L M K, the part of the fluid diſplaced by it, will be equal in bulk to the part of the inſtrument under water, and equal in weight to that of the whole inſtrument. Suppoſe the weight of the whole were 4000 grains, then it is evident we can by this means compare together the different bulks of 4000 grains of various ſorts of fluids. For if the weight A be ſuch as ſhall cauſe the aræometer to ſink in rain-water, till its ſurface comes to the middle point of the ſtem 20; and if, after this, it be immerſed in common ſpring-water, and the ſurface is obſerved to ſtand $\frac{1}{10}$ of an inch below the middle point 20; it is evident that the ſame weight of each water differs in bulk only by the magnitude of $\frac{1}{10}$ of an inch in the ſtem.

Now ſuppoſe the ſtem were ten inches long, and weighed one hundred grains, then every tenth of an inch would be one grain weight; and ſince the ſtem is of braſs, and braſs is about eight times heavier than water, the ſame bulk of water will be equal to $\frac{1}{8}$ of a grain; and conſequently to the $\frac{1}{8}$ of $\frac{1}{32000}$ part, that is, a 32000th part of the whole bulk, which is a degree of exactneſs as great as can be deſired. Yet the inſtrument is capable of ſtill greater exactneſs, by mak-

ing the ſtem or neck conſiſt of a flat thin ſlip of braſs, inſtead of one that is round or cylindrical: by this means we increaſe the ſurface, which is the moſt requiſite thing; and diminiſh the ſolidity, by which the inſtrument is rendered more exact.

In order to adapt this inſtrument to all ſorts of uſes, there ought to be two different ſtems to ſcrew on and off in a ſmall hole at *a*. One ſtem ſhould be ſuch a niee thin ſlip of braſs, or rather of ſteel, like a watch-ſpring ſet ſtraight, as we have juſt mentioned, on one ſide of which ought to be the ſeveral marks or diviſions, to which it will ſink in various ſorts of waters, as rain-water, river-water, ſpring-water, ſalt ſpring-water, &c. And on the other ſide you mark the diviſion to which it ſinks in various lighter fluids, as hot Bath-water, Briſtol-water, Lincomb-water, Chelten-water, port-wine, mountain, madeira, and various other ſorts of wine. But in this caſe the weight A on the top muſt be a little leſs than before, when it was uſed for the heavier waters.

But, in caſe of trying the ſtrength of ſpirituous liquors, a common cylindric ſtem will do beſt, becauſe of its ſtrength and ſteadineſs; and this ought to be ſo contrived that, when immerſed in what is called proof-ſpirit, the ſurface of the ſpirit may be upon the middle point 20; which is eaſily done by duly adjuſting the ſmall weight A on the top, and making the ſtem of ſuch a length that, when immerſed in water, it may juſt cover the ball, and riſe to *a*; but, when immerſed in pure ſpirit, it may ariſe to the top at A; then by dividing the upper and lower parts *a* 20, A 20, into ten equal parts each, when the inſtrument is immerſed in any ſort of ſpirituous liquor, it will immediately ſhew how much it is above or below proof.

This proof ſpirit conſiſts of half water and half alcohol, or pure ſpirit, that is, ſuch as when poured upon gunpowder, and ſet on fire, will burn all away, and permit the powder to take fire, which it will, and flaſh as in the open air. But if the ſpirit be not ſo highly rectified, there will remain ſome phlegm or water, which will make the powder wet, and unfit to take fire. This proof-ſpirit of any kind, weighs ſeven pounds twelve ounces per gallon.

The common method of ſhaking the ſpirits in a vial, and by raiſing a crown of bubbles, to judge by the manner of their riſing or breaking away whether the ſpirit be proof or near it, is very precarious and capable of great fallacy. There is no way ſo eaſy, quick, certain, and philoſophical, as this by the aræometer, which will demonſtrate infallibly the difference of bulks, and conſequently ſpecific gravities, in equal weights of ſpirits, to the 30, 40, or 50 thouſandth part of the whole, which is a degree of accuracy, beyond which nothing can be deſired.

HYDROMETRY, *Hydrometria*, the menſuration of fluids, their gravity, velocity, quantity, &c.

The word is of the ſame original with the preceding. It includes both hydroſtatics and hydraulics.

HYDROMPHALUS, in medicine and ſurgery, a tumor of the navel, containing water. See the article HERNIA.

The word is Greek, and derived from ὑδωρ, water, and ὀμφαλὸς, the navel.

The hydromphalus, when viewed between the eye and the light, is found to be tranſparent. It is diſcuſſed by emollient and reſolutive medicines, and alſo by a puncture in the middle of the navel.

HYDROPARASTATÆ, a ſect of heretics, the followers of Tatian.

This ſect were called alſo Encratitæ, Apotactitæ, Saccophori, Severiani, and Aquarians.

The Hydroparaſtatæ were a branch of the Manichees, whoſe diſtinguiſhing tenet was, that water ſhould be uſed in the euchariſt inſtead of wine.

HYDROPHOBIA, in medicine, a dread of water, which is a ſymptom ariſing in a perſon who has been bitten by a mad dog, or other mad animal.

The word is Greek, and compounded of ὑδωρ, water, and φοβέω, to fear.

The ſymptom is not peculiar to this diſtemper, though it be always an attendant; for we meet with ſeveral inſtances of fevers accompanied with a dread of water.

Dogs, wolves, and foxes, are moſt frequently affected with this madneſs, and that without any previous bite from another animal. With reſpect to the propagation of this diſtemper from brutes to mankind, the diſeaſe ſeems to be inoculated by the bite into the animal, which receives it; for the wound feſters ſome little before or about the time the diſtemper begins to appear. Something very like this happens in the inoculation of the ſmall-pox.

The ſigns of approaching madneſs in dogs are, according to Boerhaave; they become dull, and endeavour to hide themſelves; they are mute, as to their bark; but they make a kind of murmuring noiſe, refuſing, at the ſame time, meat and drink; they fly at ſtrangers; but in this ſtage, which is the firſt, they remember and reſpect their maſters; their ears and head hang, and they walk nodding, as if overpowered by ſleep. A bite received at this time is very dangerous; but not of the worſe kind. Then they begin to pant and hang out their tongue, to emit a great deal of froth from the mouth, which they keep perpetually open; ſometimes they walk ſlowly, and as if half aſleep; and then ſuddenly run, but not always directly forward: at laſt they forget their maſters; mean time their eyes look dull, full of tears and red; their tongue is of a lead colour; they are ſuddenly extenuated, and now rage exceſſively. They ſeldom ſurvive this ſtage thirty hours; and a bite received at this time, as Boerhaave ſays, is incurable. But the more raging the animal is, the more dangerous is the bite, and the more violent are the ſubſequent ſymptoms, and *vice verſa*.

Two other circumſtances, which Boerhaave has omitted, are, that all other dogs, upon ſmelling the dog going mad, will avoid him, and run away with horror, ſhaking their heads with ſome vehemence. The other circumſtance is, that the tone of the dog's voice, when he barks, will be quite altered from what it was, and ſeem hollow and hoarſe. And though, as Boerhaave obſerves, the dog may be mute in the dumb madneſs, yet it is more frequently found, that a dog, eſpecially if confined, ſhall bark for a day or two without ceaſing. There is no poiſon known which produces ſuch terrible effects as that communicated by a mad animal, nor which induces ſuch a change in a perſon who receives it; or which rages with ſuch violence, and ſo ſuddenly, when it once begins to act.

In a perſon affected with this diſorder, among other extraordinary ſymptoms, the approach of any liquor to the body, eſpecially to the tongue and lips, produces an incredible uneaſineſs, trembling, convulſions, and a ſtate next to direct madneſs: and at the ſame time the patient is racked with an inſatiable thirſt.

In general, Boerhaave affirms, that there is no certain preſervative againſt this diſorder yet known; and that there is no example, that can be depended upon, of any one having been recovered, who was once ſo far gone as to dread water. This author adds, that it is much to be lamented, that after the common methods have been put in practice perpetually without ſucceſs, for ſo many ages, others have not been tried. All the celebrated remedies for this purpoſe, he adds, owe their reputation either to barren ſpeculation, or too great confidence in the reports of others.

His own directions, however, are, 1. As ſoon as the poiſon is received into the body, the part affected, and thoſe adjacent thereto, ſhould have deep ſcarifications made in them. Then large cupping-glaſſes to be applied, or the part to be burnt pretty deep with the actual cautery, and afterwards kept in continual ſuppuration. During the whole of this time, the part is, without interruption, to be fomented with a pickle of ſea-ſalt and vinegar. 2. The cloaths, &c. which have come near the poiſon to be thrown away. 3. The patient is, immediately after receiving the misfortune, to be thrown headlong into the ſea, or ſome river, with threatening words, and other circumſtances capable of ſtriking terror into him; for which purpoſe he is frequently to be immerſed in the water, and again taken up: for the good effects are only produced by the dread and conſternation into which the mind is thrown. He is frequently to be purged with rhubarb, agaric, and the juice of elder-bark. 4. Let the patient have a gentle ſweat excited every morning before eating.

eating. 5. His feet and hands are to be daily fomented in a bath of water. Laſtly, let him frequently drink cold water, till he vomit it up: uſe acidulated liquors often: his diet muſt be moiſt, light, and laxative, and take them ſo liberally as to vomit them again. He muſt abſtain from large quantities of aromatic ſubſtances, wine, &c. violent exerciſe of body, and all commotions of mind.

The cure is principally to be attempted in the firſt ſtage, or the beginning of the ſecond. It ſeems probable, ſays he, the following method may be of ſome efficacy, eſpecially as it is confirmed by ſome few experiments. Immediately upon the ſigns of approaching madneſs, the caſe is to be treated as extremely inflammatory; wherefore a large quantity of blood muſt be taken away by a large orifice, even till the patient is faint: then directly inject nitrous clyſters, mixed with a little vinegar. Let theſe be repeated boldly, and more frequently than is conſiſtent with prudence in other caſes. After this the eyes are to be blindfolded, and he thrown into a cold pond, or cold water thrown upon him, till he be no longer afraid of it. Then let him be immediately forced to drink a large quantity of water; and toward the evening of the ſame day let a ſleep be procured.

We have an account of remedies for this malady in the Philoſophical Tranſactions; one of which is the lichen cinereus terreſtris, or aſh-coloured liverwort, which has been taken into the College Diſpenſatory, under the title of *Pulvis Antilyſſus*, and is the celebrated remedy publiſhed by Dr. Mead, with ſome variation in the proportion of the pepper. The directions, as made public, are, firſt to take away nine or ten ounces of blood; and then take of powdered aſh-coloured liverwort, four drams, and of the powder of black pepper, two drams: mix theſe together, and divide into four doſes; one of which is to be taken faſting for four days ſucceſſively, in half a pint of tepid cow's milk. After taking theſe four doſes, the patient is to be put faſting every morning for a month, either into a cold bath, cold ſpring, or river, remaining therein with his head above water, not longer than half a minute, if the water be exceſſively cold. Then let him bathe thrice a week for fifteen days.

Boerhaave, in his Aphoriſms, treating of the canine madneſs, would have us not to deſpair of diſcovering a peculiar antidote againſt this ſingular kind of poiſon: and this, ſays he, we are encouraged to hope for, from the certain inſtances we already have of remedies effectual againſt particular ſorts of poiſon. Accordingly he had a mind to try what effect mercury would have upon animals under canine madneſs; and from ſeveral experiments, he found it prove ſucceſsful, by adminiſtering ſome grains of turpeth mineral made into boluſes. He alſo mentions the remedy which M. Deſault tried with conſtant ſucceſs in the hydrophobia, which is a mercurial ointment made of one third part of mercury revived from cinnabar, one third part of human fat, and as much of hog's lard. One or two drams of this ointment at a time ſhould be rubbed by intervals, or ſucceſſively, upon and about the wound. As a farther confirmation of the efficacy of mercury in the canine madneſs, he takes notice of a medicine Mr. Cobb of Buſſelton, near Briſtol, brought from Tonquin, which is much celebrated in the Eaſt-Indies as efficacious in this diſtemper; this is a native and factitious cinnabar, of each twenty-four grains; muſk, ſixteen grains, powdered and mixed well together. This powder is to be taken all at once in a tea-cup of arrack, which is ſaid to ſecure the patient for thirty days: after which time the doſe is to be repeated in the ſame manner; but it ſhould be done as ſoon as poſſible after the bite is received: but if the patient have any ſymptoms of the diſeaſe, the ſecond doſe muſt be repeated three hours after the firſt; and this is ſaid to be ſufficient for a cure.

HYDROPIC, a dropſical patient; or a perſon ſwelled and bloated with the abundance of water. See the article DROPSY.

HYDROPOTA, in medicine, a perſon who drinks nothing but water.

It has long been controverted among phyſicians, whether or no the hydropotæ live longer than other perſons.

HYDROPS, in medicine, the ſame with dropſy. See the article DROPSY.

HYDROSCOPE, an inſtrument anciently uſed for the meaſuring of time.

The hydroſcope was a kind of water-clock conſiſting of a cylindrical tube, conical at bottom; the cylinder was graduated, or marked out with diviſions, to which the top of the water becoming ſucceſſively contiguous, as it trickled out at the vertex of the cone, pointed out the hour. See CLEPSYDRA.

HYDROSTATICAL BALLANCE, a kind of ballance contrived for the eaſy and exact finding the ſpecific gravities of bodies, both liquid and ſolid. See the article *Hydroſtatical* BALLANCE.

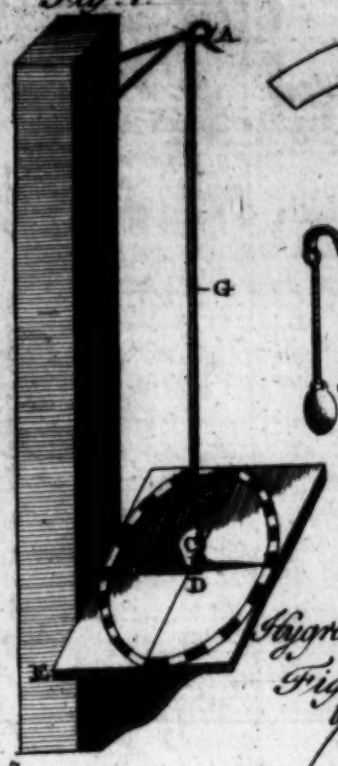
Bradford's New HYDROSTATICAL INSTRUMENT, a new invention for weighing coin, and diſcovering its defect either of weight or purity.

It conſiſts of a thin, flat, braſs-ruler, about half a foot long; on each ſide of which are two graduated lines, thoſe on the upper ſide being marked A and W (plate LXXIV. *fig.* 8) and thoſe on the under ſide B and W. (*fig.* 9) There is alſo a ſmall chain and pincers wherein to fix any piece of money intended to be weighed and proved; together with two pair of center pins, marked A and B, (*fig.* 10.) whereof the former pair A are to be uſed for proving all pieces of gold not exceeding the value of 36 s. and the other pair marked B, for all pieces from 36 s. to 72 s. or 3 l. 12 s. Laſtly, there is a ſliding-piece or index C, (*fig.* 10.) by the motion of which backwards and forwards upon the ruler, the value of any piece ſuſpended in the pincers is found upon the graduated lines already mentioned; whereof thoſe marked A and B are called ſtatical lines, as being calculated for weighing the piece in air; and thoſe marked W, W, are called hydroſtatical lines, as ſerving to point out the alloy or adulteration of the piece weighed. A whole diviſion on each line, is equal to the weight or value of 1 s. in gold; a half diviſion to 6 d. and a quarter diviſion to 3 d.

To prove a guinea: firſt ſuſpend it in the pincers, and then placing the inſide of the ſliding-piece C to 21 on the line A, on the upper ſide of the ruler, which muſt move freely on the center-pins marked A; and if the guinea and ſliding-piece exactly ballance each other, the guinea is full weight: if not, move the ſlider backward or forward, till they equiponderate, and the diviſion cut by the inſide of the ſlider is the true weight; for inſtance, ſuppoſe it reſts at 20 $\frac{1}{2}$, then does the guinea weigh only 20 s. 6 d. In the next place, to prove the alloy of the piece, let the ſlider be brought to the diviſion 20 $\frac{1}{2}$ upon the hydroſtatical line marked W; for whatever diviſion is cut by the ſlider, in weighing on the ſtatical line, it muſt be placed at the ſame on the hydroſtatical line adjoining. Then let the piece, together with the pincers and the braſs-link whereon it is ſuſpended, be immerſed in water (*fig.* 10.) as far as the notch in the ſaid link; and if the inſtrument acts in equilibrio, or the piece ſink deeper in the water, the guinea is ſtandard-gold; but if the ſlider muſt be moved farther backward before it will equiponderate, the guinea is adulterated. If alloyed with ſilver, allow 2 s. for every penny it wants in the hydroſtatical weight; and then, if the number of pence the piece is deficient in weight hydroſtatically, when doubled exceed the number of ſhillings it weighs ſtatically, you may conclude it is adulterated with ſome baſer metal than ſilver. However, a more ſpeedy method of diſcovering whether a piece of gold be adulterated or not without moving the ſlider more than once, is this: when you have weighed a piece ſtatically, bring the ſlider to the diviſion on the hydroſtatical line expreſſing its weight, and immerſing the piece and pincers as before, ſo that the ſurface of the water may be exactly at the notch or mark on the long link, if the inſtrument doth not then equiponderate, gently lower your hand that holds the fluid till the inſtrument comes to an equilibrium; at which time, if the guinea be a counterfeit, great part of the pincers will appear above water; and if a 36 s. piece be tried, not only the pincers, but a ſmall part of the coin will appear above the ſurface, if the piece be counterfeit. This laſt method is ſufficiently near the truth for common practice.

5 JA 59

Fig. 1.



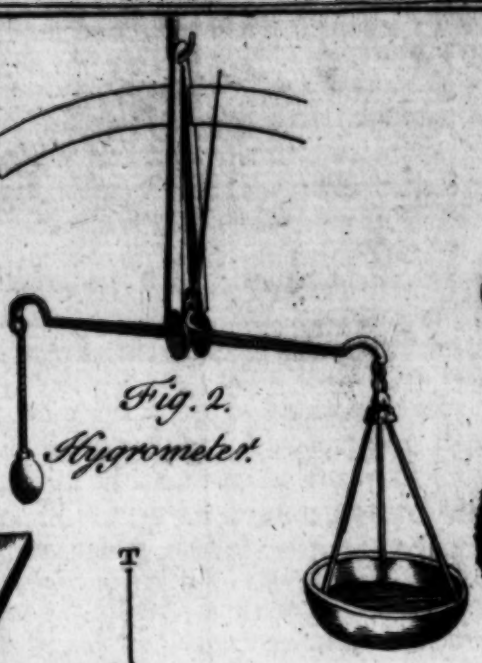
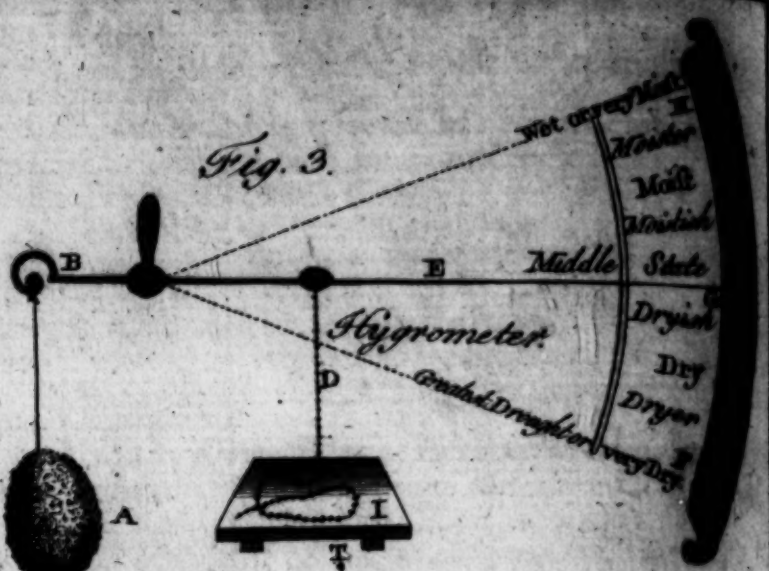


Fig. 2.
Hygrometer.

Fig. 3.



Hygrometer.

Fig. 5. Hyperbola.

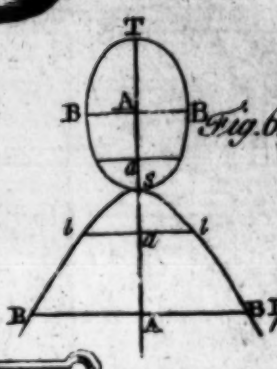


Fig. 6.

Fig. 7.

Fig. 8.

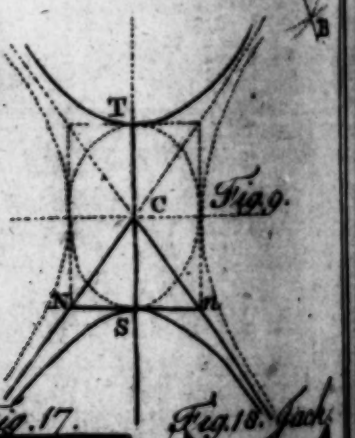


Fig. 9.

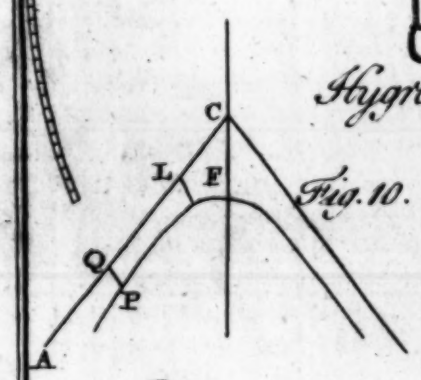


Fig. 10.

Hyperbolic Space.
Fig. 11.

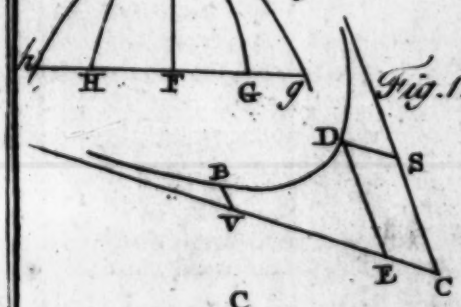
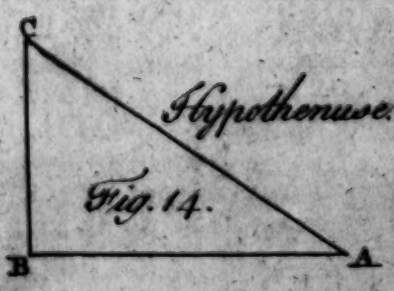


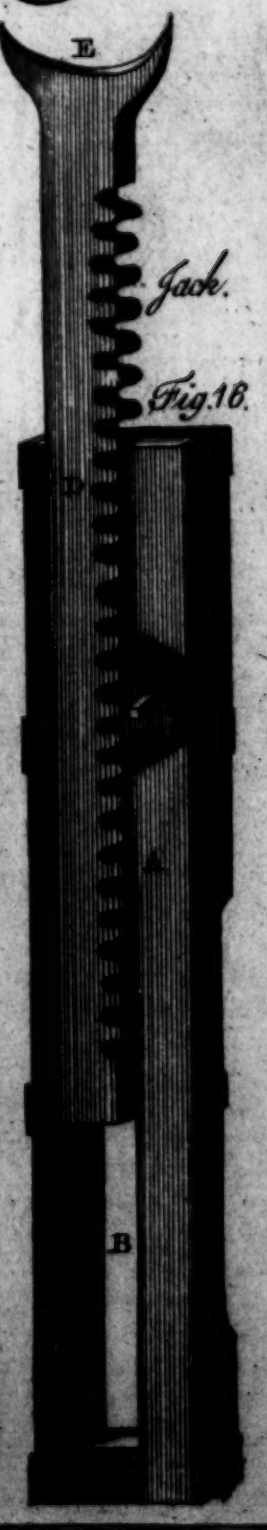
Fig. 12

Hyperbolic Conoid.
Fig. 13.

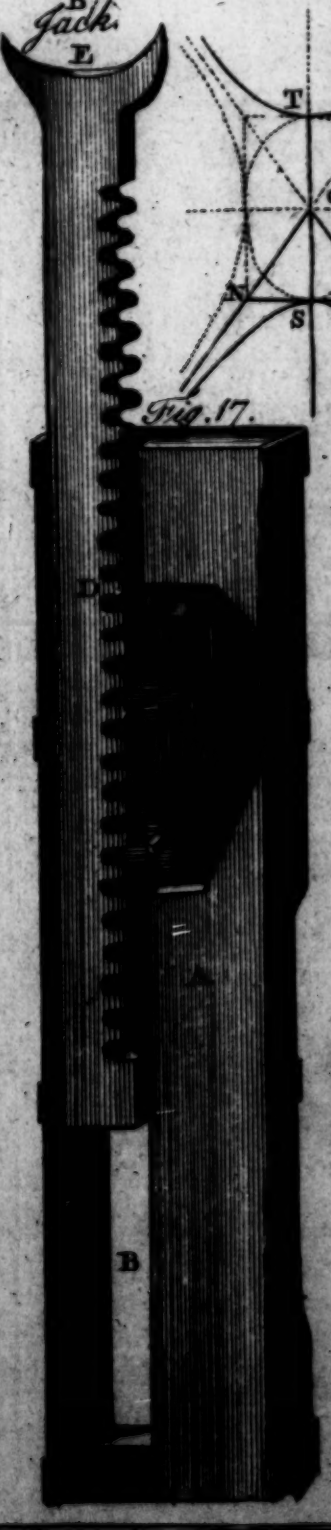


Hypothenuse.
Fig. 14.

Jack.
Fig. 15.



Jack.
Fig. 16.



Jack.
Fig. 17.

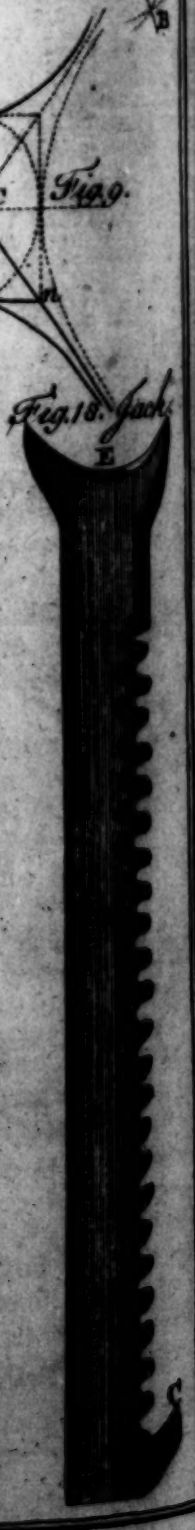


Fig. 18. Jack.

If you ſhould have occaſion to weigh and prove a very ſmall piece of gold, as 2s. 3d. or 4s. 6d. the method is to put the ſaid piece in the pincers, with ſome other piece that has been proved before; by which means, the weight and alloy of the ſmall piece may be eaſily diſcovered, as above. And if the piece be above 36 s. then the ſlider is to be placed according to the diviſions of the ſtatical and hydroſtatical lines on the under ſide of the inſtrument; which is fitted to the ſtandard of the mint, that makes the guinea to weigh 129 grains.

HYDROSTATICS, that part of mechanics which conſiders the gravity and æquilibrium of fluid bodies, particularly water, and of ſolid bodies immerſed therein.

The word is Greek, and compounded of υδωρ, water, and ςατικη, the ſcience of weights, which is derived from ιςημι, to eſtabliſh or determine.

Mr. Boyle has applied hydroſtatics in examining and proving the goodneſs and purity of metals, minerals, &c. particularly fluids, in his Hydroſtatica. See *Hydroſtatical* BALANCE.

As to the laws of hydroſtatics, with the application thereof; ſee FLUID.

Hydroſtatics and hydraulics are treated by ſome authors promiſcuouſly.

Thoſe who are acquainted but the leaſt with the ancient Egyptians, know that they found the way to keep their river within proper bounds, and to make a good uſe of its ſalutary waters, whether it were by ſpreading them over their plains, or raiſing them to conſiderable heights.

Among the Greeks, Ariſtotle was the firſt that wrote of the æquilibrium of fluids, and reduced the flight of birds, the motion of fiſhes, and the direction or ſteerage of ſhips, to the rules of mechanics.

It is well known with what addreſs Archimedes, who came after Ariſtotle, diſcovered the cheat of the goldſmith of king Hiero. The latter, ſuſpecting that the workman had allayed the gold with more ſilver than was neceſſary, ſent to the philoſopher to examine and detect the fraud. He was long at a loſs to think of any method of doing it; till one day getting into a tub full of water to bathe himſelf, he obſerved, that as he entered the tub, the water ran out; and he immediately ſaw it muſt follow, that if the tub were full, the water which ran out upon his immerſion, muſt be equal in bulk to his body.

Thence the philoſopher began thus to reaſon: If I immerſe the crown in a veſſel full of water, it will protrude as much as is equal to its bulk. If after this I immerſe the ſame weight of pure gold and pure ſilver, I ſhall get bulks of water equal to each; conſequently, having the bulks of gold, ſilver, and crown of equal weight, I have the ratio of the ſpecific gravities, which are known to be as the bulks inverſely. Then to find the ratio of gold to the ſilver in the crown, he proceeded in ſome ſuch manner as the following:

Suppoſe a veſſel filled with water to a certain height, and that the maſs, M, of gold, equal in weight to the crown, being immerſed into the water, raiſes the ſurface thereof a certain height, H; and after that, the maſs, *m*, of ſilver of the ſame weight immerſed raiſes the ſurface the height *h*; and laſtly, if the crown be immerſed, the ſurface of the water ſhall be raiſed to ſome height, *p*, between the former heights. Hence the proportion of the bulks of the gold and ſilver in the crown may be determined.

For it is evident, that if the crown had been all gold, it would have raiſed the ſurface of the water to the height H; but it raiſed that ſurface to a greater height *p*; therefore *p*—H is as the bulk of gold in the crown: and again, had the crown been of ſilver only, it would have raiſed the ſurface of the water to the height *h*; conſequently *h*—*p* is as the bulk of ſilver in the crown: hence the bulk of gold in the crown is to that of ſilver, as *p*—H to *h*—*p*. It is ſaid that Archimedes offered a hecatomb of oxen to Jupiter for inſpiring him with the thought.

This famous mathematician alſo invented that cochlea or ſcrew, which, by the motion of an inclining cylinder, makes the water riſe, while the other falls. The water acts by its own gravity in this ſimple machine, but it cannot be carried very high. See the article *Archimedes's* SCREW.

Cteſibius, by making uſe of a more compounded machine, which has kept the name of its inventor, knew how to make the water riſe to all ſorts of heights; and is in uſe at preſent, as are the ſeveral ſorts of pumps. But of the inventions of the ancients, there is none of greater importance than that of water-mills; for, as Vitruvius deſcribes them, they ſeem to have reſembled ours pretty much. It is true they were not ſo common then as they are now-a-days.

The moderns knew but little of hydroſtatics before Galileo. This great man, being of the ſame opinion with the ancients, that there was no vacuum in nature, attributed the elevation of the water in the ſucking-pump to the abhorrence of a void. Torricelli, his diſciple, remarked, that when a tube, cloſe at the upper-end, was immerſed into a veſſel full of mercury, the mercury remained ſuſpended in the tube at a certain height, and that it filled into the veſſel, when the tube was open. Torricelli communicated this experiment, but without referring it to the true cauſe; but by repeating it often, he conjectured that it might be the effect of the weight of the air.

M. Paſcal laid hold of the notion, and after being aſſured of the fact by experiments which he made, and publiſhed anno 1647, he endeavoured in 1648, to certify himſelf of the cauſe: and at length, from his experiments, he knew what Torricelli had only conjectured: and what the great duke's mathematician had ſaid doubtfully, M. Paſcal demonſtrated by the famous experiments he made on the pit of Domme, and afterwards in the treatiſes he publiſhed.

The experiments which have been made, in order to know the properties of fluids, moved M. Marriotte to make ſeveral obſervations which had not been touched on before; whereby he enriched hydraulics with a number of diſcoveries on the meaſure and expence of conveying water, according to the different heights of the reſervoirs and their various adjuncts. Afterwards he examined what concerns the conducting of water, and the ſtrength requiſite in pipes for reſiſting their different gravities.

M. Marriotte had a good deal of knowledge and dexterity in removing difficulties, and was ſingularly happy in making experiments, which he performed for the moſt part at Chantilly, and at the Royal Obſervatory. He nevertheleſs neglected what concerned the different pumps and other machines which might raiſe water. This part of the hydroſtatics had been touched but very imperfectly when the chevalier Morland undertook to treat of it. If he hath not exhauſted the ſubject, he has at leaſt given light enough for carrying on the theory and practice of it very far.

HYGIEINE, that branch of medicine which preſcribes rules for the preſervation of health; it may be divided into prophylactice, which foreſees and prevents diſeaſes; ſynteritice, employed in preſerving health; and analeptice, whoſe office is to reſtore health.

The word is Greek, υγιεινη, and derived from υγιης, ſound.

HYGROMETER, or HYGROSCOPE, a machine whereby to meaſure the degrees of the dryneſs or moiſture of the air.

The word is Greek, and compounded of υγρος, moiſt, and μετρεω, to meaſure.

In the Philoſophical Tranſactions we have ſeveral methods of conſtructing hygroſcopes.

Mr. Molyneux gives the following: AB (plate LXXV. *fig.* 1.) is a whipcord about four feet long, tied faſt to the end of the hook A. At the end of this whipcord hangs the weight 6, about a pound, or ſomething more: this weight is ſo fitted at the end to receive and carry the index D. Under theſe there is placed a graduated circle on the board EF, fixed by a bracket againſt the wall.

The moiſture of the air twiſts the cord, and gives a motion to the index over the diviſions in the graduated circle; and again, as the air grows more dry, the cord untwiſts and brings back the index by a contrary motion.

The rope A B ſhortens and lifts up the weight C by way of a ſcrew, and conſequently muſt give a circular motion to the index.

One of the grand defects of all hygrometers hitherto invented is, that they grow weak with age, and do not ſo nicely obey the alterations of the air. The alterations alſo of the air may give this kind of hygroſcope more than one turn. To remedy this, the index D has two complete turns: the point A, as being fixed, has no turn; therefore the middle point G has but one turn; and conſequently if it be hung up at the point G, or no longer than G D, half the former length, the index D will have but one turn. What is here ſaid of two turns, and the middle point G, may be accommodated to any other number of turns and points in the cord.

Mr. Gould obſerves that, when oil of vitriol is faturated in the moiſteſt weather, it afterwards retains or loſes its acquired ſtate, as the air proves more or leſs moiſt. Thus one grain, after its full increaſe, often varied the equilibrium ſo ſenſibly, that the tongue of the ballance of 1 ½ inch long, deſcribed an arch of variation to ⅓ of an inch compaſs; which arch would have been 2⅔ inches, had the tongue been but one foot in length, even with that little quantity of liquor: ſo that, if more liquor expanded under a large ſurface be made uſe of, the minuteſt alteration of weather muſt needs very much affect it; and a bare pair of ſcales will afford a hygroſcope as nice, perhaps, as any yet known.

This ballance may be contrived two ways; either ſuch whoſe pin ſhould be in the middle of the beam (*fig.* 2.) with a very ſlender tapering tongue of a foot or a foot and a half long, pointing to the diviſions on a broad arched plate fixed above in the handle; or elſe the ſcale with the liquor may be hung to a point of the beam (*fig.* 3.) very near the pin, and the other extreme made ſo long as to mark a large arch on a board placed conveniently for that purpoſe. The ſcale in either may be a concave glaſs of four or five inches diameter. Laſtly, on the diviſion of the arches ſhould be inſcribed the different temperature of the air ſhewn by the liquor.

The above author imagines oil of ſulphur per campanum, as alſo oil of tartar per deliquium, and the liquor of fixed nitre, &c. might ſucceed as well as oil of vitriol.

Another hygroſcope, he ſays, may be made of a viol ſtring running upon pullies, and ſuſpending a bullet fixed to the ſhorter end of an index, whoſe other extremity is ſo long as to deſcribe a long arch by the falling and riſing of the bullet upon the ſtretching and ſhrinking of the ſtring; which would be the more nice, were the index faſtened to the center.

But among all the inventions, the following ſeems beſt calculated both for diſpatch and accuracy.

A (*fig.* 4.) repreſents a thin piece of ſponge, ſo cut as to contain as large a ſuperficies as poſſible. This hangs by a fine thread of ſilk, upon the beam B, and is exactly ballanced from another thread of ſilk at D, ſtrung with the ſmalleſt lead ſhot, at equal diſtances, and ſo adjuſted as to cauſe the index E to point at G, in the middle of the graduated arch F, G, H, when the air is in the middle ſtate, between the greateſt moiſture and the greateſt dryneſs. I, ſhews a little table or ſhelf for that part of the ſilk and ſhot which is not ſuſpended to reſt upon.

The word hygroſcope and hygrometer are commonly both uſed in the ſame ſenſe. However, Wolfius makes ſome difference betwixt a hygroſcope and an hygrometer, ariſing from the etymology; the former only ſhewing the alterations of the air, in reſpect of humidity and dryneſs; and the latter meaſuring them.

The word hygroſcope is Greek, and compounded of υγρος, moiſt, and σκοπεω, to view, or conſider.

HYLE, or HYLEC, among alchemiſts, denotes their firſt matter, or the original chaos of things.

HYLEG, or HYLECH, in aſtrology, ſignifies a planet, or the point in the heavens, which at a perſon's nativity is accounted the ſignification of life. See the article NATIVITY.

HYMEN, in anatomy, ſignifies a membrane in general; but it is commonly taken for that circular membraneous fold, with which the anterior extremity of the great canal in virgins, and eſpecially before the firſt eruption of the menſes, is commonly bordered. This fold is of different breadths, more or leſs ſmooth, and ſometimes ſemi-lunar; and in ſome ſubjects leaves but a very ſmall opening, in others a larger; and in all renders the external orifice narrower than the reſt of the cavity. The hymen is formed by the union of the internal membrane of the great canal with that on the inſide of the alæ; it is commonly ruptured after the conſummation of marriage; is quite loſt in delivery; and afterwards only ſome irregular portions of it remain, which, from their ſuppoſed reſemblance to myrtle leaves, have been termed carunculæ myrtiformes. This circle may alſo ſuffer ſome diſorder by too great a flux of the menſes and other particular accidents. *Winſlow.*

HYMN, a religious ſong. The hymns ſung in the Chriſtian church, as diſtinguiſhed from the pſalms, are pieces of poetry compoſed by pious, but not inſpired, authors.

HYOIDES, in anatomy, a forked bone at the root of the tongue; it is ſituated in the middle ſpace between the angles of the lower jaw; it is a little bone, and reſembles, in ſome meaſure, the baſis of the lower jaw.

HYOTHYROIDES, in anatomy, a muſcle of the larynx, which ſerves to raiſe it, and conſtringe the glottis.

HYPÆTHROS, or HYPÆTHRON, in ancient architecture, a kind of temple open at the top.

Vitruvius ſays, it was an open building or portico, which had no roof or covering, as the temple of Jupiter Olympius, built by Caſſatius, a Roman architect at Athens.

HYPALLAGE, among grammarians, a ſpecies of hyperbaton, conſiſting in a mutual permutation of one caſe for another.

HYPANTE, or HYPERPANTE, a name given by the Greeks to the feaſt of the preſentation of Jeſus in the temple.

This word, which ſignifies lowly or humble meeting, was given to this feaſt from the meeting of old Simon, and Anna the propheteſs, in the temple, when Jeſus was brought thither.

HYPATE, in ancient muſic, an appellation given to the loweſt chord of a tetrachord.

HYPER, υπερ, a Greek prepoſition, frequently uſed in compoſition, where it denotes exceſs; its literal ſignification being above, or beyond.

HYPERBATON, in grammar, a figurative conſtruction inverting the natural and proper order of words and ſentences. The ſeveral ſpecies of the hyperbaton are the anaſtrophe, the hyſteron proteron, the hypallage, ſynchyſis, tmeſis, parentheſis, and the hyperbaton, ſtrictly ſo called. See ANASTROPHE, &c.

HYPERBATON, ſtrictly ſo called, is a long retention of the verb, which completes the ſentence.

HYPERBOLA, in geometry, one of the curve lines formed by the ſection of a cone. See CONIC *Sections.*

The plane of every hyperbola, is proportioned by this general theorem:

"As the ſum of the tranſverſe and any abſciſſa, multiplied into that abſciſſa, is to the ſquare of its ſemi-ordinate; ſo is the ſum of the tranſverſe and any other abſciſſa, multiplied into the abſciſſa, to the ſquare of its ſemi-ordinate."

That is, if T S (plate LXXV. *fig.* 5.) be the tranſverſe diameter, and S *a*, S A, abſciſſas, and *b a*, B A, ſemi-ordinates: then is T *a* = T S + S *a*, and T A = T S + S A. And it will be T *a* × S *a* : □ *b a* :: T A × S A : □ B A. That is, T S + S *a* × S *a* : □ *b a* :: T S + S A × S A : □ B A.

Theſe proportions are the common property of every hyperbola, and differ only from thoſe of the ellipſis in the ſigns + and −. See ELLIPSIS.

That is, if we ſuppoſe T S (*fig.* 6.) the tranſverſe diameter, common to both ſections, viz. both the ellipſis and hyperbola.

Then in the ellipſis it will be T S − S *a* × S *a* : □ *a b* :: T S − S A × S A : □ A B. And in the hyperbola it is T S + S *a* × S *a* : □ *a b* :: T S + S A × S A : □ A B as above.

And

And therefore all that is further required in the hyperbola may be found as in the ellipsis, due regard being had to the changing of the signs.

To find the latus rectum or right parameter of any hyperbola.

From the last proportion, take any of the antecedents and its consequent, viz. either $Ta \times Sa : \square ab$. Or, $TA \times SA : \square AB$. To them bring in the transverse TS, for a third term, and by those three find a fourth proportional, as in the ellipsis, and that will be the latus rectum.

To find the focus of any hyperbola.

The focus being that point in the hyperbola's axis, through which the latus rectum must pass, as in the ellipsis and parabola, it may be found by this theorem:

"To the rectangle made of half the transverse into half the latus rectum, add the square of half the transverse; the square root of that sum will be the distance of the focus, from the center of the hyperbola."

To describe a hyperbola in plano.

In order to the easy describing of an hyperbola in plano, it will be convenient to premise the following proposition, which differs from that of the ellipsis only in the signs.

Prop. If from the focus of any hyperbola there be drawn two right-lines, so as to meet each other in any point of the hyperbola's curve; the difference of those lines (in the ellipsis it is their sum) will be equal to the transverse diameter.

That is, if F (*fig.* 7.) be the focus, and it be made $Cf = CF$; then the point f is said to be a focus out of the section (or rather of the opposite section) and it will be $fB - FB = TS$.

If this proposition be truly understood, it must needs be easy to conceive how to describe the curve of any hyperbola very readily by points, when the transverse diameter and the focus are given, or any other data by which they may be found, as in the precedent rules.

Thus: — Draw any straight line at pleasure, in it set off the length of the given transverse TS (*fig.* 8.) and from its extreme points or limits, viz. T, S, set off $Tf = SF$, the distance of the given focus, viz. the point f, without, and F within the section as before; that done, upon the point f, as a center, with any assumed radius greater than TS, describe an arch of a circle; then from that radius take the transverse TS, making their difference a second radius, with which upon the point F, within the section, describe another arch to cut or cross the first arch as at B. Then will that point B be in the curve of the hyperbola, by the last proposition. And therefore it is plain, that, proceeding on in this manner, you may find as many points as may be thought convenient, which being all joined together with an even hand will form the hyperbola required.

There are several other ways of delineating an hyperbola in plano; one way is by finding a competent number of ordinates, but none more easy and expeditious than this mechanical way: We shall therefore, for brevity's sake, pass over the rest, and leave them to the learner's practice, as being easily deduced from what has been already said.

From the comparisons which have been all along made between the hyperbola and the ellipsis, it will be easy to perceive the coherence that is between those two figures. But for the better understanding of what is meant by the center and asymptote of an hyperbola, consider *fig.* 9. where it is evident that the opposite hyperbola's will always be alike, because they will always have the same transverse diameter common to both, &c. Also that the middle point, or common center of the ellipsis, is the common center to all the four conjugal hyperbola's.

And the two diagonals of the right-angled parallelogram which circumscribes the ellipsis (or is inscribed to the four hyperbola's) being continued, will be such asymptotes to those hyperbola's.

HYPERBOLÆON, in ancient music, the upper or last tetrachord or fourth.

HYPERBOLE, in rhetoric, a figure, whereby the truth and reality of things are excessively either enlarged, or diminished. See the article EXAGGERATION.

The word is Greek, ὑπερβολη, *superlatio*; formed of the verb ὑπερβαλλειν, *exsuperare*, to exceed, surpass by far.

The character of an hyperbole is to exaggerate or extenuate the idea of the things spoken of beyond the bounds of truth, or even probability. As, he ran swifter than the wind: he went slower than a tortoise, &c. Hyperboles, says Seneca, lie without deceiving; they lead the mind to truth by fictions; they convey the sentiment intended, though by expressing it in terms which render it incredible. The hyperbole promises too much, in order to make you conceive enough.

Aristotle observes, that hyperboles are the favourite figures of young authors, who love excess and exaggeration; but that philosophers should not use them without a great deal of reserve. The pitch to which an hyperbole may be carried, is a point of great delicacy. To carry it too far, is to destroy it: it is of the nature of a bowstring, which by immoderate tension, slackens; and frequently has an effect quite contrary to that intended.

Those hyperboles are best, which are latent, and are not taken for hyperboles. For this reason they should scarce ever be used but in a passion, and in the middle of some important incident: such is the hyperbole of Herodotus, speaking of the Lacedæmonians, who fought at Thermopylæ: "They defended themselves for some time with the arms that were left them, and at last with their hands and teeth; till the Barbarians, continually shooting, buried them as it were, with their arrows."

Now what likelihood is there, that naked men should defend themselves with their hands and teeth against armed men; and that so many persons should be buried under their enemies arrows? Yet does there appear some probability in the thing, by reason it is not sought for the sake of the figure, but the hyperbole seems to arise out of the subject itself. Of the like kind is that passage in a comic poet mentioned by Longinus; "He had lands in the country no longer than a Lacedæmonian epistle."

HYPERBOLICAL *Cylindroid*, in geometry, a solid figure, whose generation is given by Sir Christopher Wren, in the Philosophical Transactions, N°. 48.

There are two opposite hyperbolas joined by the transverse axis; and through the center there is a right line drawn at right angles to that axis; then the hyperbolas are supposed to revolve, by which revolution a body will be generated, which he calls an hyperbolical cylindroid; and whose basis, and all sections parallel to them, will be circles. And in N°. 53, of the Transactions, he applies it to the grinding of hyperbolical glasses; and he says they must be either formed this way, or not at all.

HYPERBOLIC *Space* is the convex area or space contained between the curve of the hyperbola and the external ordinate. If $CL = b$ (plate LXXV. *fig.* 10.) $LQ = x$, $CF = a$, and $QP = y$; then by the nature of the hyperbola $aa = by + xy$ and $y = \frac{aa}{b+x}$, whence $y\dot{x} = \frac{aa\dot{x}}{b+x}$; wherein, if $a = b$, we shall have $\frac{a\dot{x}}{a+x}$ for the fluxion of the indefinite area LQPF, whose fluent $x - \frac{x^2}{2a^2} + \frac{x^3}{3a^3} - \frac{x^4}{4a^4}$ &c. will when $a = 1$ become $x - \frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4 + \frac{1}{5}x^5$, &c. for the area required.

Any hyperbolical space GEHG (*fig.* 11.) is to any other hyperbolic figure of the same height $gEbg$ (whose latus rectum and transverse diameter, as in the circle, are equal; and also both equal to DE the transverse diameter of the former space) as the conjugate axis AB is to the transverse axis DE. The area of any asymptotical hyperbolic space DEVB (*fig.* 12.) may be found by means of the logarithms. Take the differences of the logarithms of the numbers expressing the ratio of DE to BV, and find the logarithm of that difference, to which add the constant logarithm 0,3622156887; and the sum will be the logarithm of a number expressing the space EDVB, in such parts as the oblong CD is 10000000000.

HYPERBOLIC *Conoid* is a solid generated by the entire rotation of the hyperbolic space FAG (*fig.* 13.) about the part AF of the transverse axis.

If AC be the semi-transverse axis, it will be as $2AC + AF$ is to $3AC + AF$, so is the cone whose base is the circle

circle described by FG, and altitude AF, to the conoid described as before. To prove this, let AC=a, AF=x, FG=y, the latus rectum=b, and ,7854=p; then $y^2 = bx + \frac{bxx}{2a}$; therefore $\frac{4pbx^2}{2} + \frac{2pbx^3}{3a}$ will express the solidity of the conoid, and $\frac{4pbx^2}{3} + \frac{2pbx^3}{3a}$ that of a cone, whose base is the circle described by FG and altitude AF; but these are manifestly in the proportion of $3a+x$ to $2a+x$, or of 3AC+AF to 2AC+AF.

HYPERBOLICUM ACUTUM is a solid made by the revolution of the infinite area of the space contained between the curve and the asymptote, in the Appollonian hyperbola, turning round that asymptote. This produces a solid or body infinitely long; and yet, as Torricellius plainly demonstrates (who gave it this name), it is equal to a finite magnitude.

HYPERBOLIC *Spindle*. See *Hyperbolic* SPINDLE.

HYPERBOLIFORM FIGURES, are such curves as approach, in their properties, to the nature of the hyperbola, called also hyperboloides.

HYPERCATALECTIC, in the Greek and Latin poetry, is applied to a verse, which has one or two syllables too much, or beyond the regular and just measure: as,

Musæ sorores sunt Minervæ. Also,
Musæ sorores Palladis lugent.

The Greek and Latin verses are distinguished, with respect to their measure, into four kinds, acatalectic, catalectic, brachycatalectic, and hypercatalectic. See ACATALECTIC, &c.

The hypercatalectic is also called the hyperpreter.

HYPERDULIA, in the church of Rome, a species of worship paid to the Holy Virgin; being greater than the dulia, or worship paid to the saints, but less than the latria or supreme worship paid to the Deity. See ADORATION and WORSHIP.

HYPERICUM, St. John's-wort, in botany, a plant with slender round stalks, which have two fine ridges, or sharp edgings, opposite, alternately, from joint to joint; small oblong obtuse leaves, set in pairs without pedicles; and numerous gold-coloured pentapetalous flowers on the tops of the branches, followed by little rough blackish husks, each of which is divided into three cells full of minute seeds. It is perennial, grows wild in woods and uncultivated places, and flowers in June.

This plant has been recommended as a medicine of peculiar efficacy in hysterical, hypochondriacal, and melancholic disorders, and alienations of mind; from its supposed virtue in which cases, it received the name of *fuga dæmonum*. It promises to be of some use as a mild detergent and corroborant, discovering to the senses a resinous, bitterish, balsamic impregnation. The leaves, viewed against the light, exhibit numerous transparent points, which are found to be little vesicles full of essential oil: in distillation with water, the oil separates and rises to the surface, approaching in some degree to that of turpentine. About the edges of the flower are observed black points, and on the seed-vessels small tubercles, which appear to be similar oily vesicles: the tops, when the seeds are formed, have the strongest terebinthinate smell, and yield in distillation the greatest quantity of oil. The flowery tops give a deep yellowish red tincture to rectified spirit, and a paler red to expressed oils: a tincture of the flowers in oil of olive, made by macerating four ounces of the full blown flowers, fresh gathered and freed from the cups, in a quart of oil, till the oil is sufficiently coloured, is kept for external purposes in the shops.

HYPERMETER, in the ancient poetry, the same with hypercatalectic. See the article HYPERCATALECTIC.

HYPERSARCOSIS, in medicine and surgery, an excess of flesh, or rather a fleshy excrescence, such as those generally arising upon the lips of wounds, &c. See WOUND and EXCRESCENCE.

HYPERTHYRON, in the ancient architecture, a sort of table used after the manner of a frieze, over the jaumbs of Doric doors and gates, and the lentils of windows. It lies immediately under the corona, and our workmen usually call it the king-piece.

HYPHEN, an accent, or character, in grammar, implying that two words are to be joined, or connected into one compound word, and marked thus -, as preestablished, five-leaved, &c.

Hyphens also serve to connect the syllables of such words as are divided by the end of the line.

HYPNOTIC, in the materia medica, such medicines as any way produce sleep, whether called narcotics, hypnotics, opiates, or soporifics.

Authors are of various opinions in regard ro the manner wherein hypnotics operate. See the article NARCOTICS.

HYPOCAUSTUM, among the Greeks and Romans, a subterraneous place, wherein was a furnace, to heat the baths. See BATHS.

Another kind of hypocaustum was a kind of kiln, to heat their winter parlours.

Among the moderns, it is that place where the fire is kept, that warms a stove or hot-house.

HYPOCHONDRIA, in anatomy, that part of the body on both sides, which lies under the spurious ribs, and is extended to the ilia; comprehending not only the muscles, but the internal viscera.

HYPOCHONDRIAC *Affection, Passion, or Disease, Morbus Hypochondriacus*, vulgarly called the spleen, vapours, &c. in medicine, a disorder that principally exerts its tyranny under the ensiform cartilage and spurious ribs, in the region of the hypochondria.

The hypochondriacal disease chiefly affects the abdominal viscera, viz. the stomach and intestines, the liver, spleen, pancreas, and mesentery, according to the peculiar nature of each of them. The stomach is disordered with frequent ructus's and flatulencies, the signs of crudities. The liver is swelled with thick viscid bile, obstructing its ducts. When the spleen is affected, the function of which seems to be, to convey a very fluid blood through its arteries, partly into its own cells, partly into the splenic vein, for the uses of the liver, this blood grows so thick as almost to stagnate in that vein, whereby this soft organ is tumefied and distended. If the pancreas be affected, the glands which secrete the pancreatic juice, grow scirrhous in some degree, and perform their office too sparingly: hence the bile, which mixes with it in the intestines, is not sufficiently diluted; and the chyle being too thick, passes with difficulty through the lacteals, and in some measure stagnates in its passage. When the omentum is disordered in this disease, the thin subtile oil, which is collected in its cellules, in order to be conveyed to the liver, and there to be mixed with the blood brought thither from the spleen, passes in lesser quantities than usual, whereby the blood in the vena portarum is not rendered thin and fluid enough. In fine, the consequence of the mesentery being affected is, that through the obstruction of its glands, and subsequent deficiency of the lymph, which they ought to secrete for the dilution of the chyle; this liquor becomes too thick, and less proper for nutrition. Hence, it manifestly appears, that in this disease the blood and humours grow thick and sluggish, and are rendered unfit for their respective motions, and the uses of life.

This disease, so various in appearance, is chiefly owing to two causes, rest of body, and agitation of mind: by the former the humors are rendered too sluggish in their motions; and by the latter, the blood at one time almost stagnates, and at another is driven on with excessive vehemence: and health must suffer in both cases.

This theory plainly points out the cure, which consists in purging off and correcting the humors. Yet the disease does not require strong cathartics; it is much safer to trust to the milder sort, such especially as attenuate the humors, and work by stool and urine at the same time. Of this kind are the deobstruent pills, aloetics blended with saponaceous medicines, rhubarb, Glauber's salt, and the like.

The lentor and thickness of the humors are most conveniently removed by chalybeates, bitters, and aromatics, especially in tinctures. And natural chalybeate waters are the most efficacious of all steel medicines.

In fine, all ſorts of bodily exerciſe are neceſſary; and in particular it will be of great ſervice to play at bowls or tennis, or toſs the arms briſkly to and fro with bad weights graſped in the hands; but nothing is better than riding daily on horſeback. *Mead's Monita & Præcepta.*

HYPOCISTIS, in pharmacy, an inſpiſſated juice, much reſembling the true Egyptian acacia. We meet with it in moderately large, flat maſſes. It is conſiderably hard and heavy, of a fine ſhining black colour like that of liquorice juice, when freſh broken, and of a duſkier black on the ſurface. It is brought to us from the Levant, and from ſome parts of Europe. The French make a good deal of it from the plants of their own growth, and ſometimes ſupply other places with it.

The plant from which it is produced is one of the dodecandria monogynia of Linnæus, and one of the tetrapetalæ vaſculiferæ of Ray. It grows up from the roots of ſeveral ſpecies of the ciſtus, in the manner of the orobancha or broom rape with us, and is deſcribed by all the botanical writers under the name of hypociſtis. It grows to four or five inches in height. Its ſtem is thick and fleſhy, not eaſily broken, and ſometimes of a whitiſh, ſometimes of a purpliſh, and ſometimes of a yellowiſh colour. The ſtalk is of an extremely auſtere and aſtringent taſte, with ſome degree of bitterneſs; towards the top it carries a great number of flowers interſperſed with leaves of the ſame ſquanomous kind with thoſe upon the ſtalks. The plant is eaſily ſeparated from the roots of the ciſtus to which it grows, and leaves, in the place whence it was ſeparated, a little ſmooth cavity in the ſurface without any veſtige of fibres.

This plant is very common in the iſland of Crete, and a conſiderable quantity of the inſpiſſated juice is prepared there in the ſame manner. They gather the fruits, while unripe, and expreſs the juice, which they evaporate over a very gentle fire to the conſiſtence of an extract, and then form into cakes, and expoſe to the ſun to dry.

Hypociſt is an aſtringent, and that of conſiderable power; it is good againſt diarrhœas and hæmorrhages of all kinds, and may be uſed in repellent gargariſms in the manner of the acacia; but is very rarely met with genuine in our ſhops; the German acacia being uſually ſold under its name.

HYPOGASTRIC, an appellation given to the internal branch of the iliac artery. See the articles ARTERY and ILIAC.

HYPOGASTRIC VEINS ariſe on each ſide from the iliacs, and ſend out branches to the rectum. See the article VEIN.

HYPOGASTRIUM, in anatomy, the lower part of the abdomen. See ABDOMEN.

HYPOMOCHLION, in mechanics, the ſame with fulcrum. See FULCRUM.

HYPOPYON, in medicine, a collection of purulent matter, immediately under the cornea, near the aqueous humour.

The word is Greek, and compounded of ὑπο, under, and πυον, purulent matter.

This diſorder proceeds from an extravaſation of blood, inflammation, external injuries of the eye, &c.

The principal methods of cure are three: the firſt and mildeſt is the uſe of reſolvent medicines, externally applied; to theſe may be added bleeding and purging: but when the pains and other ſymptoms increaſe, an operation is abſolutely neceſſary.

Heiſter, before he treats of the operation, deſcribes a method uſed by one Juſtus, a celebrated oculiſt in Galen's time; which was, after placing the patient conveniently before him, to lay hold of his head with both hands and ſhake it very aſſiduouſly about, till the matter diſappeared, being thereby undoubtedly thrown down behind the uvea. This, Heiſter's own experience confirmed him in: only he would have the patient's head or whole body diſpoſed in a ſupine poſture, and the eye preſſed gently with the fingers to looſen the matter.

But if this proves unſucceſsful, the patient being ſeated as in the couching for a cataract, an inciſion is made with a lancet, through the cornea, below the pupil, and about the ſpace of a line from the white of the eye, and that large enough to diſcharge the matter and aqueous humour; preſſing the eye gently by the fingers, and taking care leſt you wound the uvea: then a compreſs, moiſtened with a proper collyrium, is to be applied every third or fourth hour to the eye. If the matter be too thick to be diſcharged, the needle, which is alſo employed for making ſetons, is to be uſed. The inſtruments ſhould be wrapped up, ſo that only the point be bare. In this caſe, St. Yves adviſes to introduce a ſmall probe, or inject ſome cold water with a ſyringe, and continue this till the whole pus be diſſipated, after which the wound may be healed.

HYPORCHEMA, in the Greek poetry, a poem, conſiſting of divers kinds of verſe, and of different lengths; but always full of ſhort, or pyrrhichic feet.

HYPOSTASIS, among divines, ſignifies a perſon, or ſubſtance; chiefly uſed in ſpeaking of the perſons of the Trinity. See the article TRINITY.

HYPOSTASIS, in medicine, denotes the ſediment of urine.

HYPOTHECA, in the civil law, the ſame with mortgage in the common law. See the article MORTGAGE.

HYPOTHENAR, in anatomy, the abductor muſcle of the little finger. See the article ABDUCTOR.

HYPOTHENUSE, or HYPOTENUSE, in geometry, the longeſt ſide of a right-angled triangle, which ſubtends the right angle. Thus in the right-angled triangle ABC (plate LXXIV. *fig.* 14.) AC is the hypothenuſe.

The word is Greek, and derived from ὑπο, under, and τεινω, to extend.

The 47th prop. of Euclid's firſt book demonſtrates that, in every rectilinear right-angled triangle, the ſquare of the hypothenuſe is equal to the ſquares of both the other ſides. It is particularly called the Pythagorean problem, from its invention by Pythagoras, who is ſaid to have ſacrificed a whole hecatomb to the muſes, in gratitude for their aſſiſting him in the diſcovery.

HYPOTHESIS, in logic, a propoſition, or principle, which is taken for granted, in order to draw concluſions therefrom, for the proof of ſome point in queſtion.

The word is Greek, and compounded of ὑπο, under, and θεσις, a theſis, or poſition, which is derived from τιθημι, to place or put.

HYPOTHESIS, in phyſics, &c. an imaginary ſyſtem laid down to account for ſome phænomenon of nature.

Whatever is not derived from phænomena, ſays Sir Iſaac Newton, is an hypotheſis; and no hypotheſes of any kind are to be admitted in experimental philoſophy.

HYPOTHESIS, in aſtronomy, is more particularly applied to the ſeveral ſyſtems of the heavens, as different aſtronomers have ſuppoſed the arrangement and motion of the heavenly bodies. The principal of theſe are the Ptolemaic, Copernican, and Tychonic ſyſtems.

HYPOTRACHELION, in architecture, denotes a little frieze in the Tuſcan and Doric capitals, between the aſtragal and annulets, called likewiſe colerin, gorgerin, &c. By ſome it is applied to the neck of any column, or that part of the capital below the aſtragal.

HYPOTYPOSIS, in rhetoric, ſignifies a lively deſcription.

HYPOZOMA, in anatomy, a membrane that ſeparates two cavities: ſuch is the diaphragm.

HYPSILOIDES, in anatomy, the ſame with the os hyoides. See the article HYOIDES.

HYSSOP, in botany, a low ſhrubby medicinal plant, with brittle branchy ſtalks, ſquare when young, and round when they grow woody; oblong narrow green leaves ſet in pairs; and looſe ſpikes of labiated blue flowers, whoſe upper lip is cloven and turned upwards, ſtanding in rows, towards the tops of the ſtalks, all on one ſide. It is perennial, cultivated in our gardens, and flowers in July and Auguſt.

The whole plant has an acrid taſte, and a very ſtrong ſmell: it is attenuant and diſcutient. It is greatly recommended in diſorders of the lungs, when they are loaded with a foul and thick matter. It alſo ſtrengthens the ſtomach, and aſſiſts digeſtion; it promotes expectoration by its acrimony, and by its power of attenuating the viſcous matter in the lungs, and is therefore good in

moiſt aſthmas: its good effects in the ſtomach are of the ſame kind, depending on its attenuating and abſterging the viſcous phlegm lodged there, and impeding in it the diſcharge of its proper functions. It is alſo good in diſeaſes of the head; it is beſt taken in infuſion in the manner of tea, not made ſo ſtrong as to be diſagreeable to the palate, and often repeated. The diſtilled water, by ſome made choice of as a baſis for pectoral mixtures and julaps, does not appear ſuperior or equal to the infuſion.

Externally, hyſſop is greatly recommended in bruiſes; the blackneſs ſettling under the eyes from blows is carried off very readily by a cataplaſm of the leaves, or only a little bundle of them ſewed up in a linen rag, and applied to the part: and Ray gives us an account from Mr. Boyle, of a violent contuſion of the thigh, from the kick of a horſe, very happily cured by this herb, boiled as a cataplaſm; he tells us, the violent pain was almoſt inſtantly removed, and the very mark and blackneſs taken off in a few hours.

HYSTERICAL *Diſeaſe*, HYSTERIC *Affection*, or *Paſſion*, in medicine, a diſeaſe in women, likewiſe called a ſuffocation of the uterus, or fits of the mother.

There is no diſeaſe ſo vexatious to women as that called hyſterical; and although it may not be attended with great danger, yet it is frequently very terrifying: and it alſo ſometimes deprives them of their ſenſes as effectually, as if they had been ſeized with an epileptic fit.

When a woman has fallen into an hyſterical fit, bloodletting will be of uſe, if ſhe has ſtrength to bear it; if not, cupping-glaſſes are to be applied to her groins or hips: but if ſhe continues long in it, put the ſnuff of a candle, or ſome other thing of a fœtid ſmell, to her noſtrils, in order to rouſe her. In the mean time her thighs and legs ought to be rubbed.

When ſhe is recovered from the fit, proper means muſt be uſed to prevent a relapſe. If ſhe be liable to obſtructions, and not regular, the menſtrual diſcharges are to be promoted. The ſtrong ſmelling gums and ſteel medicines are very ſerviceable, and it is very beneficial to uſe exerciſe. But the diſturbances of the mind generally require proper remedies. *Mead.*

HYSTERIC COLIC, a common ſymptom of the hyſteric paſſion, attended with a moſt violent pain about the pit of the ſtomach; as alſo with a vomiting of a greeniſh humour, and great ſinking of the ſpirits. After a day or two the pain goes off, but upon the ſlighteſt motion or perturbation of the mind it ſoon returns again.

Neither bleeding nor cathartics have any place in the cure. According to Sydenham, it will be proper firſt to adviſe the patient to drink upwards of a gallon of poſſet-drink, to clear the ſtomach of its impurities, by throwing it up again, that the paregoric may not be hindered; afterwards give twenty-five drops of the Thebaic tincture, in an ounce of the ſpirit of cinnamon-water. The laſt is to be repeated, at due intervals, till the ſymptoms diſappear; that is, the effect of one doſe muſt be known before another is given; yet ſometimes in plethoric bodies, if the ſtrength will permit, it is better to prepare the way by bleeding and purging, or both, for an anodyne.

But if the hyſteric colic comes on by fits, the following may be uſed in the intervals, or when the fit is off: take large doſes of the balſam of Peru, that is, twenty, thirty, or forty drops, in a ſpoonful of the fineſt and whiteſt ſugar: this may be taken twice or thrice in a day.

HYSTERON PROTERON, in grammar and rhetoric, a ſpecies of the hyperbaton, wherein the proper order of conſtruction is ſo inverted, as that the part of any ſentence which ſhould naturally come firſt is placed laſt, as in this of Terence, *Valet & vivit*, for *Vivit & valet*.

HYSTEROTOMIA, υστεροτομια, in anatomy, an anatomical diſſection of the uterus or womb. See the article UTERUS.

HYSTEROTOMOTOCY, υστεροτομοτοκια, among chirurgical writers, the ſame with the Cæſarian ſection. See CÆSARIAN *Section*.

J A C

I Is the third vowel and ninth letter of the Engliſh alphabet: it is alſo a conſonant, and accordingly has two forms. When a conſonant, it is lengthened downwards, thus J, and pronounced not much unlike the ſoft G before *e*, as in geſture.

The letter I was derived from the old Hebrew *Jod*, and is ſounded by throwing the breath ſuddenly againſt the palate with a ſmall hollowing of the tongue, and the ſame opening of the lips and teeth nearly as in pronouncing A and E.

The Greeks had no J conſonant, and therefore made uſe of the I vowel inſtead of it, as ΙΗΣΟΥΣ. The Engliſh and French have two kinds of J conſonant; the firſt has a ſnuffling kind of ſound, and ſerves to modify that of the following vowels, as in *Jew*, *jolly*, &c. The latter is pronounced like the Hebrew *Jod*, which is ſounded as the conſonant *y*, as we find it ſtill among the Germans, &c. Of this we have ſome inſtances in words which are indifferently written with a *y* or *i* before a vowel; as *voiage*, *voyage*, &c.

The pronunciation of the I vowel is obſerved to be much the ſame in all nations in Europe in the Latin word *inimici*. To denote the quantity of this vowel, though it was not marked to ſhew that it was long, yet it was made bigger than the reſt, as *ÆdIIis*, *PIſo*, &c. This *i* long was pronounced like *ei*, as *divei* for *divi*, &c. Lipſius ſays that *i* was double, when it was to be ſounded long, as *dii*, *diis*, &c.

The ancients ſometimes changed *i* into *u*, as *decumus* for *decimus*, *maxumus* for *maximus*, &c. According to Plato, the vowel *i* is proper to expreſs delicate but humble things, as in this verſe in Virgil, which abounds in *i*'s, and is generally admired.

Accipiunt inimicum imbrem, rimiſque fatiſcunt.

J, in abbreviations and cyphers, ſtands for Jeſus.

I was uſed by the ancients as a numeral, denoting 100, according to this verſe.

I. c. *Compar erit, et centum ſignificabit.*

The Greek *Iota*, and the Hebrew *Jod*, ſtand but for ten.

JACENT, a term applied by Helmont to nature, when a diſeaſe is riſen to a head, and the morbific matter ſtrives to ſuppreſs the vital flame.

JACK, in mechanics, a portable machine for raiſing great weights.

In order to explain the operation of this machine, we have given perſpective views of its ſeveral parts on plate LXXIV. *fig.* 15, 16, 17, 18, where *fig.* 15. is the whole machine; *fig.* 16, ſhews the rack, and the pinion which carries it; *fig.* 17, diſplays the whole machinery; and *fig.* 18, the rack, ſeparately. The ſame letters refer to the ſame parts in all the four figures.

A, is a ſtrong caſe of wood, firmly bound with iron.

B, the open part of the caſe in which the rack moves.

C, the bottom claw of the jack, intended for raiſing weights very near the ground.

D, the rack, ſeparated from the other parts of the machinery.

J A C

E, the upper claw, or fork, of the jack.

F, a pinion of four leaves, that moves the rack D.

G, the winch or crank of the handle.

H, a hook to prevent the weight, when raiſed to a ſufficient height, from falling down again, by putting the curved part of the hook round the handle.

I, a large wheel, with ſixteen teeth.

K, a pinion of four leaves, that moves the large wheel I.

The power of this machine is very eaſily calculated in the following manner:

Suppoſe the winch or crank G, to be four times as long as the radius of the pinion K, then will the power of the machine in this part be as 4 to 1. But the pinion K has only four leaves, and the wheel I ſixteen teeth; therefore the power of the machine in this part is alſo as 4 to 1. Conſequently $4\times4=16$, is the power of both theſe parts conjointly. And as the wheel I has ſixteen teeth, and the pinion T, that moves the rack, only four leaves, the power of the machine in this part is alſo as 4 to 1. Conſequently the whole power of the machine is as 64 to 1: for $4\times4\times4=64$. If therefore we ſuppoſe a man can work at the handle with a force of thirty pounds, he will be able to raiſe a weight of one thouſand nine hundred and twenty pounds, ſuppoſing the machine to have no friction.

Kitchen JACK, a compound engine, where the weight is the power applied to overcome the friction of the parts, and the weight with which the ſpit is charged; and a ſteady and uniform motion is obtained by means of the fly. See the article FLY.

Smoak JACK. See SMOAK-JACK.

JACK-DAW, in ornithology, a ſpecies of corvus, with a black and grey head, a browniſh black body, and the wings and tail black.

It is one of the ſmalleſt of the crow-kind, but an erect and well-ſhaped bird.

JACKALL, in zoology, an animal of the dog-kind, with a ſlender ſnout.

It is a very beautiful creature, and ſo like a dog, as to be miſtaken at firſt ſight for ſome mungrel breed of that animal.

Its ſize is that of a ſmall hound; and, in the Eaſt, where it is a native, there are vaſt packs of them, often more than two hundred in a company, which hunt animals they would never dare to attack ſingle. It is not impoſſible that lions and other beaſts of prey may be alarmed by the cries of theſe animals in their chace, and fall in and rob them of their prey; but the general opinion of their attendance on the lion, is fabulous.

JACOBINE, or JACK, in ornithology, a very ſmall ſort of pigeon, with a range of feathers inverted quite over the hinder part of the head; bearing ſome reſemblance to a friar's hood, whence the name.

JACOBINE MONKS, the ſame with the Dominicans. See DOMINICANS.

JACOBITES, a term of reproach beſtowed on the perſons, who, vindicating the doctrines of paſſive obedience and non-reſiſtance with reſpect to the arbitrary pro-

proceedings of princes, diſallow of the late Revolution, and aſſert the ſuppoſed rights, and adhere to the intereſts of the late abdicated king James and his family.

JACOBITES, in church-hiſtory, a ſect of chriſtians in Syria and Meſopotamia; ſo called either from Jacob, a Syrian, who lived in the reign of the emperor Mauricius; or from one Jacob, a monk, who flouriſhed in the year 550.

JACOB's-STAFF, a mathematical inſtrument, otherwiſe called fore-ſtaff. See FORE-STAFF.

JADE-STONE, the name given to a hard greyiſh-green ſpecies of jaſper, of which the Turks generally make the handles of the ſabres of great people. See the article JASPER.

JALAP, in botany, a plant with thick, fleſhy raddiſh-like roots; jointed ſtalks and branches; acuminated ſomewhat oval leaves ſet in pairs; and elegant, numerous, monopetalous, funnel ſhaped flowers, purple, yellow, white, or diverſly variegated, ſtanding in double cups, of which the innermoſt incloſes the flower and the outer ſurrounds its baſis: each flower is followed by a wrinkled, roundiſh, pentagonal, umbilicated fruit, about the ſize of a peppercorn, including a white kernel. It is perennial, a native of the Eaſt-Indies, and cultivated in our gardens. Whether the roots produced here are equivalent in virtue to thoſe which are brought from abroad, has not, Dr. Lewis obſerves, been yet experienced.

The officinal jalap roots come from the province of Xalapa in New Spain; in thin tranſverſe ſlices, ſolid, hard, weighty, of a dark greyiſh colour on the outſide or cortical part, internally of a dark greyiſh, with ſeveral black circular ſtriæ: the hardeſt, darkeſt coloured, and thoſe which have the moſt of theſe reſinous veins, are the beſt.

This root has ſcarcely any ſmell, and very little taſte upon the tongue: ſwallowed, it affects the throat with a ſlight kind of pungency and heat. Taken in doſes of a ſcruple or half a dram, it proves an effectual, and in general a ſafe purgative; very rarely occaſioning any ſevere gripes or nauſea, which too frequently accompany the other ſtrong cathartics. Some have prohibited the uſe of this cathartic to children; apparently on no very good foundation. Young children, from the laxity of their ſolids, and the ſoft lubricating quality of their food, generally bear theſe kinds of medicines better than adults; and adults of a ſpongy, lax, or weak habit, better than the rigid or robuſt. Few, if any, of the ſtrong reſinous purgatives are in either caſe more innocent than jalap.

Theſe plants are always propagated by ſeeds, which ſhould be ſown upon a moderate hot-bed in March; and when they come up, they ſhould be tranſplanted into another hot-bed, at ſix inches diſtance from each other; and when they have taken root, the glaſſes muſt be raiſed every day, that the plants may have a great deal of air, otherwiſe they are very ſubject to be drawn up tall and weak; nor can they be recovered to a ſufficient ſtrength again in a month's time, if once they are thus drawn. When the plants are grown to be a foot high, they ſhould be put into pots filled with rich light earth, which ſhould be plunged into a very moderate hot-bed, to facilitate their taking root: and in removing them, you muſt be very careful to perſerve as much earth to their roots as you can; for their roots have but few fibres to retain it in a ball, as many other plants will do; and it ſometimes happens, when the root is left bare, it ſeldom takes freſh hold of the ground, at leaſt not in a conſiderable time; ſo that the plants will make but a poor figure that ſeaſon. When they are tranſplanted into the pots, and have taken root again, they ſhould be hardened to endure the open air, for they are not tender; but, on the contrary, they will not thrive well, if too much drawn or forced in the hot-bed. In the middle of May the pots may be removed into the places where they are deſigned to be continued for that ſeaſon; obſerving to ſupport the branches with a ſtrong ſtake, and to water them as often as they require it. You may alſo in May plant ſome of them into the middle of the large borders of the pleaſure-garden, doing it carefully; and obſerve to ſhade and water them until they have taken root; after which, they will require no farther care but to ſupport them from being broken down by the winds, which they are very ſubject to be, eſpecially when their heads are large.

The plants, thus raiſed, will grow to the height of three or four feet, and ſpread their branches very wide, eſpecially if the roots have room in the pots; and their flowers will begin to appear in June, and they will continue conſtantly flowering until the froſt prevents them; which, together with the great diverſity of colours in the flowers upon the ſame plant, renders them valuable to every curious perſon. The flowers of theſe plants never expand in the day time, while the ſun is hot; but in the evening, when the ſun declines, they begin to open, and continue expanded till the ſun ſhines warm upon them the next day; ſo that, when it happens to be cloudy weather, as alſo late in autumn, when the weather is cool, the flowers will remain open moſt part of the day.

As the flowers are produced ſucceſſively almoſt every day, ſo the ſeeds are in a ſhort time after ripe, and ſoon fall to the ground; ſo that, when your ſeeds begin to ripen, you muſt careſully look for them upon the ground twice a week: otherwiſe, if they lie too long upon the ground, and there ſhould fall ſome rain, they will ſprout, and be good for nothing. In ſowing theſe ſeeds, you ſhould be careful to take them from ſuch plants as produced the greateſt variety of flowers; for, if you ſave them from ſuch as produce only plain coloured flowers, the ſeeds will always produce the ſame ſort; and thoſe with yellow and red variegated flowers will conſtantly produce the ſame; theſe never varying from the red and yellow to the purple and white, though they will ſometimes degenerate into plain yellow or red flowers, as they will into plain purple or white: but they will conſtantly retain one or both of their original colours.

JAMAICA-PEPPER, *Pimienta*, or *Pimenta*, in the materia medica. See PIMIENTA.

JAMAICA-WOOD, a name ſometimes given to brazil. See the article BRAZIL.

JAMB, or JAUMB, among carpenters, an appellation given to door-poſts, as alſo to the upright poſts at the ſides of window-frames; and among bricklayers, it denotes the upright ſides of chimnies, from the hearth to the mantle-tree.

IAMBIC VERSES, are verſes in the Greek and Latin poetry, which are ſo called, as they wholly, or, for the moſt part, conſiſt of an iambus or iambic foot. Iambics may be conſidered either as to the diverſity, or number of their feet.

1. Pure iambics; namely, ſuch as conſiſt of nothing but iambus's, as that of Catullus, in praiſe of a yacht:

Phaſelus ille, quem videtis, hoſpites.

And Horace, in his Epod. joins theſe to hexameters:

Altera jam teritur bellis civilibus ætas,
Suis et ipſa Roma viribus ruit.

2. Thoſe ſimple iambics, which have the iambus in the even places; to wit, the ſecond, fourth, and ſixth feet; though we ſometimes find tribrachys's added to them, only that the laſt foot ſhould always be an iambus: and in the uneven places, that is, the firſt, third, and fifth, a ſpondee, anapeſte, and even a dactyle in the firſt foot, as that of Medea in Ovid:

Servare potui, perdere an poſſim rogas?

3. The free iambics, in which the laſt foot alone is an iambus, as that of Phædrus:

Amittit merito proprium, qui alienum appetit.

In comedy, the authors are leſs confined, as we may ſee in Terence, Plautus, &c. only the ſixth foot is indiſpenſably to be an iambus.

As to the diverſity ariſing from the number of ſyllables:

1. Thoſe iambics that conſiſt of four feet are called dimeters, as

Quærunturin ſylvis aves.

2. Iambics of ſix feet are called trimeters: theſe verſes are chiefly uſed for the theatre, particularly in tragedy

and are more natural to the ſtage than thoſe of ten or twelve feet, uſed in the modern drama, in regard they approach near to proſe, and favour leſs of affection and poetry:

Dii conjugales, tuque genialis tori.
Lucina, cuſtos, &c.

3. Iambics with eight feet are called tetfameters, and are only uſed in comedy, as that of Terence,

Pecuniam in loco negligere maximum interdum eſt lucrum.

Some add to theſe an iambic monometer, conſiſting of two feet, as,

Virtus beat.

They are denominated monometer, dimeter, trimeter, and tetrameter, as being of one, two, three, and four meaſures; each meaſure conſiſting of two feet; for the Greeks meaſured their verſes two feet by two feet, by bipodys or epitrites; namely, by joining the iambus and ſpondee together.

Thoſe iambics already mentioned are perfect, having their proper number of feet, without any redundant or deficient. The imperfect iambics are,

1. The catalectic, which want a ſyllable, as,

Muſæ Jovem canebant.

2. The brachycatalectic, ſuch as have either a foot or a ſyllable too much, as,

Muſæ ſorores ſunt Minervæ.
Muſæ ſorores Palladis lugent.

Many of the church hymns and anthems are dimeter iambics; that is, conſiſting of four feet.

IAMBUS, in ancient poetry, a ſimple foot conſiſting of a ſhort and a long ſyllable, as *pios*. See FOOT.

JAMES, or *Knights of St.* JAMES, a military order in Spain, firſt inſtituted about the year 1170, by Ferdinand II. king of Leon and Galicia. The greateſt dignity belonging to this order is grand maſter, which has been united to the crown of Spain. The knights are obliged to make proof of their deſcent from families that have been noble for four generations, on both ſides: they muſt alſo make it appear that their ſaid anceſtors have neither been Jews, Saracens, nor heretics; nor have ever been called into queſtion by the inquiſition. The novices are obliged to ſerve ſix months in the galleys, and to live a month in a monaſtery; they obſerve the rule of St. Auſtin, making no vows but of poverty, obedience, and conjugal fidelity.

St. JAMES'S-DAY, a feſtival of the Chriſtian church obſerved on the 25th of July, in memory of St. James the greater, ſon of Zebedee.

Epiſtle of St. JAMES, a canonical book of the New Teſtament, being the firſt of the catholic or general epiſtles; which are ſo called, as not being written to one but to ſeveral Chriſtian churches.

This general Epiſtle is addreſſed partly to the believing and partly to the infidel Jews; and is deſigned to correct the errors, ſoften the ungoverned zeal, and reform the indecent behaviour of the latter; and to comfort the former under the great hardſhips they then did, or ſhortly were to ſuffer, for the ſake of Chriſtianity.

JANIZARIES, an order of the Turkiſh infantry, reputed the grand ſignior's guards, and the main ſtrength of the Ottoman army.

JANSENISTS, in church-hiſtory, a ſect of the Roman-catholics in France, who follow the opinions of Janſenius, biſhop of Ypres, and doctor of divinity of the univerſities of Louvain and Douay, in relation to grace and predeſtination.

In the year 1640, the two univerſities juſt mentioned, and particularly father Molina and father Leonard Celſus, thought fit to condemn the opinions of the Jeſuits on grace and free-will. This having ſet the controverſy on foot, Janſenius oppoſed to the doctrine of the Jeſuits the ſentiments of St. Auguſtine, and wrote a treatiſe on grace, which he entitled Auguſtinus. This treatiſe was attacked by the Jeſuits, who accuſed Janſenius of maintaining dangerous and heretical opinions; and afterwards, in 1642, obtained of pope Urban VIII. a formal condemnation of the treatiſe wrote by Janſenius: when the partiſans of Janſenius gave out that this bull was ſpurious, and compoſed by a perſon entirely devoted to the jeſuits. After the death of Urban VIII. the affair of Janſeniſm began to be more warmly controverted, and gave birth to an infinite number of polemical writings concerning grace; and what occaſioned ſome mirth, was the titles which each party gave to their writings: one writer publiſhed, The Torch of St. Auguſtin, another found Snuffers for St. Auguſtin's Torch, and father Veron formed a Gag for the Janſeniſts, &c. In the year 1650, ſixty-eight biſhops of France ſubſcribed a letter to pope Innocent X. to obtain an enquiry into, and condemnation of the five following propoſitions, extracted from Janſenius's Auguſtinus: I. Some of God's commandments are impoſſible to be obſerved by the righteous, even though they endeavour, with all their power, to accompliſh them. II. In the ſtate of corrupted nature, we are incapable of reſiſting inward grace. III. Merit and demerit in a ſtate of corrupted nature, does not depend on a liberty which excludes neceſſity, but on a liberty which excludes conſtraint. IV. The Semipelagians admitted the neceſſity of an inward preventing grace for the performance of each particular act, even for the beginning of faith, but they were heretics in maintaining that this grace was of ſuch a nature, that the will of man was able either to reſiſt or obey it. V. It is Semipelagianiſm to ſay that Jeſus Chriſt died, or ſhed his blood, for all mankind in general.

In the year 1652, the pope appointed a congregation for examining into the diſpute in relation to grace. In this congregation Janſenius was condemned, and the bull of condemnation, publiſhed in May 1653, filled all the pulpits in Paris with violent outeries and alarms againſt the hereſy of the Janſeniſts. In the year 1656, pope Alexander VII. iſſued out another bull, in which he condemned the five propoſitions of Janſenius. However, the Janſeniſts affirm, that theſe propoſitions are not to be found in his book; but that ſome of his enemies having cauſed them to be printed on a ſheet, inſerted them in the book, and thereby deceived the pope. At laſt Clement XI. put an end to the diſpute by his conſtitution of July 17, 1705; in which, after having recited the conſtitutions of his predeceſſors in relation to this affair, he declares, "That in order to pay a proper obedience to the papal conſtitutions concerning the preſent queſtion, it is neceſſary to receive them with a reſpectful ſilence." The clergy of Paris, the ſame year, approved and accepted this bull, and none dared to oppoſe it.

This is the famous bull *Unigenitus*, ſo called from its beginning with the words *unigenitus dei filius*, &c. which has occaſioned ſo much confuſion in France.

JANUARY, the firſt month in the year, according to the preſent computation. It was introduced by Numa into the calendar, and placed at the winter ſolſtice, where March was before, which Romulus had placed at the vernal equinox.

The word is derived from Janus, to whom the Romans on the firſt of this month offered ſolemn ſacrifices.

JAPAN EARTH, in the materia medica. See the article TERRA *Japonica*.

JAPANNING, the art of varniſhing and drawing figures on wood, in the ſame manner as is done by the natives of Japan in the Eaſt-Indies.

The ſubſtances which admit of being japanned are almoſt every kind that are dry and rigid, or not too flexible: as wood, metals, leather, and paper prepared.

Wood and metals do not require any other preparation, but to have their ſurface perfectly even and clean: but leather ſhould be ſecurely ſtrained either on frames, or on boards; as its bending or forming folds would otherwiſe crack and force off the coats of varniſh; and paper ſhould be treated in the ſame manner; and have a previous ſtrong coat of ſome kind of ſize; but it is rarely made the ſubject of japanning till it is converted into papier machè, or wrought by other means into ſuch form, that its original ſtate, particularly with reſpect to flexibility, is loſt.

One principal variation from the method formerly uſed in japanning is, the uſing or omitting any priming or undercoat on the work to be japanned. In the older practice, ſuch priming was always uſed; and is at preſent re-

ed in the French manner of japanning coaches and snuff-boxes of the papier machè: but in the Birmingham manufacture here, it has been always rejected. The advantage of uſing ſuch priming or undercoat is, that it makes a ſaving in the quantity of varniſh uſed; becauſe the matter of which the priming is compoſed fills up the inequalities of the body to be varniſhed; and makes it eaſy, by means of rubbing and water-poliſhing, to gain an even ſurface for the varniſh: and this was therefore ſuch a convenience in the caſe of wood, as the giving a hardneſs and firmneſs to the ground was alſo in the caſe of leather, that it became an eſtabliſhed method; and is therefore retained even in the inſtance of the papier machè, by the French, who applied the received method of japanning to that kind of work on its introduction. There is nevertheleſs this inconvenience always attending the uſe of an undercoat of ſize, that the japan coats of varniſh and colour will be conſtantly liable to be cracked and peeled off, by any violence, and will not endure near ſo long as the bodies japanned in the ſame manner, but without any ſuch priming; as may be eaſily obſerved in comparing the wear of the Paris and Birmingham ſnuff-boxes; which latter, when good of their kind, never peel or crack, or ſuffer any damage, unleſs by great violence, and ſuch a continued rubbing, as waſtes away the ſubſtance of the varniſh; while the japan coats of the Pariſian crack and fly off in flakes, whenever any knock or fall, particularly near the edges, expoſes them to be injured. But the Birmingham manufacturers, who originally practiſed the japanning only on metals, to which the reaſon above given for the uſe of priming did not extend, and who took up this art of themſelves as an invention, of courſe omitted at firſt the uſe of any ſuch undercoat; and not finding it more neceſſary in the inſtance of papier machè, than on metals, continue ſtill to reject it. On which account the boxes of their manufacture are, with regard to the wear, greatly better than the French.

The laying on the colours in gum-water, inſtead of varniſh, is alſo another variation from the method of japanning formerly practiſed: but the much greater ſtrength of the work, where they are laid on in varniſh or oil, has occaſioned this way to be exploded with the greateſt reaſon in all regular manufactures: however, they who may practiſe japanning on cabinets, or other ſuch pieces as are not expoſed to much wear and violence, for their amuſement only, and conſequently may not find it worth their while to encumber themſelves with the preparations neceſſary for the other methods, may paint with water colours on an undercoat laid on the wood, or other ſubſtance of which the piece to be japanned is formed; and then finiſh with the proper coats of varniſh, according to the methods below taught: and if the colours are tempered with the ſtrongeſt iſinglaſs ſize and honey, inſtead of gum-water, and laid on very flat and even, the work will not be much inferior in appearance to that done by the other method; and will laſt as long as the old japan.

Of JAPAN *Grounds.*—The proper grounds are either ſuch as are formed by the varniſh and colour, where the whole is to remain of one ſimple colour; or by the varniſh either coloured, or without colour, on which ſome painting or other decoration is afterwards to be laid. It is neceſſary, however, before we proceed to ſpeak of the particular grounds, to ſhew the manner of laying on the priming or undercoat, where any ſuch is uſed.

This priming is of the ſame nature with that called clear-coating, or vulgarly clear-coaling, practiſed erroneouſly by the houſe-painters; and conſiſts only in laying in and drying in the moſt even manner, a compoſition of ſize and whiting, or ſometimes lime inſtead of the latter. The common ſize has been generally uſed for this purpoſe; but where the work is of a nicer kind, it is better to employ the glover's or the parchment ſize; and if a third of iſinglaſs be added, it will be ſtill better; and if not laid on too thick, much leſs liable to peel and crack. The work ſhould be prepared for this priming, by being well ſmoothed with the fiſh-ſkin, or glaſs-ſhaver; and, being made thoroughly clean, ſhould be bruſhed over once or twice with hot ſize, diluted with two thirds of water, if it be of the common ſtrength. The priming ſhould then be laid on with a bruſh as even as poſſible; and ſhould be formed of a ſize, whoſe conſiſtence is betwixt the common kind and glue, mixed with as much whiting as will give it a ſufficient body of colour to hide the ſurface of whatever it is laid upon, but not more.

If the ſurface be very clean, on which the priming is uſed, two coats of it, laid on in this manner, will be ſufficient; but if, on trial with a fine rag wet, it will not receive a proper water poliſh, on account of any inequalities not ſufficiently filled up and covered, two or more coats muſt be given it; and whether a greater or leſs number be uſed, the work ſhould be ſmoothed, after the laſt coat but one is dry, by rubbing it with the Dutch ruſhes. When the laſt coat is dry, the water poliſh ſhould be given, by paſſing over every part of it with a fine rag gently moiſtened, till the whole appear perfectly plain and even. The priming will then be completed, and the work ready to receive the painting or coloured varniſh; the reſt of the proceedings being the ſame in this caſe as where no priming is uſed.

When wood or leather is to be japanned, and no priming is uſed, the beſt preparation is to lay two or three coats of coarſe varniſh compoſed in the following manner:

"Take of rectified ſpirit of wine one pint, and of coarſe ſeed-lac and reſin each two ounces. Diſſolve the ſeed-lac and reſin in the ſpirit; and then ſtrain off the varniſh."

This varniſh, as well as all others formed of ſpirit of wine, muſt be laid on in a warm place; and, if it can be conveniently managed, the piece of work to be varniſhed ſhould be made warm likewiſe: and for the ſame reaſon all dampneſs ſhould be avoided; for either cold or moiſture chill this kind of varniſh, and prevent its taking proper hold of the ſubſtance on which it is laid.

When the work is ſo prepared, or by the priming with the compoſition of ſize and whiting above deſcribed, the proper japan ground muſt be laid on; which is much the beſt formed of ſhell-lac varniſh, and the colour deſired, if white be not in queſtion, which demands a peculiar treatment, or great brightneſs be not required; when alſo other means muſt be purſued.

The colours uſed with the ſhell-lac varniſh may be any pigments whatever which give the teint of the ground deſired; and they may be mixed together to form browns or any compound colours.

As metals never require to be undercoated with whiting, they may be treated in the ſame manner as wood or leather, when the undercoat is omitted, except in the inſtances particularly ſpoken of below.

White JAPAN *Grounds.*—The forming a ground perfectly white, and of the firſt degree of hardneſs, remains hitherto a deſideratum, or matter ſought for, in the art of japanning, as there are no ſubſtances which form a very hard varniſh, but what have too much colour not to deprave the whiteneſs, when laid on of a due thickneſs over the work.

The neareſt approach, however, to a perfect white varniſh, already known, is made by the following compoſition.

"Take flake white, or white lead, waſhed over and ground up with a ſixth of its weight of ſtarch, and then dried; and temper it, properly for ſpreading, with the maſtich varniſh prepared as under the article VARNISH.

"Lay theſe on the body to be japanned, prepared either with or without the undercoat of whiting, in the manner as above ordered; and then varniſh over it with five or ſix coats of the following varniſh.

"Provide any quantity of the beſt ſeed lac; and pick out of it all the cleareſt and whiteſt grains, reſerving the more coloured and fouler parts for the coarſe varniſhes, ſuch as that uſed for priming or preparing wood or leather. Take of this picked ſeed-lac two ounces; and of gum-animi three ounces; and diſſolve them, being previouſly reduced to a groſs powder, in about a quart of ſpirit of wine; and ſtrain off the clear varniſh."

The ſeed-lac will yet give a ſlight tinge to this compoſition; but cannot be omitted where the varniſh is wanted to be hard; though, when a ſofter will anſwer the end, the proportion may be diminiſhed; and a little crude

turpentine

turpentine added to the gum-animi to take off the bitterneſs.

A very good varniſh, free entirely from all bitterneſs, may be formed by diſſolving as much gum-animi as the oil will take, in old nut or poppy oil; which muſt be made to boil gently, when the gum is put into it. The ground of white colour itſelf may be laid on in this varniſh; and then a coat or two of it may be put over the ground; but it muſt be well diluted with oil of turpentine when it is uſed. This, though free from brittleneſs, is nevertheleſs liable to ſuffer by being indented or bruiſed by any ſlight ſtrokes; and it will not well bear any poliſh, but may be brought to a very ſmooth ſurface without, if it be judiciouſly managed in the laying it on. It is likewiſe ſomewhat tedious in drying, and will require ſome time where ſeveral coats are laid on; as the laſt ought not to contain much oil of turpentine.

Blue JAPAN *Grounds.*—Blue japan grounds may be formed of bright Pruſſian blue; or of verditer glazed over by Pruſſian blue; or of ſmalt. The colour may be beſt mixed with ſhell-lac varniſh; and brought to a poliſhing ſtate by five or ſix coats of varniſh of ſeed-lac; but the varniſh, nevertheleſs, will ſomewhat injure the colour, by giving to a true blue a caſt of green; and fouling in ſome degree a warm blue, by the yellow it contains: where, therefore, a bright blue is required, and a leſs degree of hardneſs can be diſpenſed with, the method before directed, in the caſe of white grounds, muſt be purſued.

Red JAPAN *Grounds.*—For a ſcarlet japan ground, vermilion may be uſed; but the vermilion has a glaring effect, that renders it much leſs beautiful than the crimſon produced by glazing it over with carmine or fine lake; or even with roſe pink, which has a very good effect uſed for this purpoſe. For a very bright crimſon nevertheleſs, inſtead of glazing with carmine, the Indian lake ſhould be uſed, diſſolved in the ſpirit of which the varniſh is compounded, which it readily admits of when good: and, in this caſe, inſtead of glazing with the ſhell-lac varniſh, the upper or poliſhing coats need only be uſed; as they will equally receive and convey the tinge of the Indian lake, which may be actually diſſolved by ſpirit of wine: and this will be found a much cheaper method than the uſing carmine. If, nevertheleſs, the higheſt degree of brightneſs be required, the white varniſhes muſt be uſed.

Yellow JAPAN *Grounds.*—For bright yellow grounds, the king's yellow, or the turpeth mineral, ſhould be employed, either alone or mixed with fine Dutch pink: and the effect may be ſtill more heightened by diſſolving powdered turmeric root in the ſpirit of wine of which the upper or poliſhing coat is made; which ſpirit of wine muſt be ſtrained from off the dregs, before the ſeed-lac be added to it to form the varniſh.

The ſeed-lac varniſh is not equally injurious here, and with greens, as in the caſe of other colours; becauſe being only tinged with a reddiſh yellow, it is little more than an addition to the force of the colours.

Yellow grounds may be likewiſe formed of the Dutch pink only; which, when good, will not be wanting in brightneſs, though extremely cheap.

Green JAPAN *Grounds.*—Green grounds may be produced by mixing the king's yellow and bright Pruſſian blue; or rather, the turpeth mineral and Pruſſian blue; and a cheap, but fouler kind, by verdigriſe with a little of the above mentioned yellows, or Dutch pink. But where a very bright green is wanted, the cryſtals of verdigriſe, called diſtilled verdigriſe, ſhould be employed; and to heighten the effect, they ſhould be laid on a ground of leaf gold, which renders the colour extremely brilliant and pleaſing.

They may any of them be uſed ſucceſsfully with good ſeed-lac varniſh, for the reaſon before given, but will be ſtill brighter with white varniſh.

Orange-coloured JAPAN *Grounds.*—Orange-coloured japan grounds may be formed by mixing vermilion, or red lead with king's yellow, or Dutch pink; or the orange lake, which will make a brighter orange ground than can be produced by any mixture.

Purple JAPAN *Grounds.*—Purple japan grounds may be produced by the mixture of lake, and Pruſſian blue: or a fouler kind, by vermilion and Pruſſian blue. They may be treated as the reſt, with reſpect to the varniſh.

Black JAPAN *Grounds to be produced without Heat.*—Black grounds may be formed by either ivory-black, or lamp-black: but the former is preferable, where it is perfectly good.

Theſe may be always laid on with the ſhell-lac varniſh; and have their upper or poliſhing coats of common ſeed-lac varniſh; as the tinge or foulneſs of the varniſh can be here no injury.

Common black JAPAN *Grounds on Iron or Copper, produced by means of Heat.*—For forming the common black japan grounds by means of heat, the piece of work to be japanned muſt be painted over with drying oil: and when it is of a moderate dryneſs, muſt be put into a ſtove of ſuch degree of heat, as will change the oil black, without burning it ſo as to deſtroy or weaken its tenacity. The ſtove ſhould not be too hot when the work is put into it, nor the heat increaſed too faſt; either of which errors would make it bliſter: but the ſlower the heat is augmented, and the longer it is continued, provided it be reſtrained within the due degree, the harder will be the coat of japan. This kind of varniſh requires no poliſh, having received, when properly managed, a ſufficient one from the heat.

The fine Tortoiſe-ſhell JAPAN *Ground, produced by means of Heat.*—The beſt kind of tortoiſe-ſhell ground produced by heat is not leſs valuable for its great hardneſs, and enduring to be made hotter than boiling water, without damage, than for its beautiful appearance. It is to be made by means of a varniſh, prepared in the following manner:

"Take of good linſeed oil one gallon, and of umbre half a pound: boil them together till the oil become very brown and thick: ſtrain it then through a coarſe cloth; and ſet it again to boil; in which ſtate it muſt be continued till it acquire a pitchy conſiſtence; when it will be fit for uſe."

Having prepared thus the varniſh, clean well the iron or copper-plate, or other piece which is to be japanned; and then lay vermilion tempered with ſhell-lac varniſh, or with drying oil diluted with oil of turpentine very thinly, on the places intended to imitate the more tranſparent parts of the tortoiſe-ſhell. When the vermilion is dry, bruſh over the whole with the black varniſh, tempered to a due conſiſtence with oil of turpentine; and when it is ſet and firm, put the work into a ſtove, where it may undergo a very ſtrong heat, and muſt be continued a conſiderable time; if even three weeks or a month, it will be the better.

This was given amongſt other receipts by Kunkel; but appears to have been neglected till it was revived with great ſucceſs in the Birmingham manufactures, where it was not only the ground of ſnuff-boxes, dreſſing-boxes, and other ſuch leſſer pieces, but of thoſe beautiful tea-waiters, which have been ſo juſtly eſteemed and admired in ſeveral parts of Europe where they have been ſent. This ground may be decorated with painting and gilding, in the ſame manner as any other varniſhed ſurface, which had beſt be done after the ground has been duly hardened by the hot ſtove; but it is well to give a ſecond annealing with a more gentle heat after it is finiſhed.

Method of Painting JAPAN *Work.*—Japan work ought properly to be painted with colours in varniſh; though, in order for the greater diſpatch, and, in ſome very nice works in ſmall, for the freer uſe of the pencil, the colours are ſometimes tempered in oil; which ſhould previouſly have a fourth part of its weight of gum-animi diſſolved in it; or, in default of that, of the gums ſanderac or maſtic. When the oil is thus uſed, it ſhould be well diluted with ſpirit of turpentine, that the colours may be laid more evenly and thin; by which means, fewer of the poliſhing or upper coats of varniſh become neceſſary.

In ſome inſtances, water colours are laid on grounds of gold, in the manner of other paintings, and are beſt, when ſo uſed, in their proper appearance, without any varniſh over them; and they are alſo ſometimes ſo managed as to have the effect of emboſſed work. The colours employed in this way, for painting, are beſt prepared by means of iſinglaſs ſize corrected with honey or ſugar candy.

candy. The body of which the embossed work is raised, need not, however, be tinged with the exterior colour; but may be best formed of very strong gum-water, thickened to a proper consistence by bole armoniac and whiting in equal parts; which being laid on in the proper figure, and repaired when dry, may be then painted with the proper colours tempered in the isinglass size, or in the general manner with shell-lac varnish.

Manner of Varnishing JAPAN *Work.*—The last, and finishing part of japanning, lies in the laying on and polishing the outer coats of varnish; which are necessary, as well in the pieces that have only one simple ground of colour, as with those that are painted. This is in general best done with common seed-lac varnish, except in the instances, and on those occasions where we have already shewn other methods to be more expedient: and the same reasons which decide as to the fitness or impropriety of the varnishes, with respect to the colours of the ground, hold equally well with regard to those of the painting: for where brightness is the most material point, and a tinge of yellow will injure it, seed-lac must give way to the whiter gums; but where hardness, and a greater tenacity, are most essential, it must be adhered to; and where both are so necessary, that it is proper one should give way to the other, in a certain degree reciprocally, a mixed varnish must be adopted.

This mixed varnish, as we have already observed, should be made of the picked seed-lac. The common seed-lac varnish, which is the most useful preparation of the kind hitherto invented, may be thus made.

"Take of seed-lac three ounces, and put it into water to free it from the sticks and filth that are frequently intermixed with it; and which must be done by stirring it about, and then pouring off the water, and adding fresh quantities in order to repeat the operation, till it be freed from all impurities; as it very effectually may be by this means. Dry it then, and powder it grossly, and put it, with a pint of rectified spirit of wine, into a bottle, of which it will not fill above two thirds. Shake the mixture well together; and place the bottle in a gentle heat, till the seed appear to be dissolved; the shaking being in the mean time repeated as often as may be convenient: and then pour off all which can be obtained clear by that method; and strain the remainder through a coarse cloth. The varnish thus prepared must be kept for use in a bottle well stopt."

When the spirit of wine is very strong, it will dissolve a greater proportion of the seed-lac: but this will saturate the common, which is seldom of a strength sufficient for making varnishes in perfection. As the chilling, which is the most inconvenient accident attending those of this kind, is prevented, or produced more frequently, according to the strength of the spirit; we shall therefore take this opportunity of shewing a method by which weaker rectified spirits may with great ease, at any time, be freed from the phlegm, and rendered of the first degree of strength.

"Take a pint of the common rectified spirit of wine, and put it into a bottle, of which it will not fill above three parts. Add to it half an ounce of pearl-ashes, salt of tartar, or any other alkaline salt, heated red-hot, and powdered, as well as it can be without much loss of its heat. Shake the mixture frequently for the space of half an hour; before which time, a great part of the phlegm will be separated from the spirit; and will appear, together with the undissolved part of the salts, in the bottom of the bottle. Let the spirit then be poured off, or freed from the phlegm and salts by means of a tritorium or separating funnel; and let half an ounce of the pearl ashes, heated and powdered as before, be added to it, and the same treatment repeated. This may be done a third time, if the quantity of phlegm separated by the addition of the pearl-ashes appear considerable. An ounce of alum reduced to powder and made hot, but not burnt, must then be put into the spirit; and suffered to remain some hours; the bottle being frequently shaken: after which, the spirit, being poured off from it, will be fit for use."

The addition of the alum is necessary, to neutralize the remains of the alkaline salt or pearl-ashes; which would otherwise greatly deprave the spirit with respect to varnishes and lacquer, where vegetable colours are concerned; and must consequently render another distillation necessary.

The manner of using the seed-lac, or white varnishes, is the same, except with regard to the substance used in polishing; which, where a pure white, or great clearness of other colours, is in question, should be itself white: whereas the browner sorts of polishing dust, as being cheaper, and doing their business with greater dispatch, may be used in other cases. The pieces of work to be varnished should be placed near a fire, or in a room where there is a stove, and made perfectly dry; and then the varnish may be rubbed over them by the proper brushes made for that purpose, beginning in the middle, and passing the brush to one end; and then with another stroke from the middle, passing it to the other. But no part should be crossed or twice passed over, in forming one coat, where it can possibly be avoided. When one coat is dry, another must be laid over it; and this must be continued at least five or six times, or more; if, on trial, there be not a sufficient thickness of varnish to bear the polish, without laying bare the painting, or the ground colour underneath.

When a sufficient number of coats is thus laid on, the work is fit to be polished: which must be done, in common cases, by rubbing it with a rag dipped in Tripoli or pumice stone, commonly called rotten stone, finely powdered: but towards the end of the rubbing, a little oil of any kind should be used along with the powder; and when the work appears sufficiently bright and glossy, it should be well rubbed with the oil alone, to clean it from the powder; and give it a still brighter lustre.

In the case of white grounds, instead of the Tripoli or pumice stone, fine putty or whiting must be used; both which should be washed over to prevent the danger of damaging the work from any sand or other gritty matter, that may happen to be commixed with them.

It is a great improvement of all kinds of japan work, to harden the varnish by means of heat; which, in every degree that it can be applied short of what would burn or calcine the matter, tends to give it a more firm and strong texture. Where metals form the body, therefore, a very hot stove may be used, and the pieces of work may be continued in it a considerable time; especially if the heat be gradually increased: but where wood is in question, heat must be sparingly used, as it would otherwise warp or shrink the body, so as to injure the general figure.

Method of Gilding JAPAN *Work.* See the article GILDING.

JASHER, a book mentioned in Scripture, and said by some to be lost. But some of the most celebrated Hebrew doctors say they have found it; telling us, that it is the book of Genesis, wherein are contained the acts of Abraham, Isaac, Jacob, and the other patriarchs, who were, by way of excellence, called Jasherim the Just: but that man must be easily satisfied, who can acquiesce with this interpretation. Dr. Lightfoot thinks the book of Jasher is the same with the book of the Wars of God; but there is little foundation for it. This book, according to Grotius, was a triumphal poem; but Josephus seems to bid fairest for the truth, who says, that by this book are to be understood certain records kept in some place on purpose, and afterwards in the temple, giving an account of what happened among the Hebrews from year to year, and particularly the prodigy of the sun's standing still, and directions and laws about the use of the bow; that is, the setting up of archery, and maintaining military exercises. If it be enquired why the title given to these Hebrew annals was the book of Jásher; that is, the upright; this may be given as a reason, Because it was by all persons reckoned as a very just and authentic account of all those events and occurrences which it recorded: it was composed with great uprightness and truth; thence it went commonly by the name of Jasher's book, or chronicle. It was not the work of any inspired person, but was of the nature of common civil annals; and, consequently, we cannot infer from hence, that any book properly belonging to the Holy Scripture, that is, that was written by the inspiration of the Holy Ghost, is at this day missing.

JASMINUM, the jaſmine, or jeſſamine-tree, in botany, a genus of plants, the leaves of which are in many ſpecies pinnated; the cup of the flower conſiſts of one leaf, but is divided at the top into five ſegments; the flower conſiſts of one leaf, is funnel-ſhaped, and divided into five ſegments: the flowers are ſucceeded by berries, which ſplit in the middle, each ſide, for the moſt part, containing a ſeparate ſeed.

The common white jaſmine is eaſily propagated by laying down the tender branches in the ſpring, which, by the ſucceeding ſpring, will be rooted ſtrong enough to be tranſplanted. They may alſo be raiſed by cuttings, which ſhould be planted in autumn in a moiſt border, where they may have the morning ſun: but they muſt be ſcreened from the violence of the ſun in the heat of the day, and frequently watered in dry weather. The cuttings, thus managed, will many of them live, and have roots fit to be removed in the following ſpring: but this method is ſeldom practiſed, the layers always making the beſt plants.

The two ſtriped ſorts ſhould be planted in a warm ſituation, eſpecially the white ſtriped; for they are much more tender than the plain, and are very ſubject to be deſtroyed by great froſts, if they are expoſed thereto: it will therefore be proper to preſerve a plant of each kind in pots, which may be removed into the green-houſe in winter, leſt, by expoſing them to the cold, they ſhould all be deſtroyed, and the variety loſt.

JASPER, in natural hiſtory, a genus of ſcrupi, of a complex irregular ſtructure, of great variety of colours, and emulating the appearance of the finer marbles, or ſemipellucid gems.

The great characteriſtic of jaſpers is, that they all readily ſtrike fire with ſteel, and make not the leaſt effervescence with aqua-fortis.

Jaſpers, though commonly reckoned among the precious ſtones, ought undoubtedly to be ranged among the ſcrupi; being only opake cryſtalline maſſes, variouſly debaſed with an earthy admixture: and to this laſt ingredient it is that they owe all their variety of colours, as white, green, red, brown, and bluiſh.

The ſeveral kinds of nephritic ſtone, and the lapis divinus or jade, are all genuine jaſpers; but the hard, bright, green jaſper, of the Eaſt-Indies, ſeems to be the true medicinal kind. It is found in maſſes of various ſizes and ſhapes, but the more uſual ſtandard as to ſize, is between four and ſix inches in diameter; but there are maſſes of it found of a foot or more in diameter, and others no larger than a horſe-bean. It is generally ſimple and unmixed; but if it be variegated at all, it is always with white, and this is diſpoſed not in ſtreaks or veins, but in clouds. It is capable of a very fine poliſh, and when the white clouds are well diſpoſed, is very beautiful, and in pieces not too thick, is tolerably pellucid, when held up againſt the light.

JASPI-CAMEA, in natural hiſtory, the dull, broad-zoned, green and white camea; being a very elegant ſpecies much reſembling the common camea in all things but colour. See CAMEA.

JASPONYX, in natural hiſtory, the pureſt horn-coloured onyx, with beautiful green zones, which are compoſed of the genuine matter of the fineſt jaſpers. See the articles JASPER and ONYX.

JAVELIN, *Haſta*, in antiquity, a ſort of ſpear, five feet and a half long; the ſhaft of which was of wood, with a ſteel point.

Every ſoldier, in the Roman armies, had ſeven of theſe, which were very light and ſlender.

JAUNDICE, in medicine, a diſeaſe ariſing from a vitiated ſtate of the blood and humours, by means of an excrementitious bile, from a fault of the bilious ducts, greatly injuring the functions of the whole body, and rendering the ſkin of a yellow or livid colour.

The bile is a kind of natural ſapo, that is, a mixture of oil, water, and ſalt, both volatile and fixed, ſeparated from the blood in the liver for various uſes of the animal body: and as the blood itſelf may be vitiated many ways, it is no wonder that this humour is ſometimes rendered unfit for its offices. Now it is often faulty by its lentor or viſcidity, and ſometimes alſo for its exceſſive thinneſs. In the firſt caſe the ſecretory glands of the bile are obſtructed, and the ſmall quantity of it that is ſecrated, ſtagnates in the hepatic ducts; whence the liver grows hard, and under its tunicle are formed whitiſh concretions, reſembling hard ſope. But this diſeaſe ariſes, not only from the viſcidity of the bile, whereby it ſtops in its paſſage, but alſo from its want of due conſiſtence: for here the volatile ſalt, which is one of the compounding principles of the bile, over-abounds; whence the bile becomes too thin, hot, and irritating to the inteſtines. In the former caſe the body is too coſtive, and the fæces are hard, and of a clay colour: in the latter a diarrhœa, attended by a fever and thin yellow ſtools, conſtantly teizes the patient. Perſons who ſpend their lives in a ſedentary manner, without proper exerciſe, are moſt liable to the former; becauſe the oily part of the bile grows too thick and viſcid for want of a due proportion of ſalt: and thoſe who render their faculties uſeleſs, by too high feeding and drinking ſpirituous liquors, are generally moſt expoſed to the latter.

But there is another ſpecies of jaundice, owing to a very different cauſe from thoſe above deſcribed; and that is nervous ſpaſms, when the ſubtile elaſtic fluid of the nerves, by becoming too acrid and irritating, conſtringes the bilious ducts to the degree of hindering its paſſage through the liver; and conſequently it muſt remain in the blood, and thence be thrown on the different parts of the body.

I muſt alſo obſerve, that there ſometimes happens another kind of conſtriction, occaſioned by the ſcirrhoſity of the abdominal glands; in which caſe, though the liver and gall bladder be loaded with bile, yet no part of it can paſs into the inteſtines; of which I formerly ſaw a remarkable inſtance in the hoſpital. It was in a working man of about forty-two years of age, who, five months after returning from an acute fever, was ſeized with an inflammation in the right hypochondrium; of which, when he was relieved, he fell into an obſtinate jaundice, with coſtiveneſs and clayey ſtools, and died in a ſhort time. Upon opening the abdomen, we found four pounds of pure blood, in appearance at leaſt, floating in it. We wondered whence this blood proceeded, but ſoon obſerved ſome little membranes, which ſeemed to be the pieces of burſted ſack; and the omentum was mortified in this place. The pancreas was not only ſcirrhous, but alſo cancerous: for upon cutting into it, there flew out into the ſurgeon's face ſome drops of ſerofity of ſo acrid and corroſive a nature, that they burnt the ſkin like oil of vitriol. The ſpleen was ſcirrhous likewiſe. The gall-bladder was very large, and full of bile; not yellow, but of a dark green, and too viſcid. There was no ſcirrhoſity in the liver; but in what part ſoever it was cut, the ſame ſort of bile iſſued. In fine, we obſerved that every part of the body, membranes, fat, glands, nay the very ſubſtance of the ribs, was of a yellow hue, except the muſcular fibres alone, which were not in the leaſt tinged. Upon preſſing the gall-bladder with the fingers, we could not force one drop of bile into the inteſtines; for at the union of the hepatic duct with the cyſtic, the paſſage was ſo vaſtly ſtraightened, that it would not admit a ſtyle. And my reaſon for relating this caſe is, to make appear, from how many different cauſes, and ſome of theſe fatal, this diſeaſe may ariſe.

A diſeaſe attended with ſuch variety of circumſtances, requires different methods of cure. In caſe of coſtiveneſs with aſh-coloured or whitiſh ſtools, ſaponaceous medicines, both alone and joined with rhubarb, are neceſſary. When the belly is too looſe, the looſeneſs is rather to be moderated than ſtopped; which is beſt done by rhubarb with the admixture of an anodyne. But paregorics are never more proper in this diſeaſe than in thoſe caſes, which we have ſaid to be owing to a conſtriction of the biliary ducts by nervous ſpaſms: but in every kind of jaundice, attended with actual inflammation, blood is to be drawn; and, generally ſpeaking, a vomit is to be given. This inflammation frequently ſuppurates and turns to a vomica; from which, if pure white matter iſſues, it is a promiſing ſign, becauſe the evil lies in the tunicle or outward membrane. But if the whole ſubſtance of the liver is conſumed with it, the patient labours under a ſlow fever and great anxiety for a good while, and then dies.

Laſtly, for correcting the bile itſelf nothing is more uſeful than the following draught.

Take of lemon juice ſix drams; of ſalt wormwood half a dram; of ſimple cinnamon-water one ounce; of double refined ſugar one ſcruple: mix.

And it will be of ſervice likewiſe, in caſe of a looſeneſs, if its irritating quality be duly checked by opiates. Upon the ſame principle, Mynſicht's elixir of vitriol, taken in Bath or Spaw water, is a very good medicine. *Mead's Monita & Præcepta.*

JAW, *Maxilla*, in anatomy. See the article MAXILLA.

IBERIS, ſciatica-creſs, in botany, a genus of plants, the corolla whereof conſiſts of four unequal petals, vertically oval, obtuſe, and patent; the fruit is a little pod erect, roundiſh, compreſſed, ſurrounded by an acute bifid margin on the upper ſide, and containing two cells: the ſeed, in each cell, is ſingle and roundiſh.

IBEX, in zoology, an animal of the goat-kind, with extremely long nodoſe horns, which bend backwards, and are of a blackiſh colour, and annulated on the ſurface. The body is of a dark duſky colour, and is leſs in proportion to the height than that of the common goat: it has a great reſemblance to the deer-kind; the legs are alſo perfectly, like thoſe of the deer, ſtraight, elegant, and ſlender. It is frequent in many parts of Europe, and, notwithſtanding its vaſt horns, runs and leaps with ſurpriſing force and agility.

IBIS, a bird which was very uſeful to the Egyptians for deſtroying ſerpents, locuſts, and caterpillars; and, on that account, had divine honours paid it.

It is all over black, and about the ſize of the curlew, with the head of a cormorant, and the long neck of a heron.

ICE, *Glacies*, in phyſiology, a ſolid, tranſparent, and brittle body, formed of ſome fluid, particularly water, by means of cold. See COLD, FROST, and FREEZING.

ICE-HOUSE, a building contrived to preſerve ice for the uſe of a family in the ſummer ſeaſon.

Ice-houſes are more generally uſed in warm countries, than with us, particularly in Italy, where the meaneſt perſon, who rents a houſe, has his vault or cellar for ice.

ICH DIEN, the motto of the prince of Wales's arms, ſignifying, in the High Dutch, I ſerve.

ICHNEUMON, in zoology, the name of an animal, of which there have been a multitude of idle and fabulous things aſſerted. It is a creature of the weaſel kind, with a longer and narrower body than a cat, and ſomething approaching both in ſhape and colour to the badger. Its noſe is black and ſharp, like that of a ferret. It has no beard, or whiſkers: its noſe is prominent, and its ears ſhort and round. Its colour is a yellowiſh grey, much like that of ſome of the monkey claſs. This is its appearance when in a good humour; but, when frighted or provoked, it raiſes its hairs upright, and ſhews them variegated at intervals with grey and yellow in diſtinct portions. Its legs are ſhort, and its feet have all five toes. Its tail is very long, and thick at the inſertion; its teeth, and its tongue, like thoſe of the cat: and, what is very ſingular, is, that in both ſexes it has a large aperture ſituated below the anus, which it dilates and contracts at pleaſure. Hence came the old opinion, that both male and female conceived, and brought forth young, in this animal. It is naturally a very cleanly animal, and is very briſk and nimble, and of great courage. It will engage a large dog; and if it have a quarrel with a cat, will deſtroy that creature by three bites on the throat. Its noſe is ſo ſharp and narrow, that it can very hardly lay hold of any thing large with its teeth, and ſcarce can bite a man's clenched fiſt. It is very expert in ſeizing its prey; it ſtands erect on its hinder-legs, to deſcry where it is; then, throwing itſelf flat on its belly, crawls very ſlowly towards it, and when within reach, darts violently upon it. It feeds indifferently on all animals that it can get at. Its common food are the ſnail, the lizard, the chameleon, ſuch ſerpents as it can manage, and frogs and mice; it is alſo very fond of birds, and of none ſo much as the hen and chicken.

ICHNEUMON is alſo the name of a genus of flies, of the hymenoptera order, with a triple ſting at the anus.

ICHNOGRAPHY, in perſpective, the view of any thing cut off by a plane parallel to the horizon, juſt at the baſe of it.

Among painters it ſignifies a deſcription of images, or of ancient ſtatues of marble and copper, of buſts and ſemi-buſts, of paintings in freſco, Moſaic works, and ancient pieces of miniature.

ICHNOGRAPHY, in architecture, a deſcription or draught of the platform or ground-work of a houſe, or other building. Or it is the geometrical plan or platform of an edifice or houſe, or the ground-work of an houſe or building, delineated upon paper, deſcribing the form of the ſeveral apartments, rooms, windows, chimnies, &c. See the article BUILDING.

ICHNOGRAPHY, in fortification, denotes the plan or repreſentation of the length and breadth of a fortreſs, the diſtinct parts of which are marked out, either on the ground itſelf, or on paper.

ICHOGLANS, the grand ſignior's pages, ſerving in the ſeraglio.

ICHOR properly ſignifies a thin watery humour, like ſerum; but is ſometimes alſo uſed for a thicker kind, flowing from ulcers, called likewiſe ſanies.

ICHTHYOCOLLA, vulgarly called iſinglaſs, a ſolid glutinous ſubſtance, prepared from a fiſh of the ſturgeon kind caught in the rivers of Ruſſia and Hungary. The ſkin, fins, &c. are boiled in water, the decoction inſpiſſated to a due conſiſtence, and then poured out ſo as to form thin cakes; which are either exſiccated in that form, or cut while ſoft into ſlices, and rolled up into ſpiral, horſe-ſhoe, and other ſhapes. The beſt is thin, clear, and almoſt tranſparent pieces.

Ichthyocolla is one of the pureſt and fineſt of the animal glues, of no particular ſmell or taſte. Beaten into ſhreds, it diſſolves pretty readily in boiling water or milk, and forms a gelatinous ſubſtance, which yields a mild nutriment, and proves uſeful medicinally in ſome diſorders ariſing from a ſharpneſs and colliquation of the humours. A ſolution of it in water, curiouſly ſpread, whilſt hot, upon ſilk, affords an elegant ſticking plaſter for ſlight injuries of the ſkin, not eaſily ſeparable from the part by water, and ſcarcely inferior to the more compounded one, ſold under the name of the ladies black plaſter, in which different balſams and reſins are joined to the ichthyocolla.

ICHTHYOLOGY, *ιχθυολογια*, the ſcience of fiſhes, or that branch of zoology which treats of fiſhes. See the article FISH.

ICHTHYOLOGIST, an author who has written profeſſedly of fiſhes.

ICHTHYS, *ιχθυς*, in antiquity, a celebrated acroſtic of the Erythræan ſibyl; the firſt words of each verſe of which were, Ιησους Χριστος Θεου υιος σωτηρ, that is, *Jeſus Chriſtus Dei filius ſervator*; and the initial Greek letters form the word *ιχθυς*, whence the name.

ICONOCLASTS, *εικονοκλαστοι*, in church hiſtory, an appellation given to thoſe perſons, who, in the eighth century, oppoſed image-worſhip; and is ſtill given by the church of Rome, to all Chriſtians who reject the uſe of images in religious matters. See IMAGE.

ICOSAHEDRON, a regular ſolid, terminated by twenty equilateral and equal triangles.

The word is Greek, and compounded of *εικοσι*, twenty, and *εδρα*, a baſe.

It may be conſidered as conſiſting of twenty triangular pyramids, whoſe vertices meet in the center of a ſphere that circumſcribes them, and therefore have their heights and baſes equal; wherefore the ſolidity of one of theſe pyramids multiplied by twenty, the number of baſes, gives the ſolid content of the icoſahedron.

ICOSANDRIA, in the Linnæan ſyſtem of botany, a claſs of plants, the twelfth in order, the characters of which are theſe; the cup of the flower is monophyllous and hollow, with the corolla affixed by the ungues to its ſides, and about twenty ſtamina inſerted either into the ſide of the cup, or corolla. See the article BOTANY.

The term icoſandria is here taken in a lax and indeterminate ſenſe, ſo as to comprehend all plants with more than twelve ſtamina, and for the moſt part not much exceeding twenty; however, the characteriſtic of the claſs

is rather to be taken from the manner of inſertion, than number of the ſtamina.

To this claſs belong the cactus or torch-thiſtle, the amygdalus or almond-tree, the ceraſus, or cherry, &c.

ICTERIC Disease, the ſame with the jaundice. See Jaundice.

IDEA, the repreſentation or reſemblance of ſomething, even though not ſeen, as conceived by the mind.

The word is Greek, ſignifying the ſame thing, and derived from εἰδω, to ſee.

As to the origin of ideas, the Peripatetics maintain that external objects emit ſpecies entirely reſembling them, and that theſe ſpecies ſtriking on our ſenſes are by them tranſmitted to the underſtanding; that being material, they are rendered intelligible by the active intellect, and are at length received by the paſſive.

Others think that our ſouls have of themſelves the power of producing ideas of things we would think upon, and that they are excited to this by the impreſſions which objects make on our ſenſes, though theſe impreſſions are not images of any thing reſembling the objects that occaſioned them.

Others maintain that the mind, by conſidering itſelf and its own perfections, can diſcover all things that are without. Others, with Des Cartes, hold that our ideas are innate or born along with us.

Malebranche and his followers maintain that God has in himſelf the ideas of all the beings he has created, and thus he ſees all things in conſidering his own perfections to which they correſpond; and that, as he is intimately united to our ſouls by his preſence, our minds perceive things in him which repreſent created beings; and that thus we come by all our ideas: and yet, ſays he, though we ſee all ſenſible things in God, we have not our ſenſations in him: for in our perception of any ſenſible object is included both a ſenſation and a pure idea. The ſenſation is a modification of the ſoul, and it is God who cauſes it in us; but the idea joined with the ſenſation is in God, and it is in him we ſee it.

The Carteſians diſtinguiſh three kinds of ideas; the firſt innate; ſuch as we have of God, as a being infinitely perfect: ſecondly, adventitious, which the mind receives in proportion as objects preſent themſelves to our ſenſes: thirdly, factitious, thoſe which the mind forms by aſſembling and combining the ideas it already had, and theſe are called complex. But Mr. Locke has made it appear that all our ideas are owing to our ſenſes, and the reflection of our minds upon thoſe ideas which the ſenſes have at firſt furniſhed us with; and that the diſtinction of the Carteſians is mere chimera. See *Locke's Eſſay on the Human Underſtanding*.

So that a perſon deſtitute of one ſenſe would have no idea belonging to that ſenſe; and if deſtitute of all the ſenſes, he would have no idea at all, not even of reflection, as wanting all ſenſation that ſhould excite in him the operations of his mind, which are the objects of his reflection. Thus far the mind is altogether paſſive.

Ideas only ſeem to be innate, becauſe we find we have them, as ſoon as we come to the uſe of reaſon, being in effect what we formed from the ideas wherewith the mind was inſenſibly filled by the ſenſes.

Ideas are divided into ſimple and complex.

Simple Ideas comprize all thoſe which come into the mind by ſenſation; ſome of which we acquire purely by means of one ſenſe; others by ſeveral ſenſes: there are other ſimple ideas formed in the mind both by ſenſation and reflection jointly. Of ſome of theſe kinds of ideas all our knowledge conſiſts.

We ſhould diſtinguiſh between ſimple ideas, as they are perceptions in the mind, and as they are modifications of the bodies that cauſe ſuch perceptions, that we may not think they are exactly the images of ſomething inherent in the object; for moſt of thoſe of ſenſation are in the mind no more the likeneſs of any thing exiſting without us, than the names that ſtand for them are the likeneſs of the ideas.

But here the qualities of the bodies which produce theſe ideas in us are to be diſtinguiſhed into primary and ſecondary: the former are ſuch as are utterly inſeparable from the body, in whatever ſtate it be, and ſuch as our ſenſes conſtantly find in every particle of matter, as ſolidity, extenſion, &c. Secondary qualities are ſuch as are only powers in the objects to produce various ſenſations in us by means of their primary ones, as the figure, bulk, &c. of their particles, as colour, taſte, &c.

Now the ideas of primary qualities are in ſome ſenſe reſemblances of them; but thoſe produced in us by the ſecondary qualities have no reſemblance of them at all, being only a power to produce thoſe ſenſations in us.

The mind has ſeveral faculties of managing theſe ſimple ideas, as 1. That of diſtinguiſhing rightly between one and another, wherein conſiſts the accuracy of judgment. 2. That of comparing them one with another, as to extent, time, place, or any other circumſtances of relation. 3. That of putting together the ſimple ideas of ſenſation and reflection, in order to form complex ones. 4. Children, having got ſome ideas, by degrees learn the uſe of ſigns: hence the uſe of words being to ſtand as outward marks of our internal ideas, if every particular idea that we take in, ſhould have a particular name affixed to it, names would grow endleſs. To prevent this, the mind has another faculty, whereby it can make the particular ideas received from ſuch objects become general; which is done by conſidering them as they are appearances in the mind ſeparate from all other exiſtences, and circumſtances of exiſtence, &c. and this is called abſtraction. Thus the ſame colour being obſerved to day in chalk, which we obſerved yeſterday in paper, we, conſidering that appearance alone, make it a repreſentation of all the ſame kind, and call it whiteneſs.

From theſe four powers all our complex ideas are formed: and as before the underſtanding was paſſive, ſo here it is active.

Complex Ideas may be reduced to theſe three heads, namely, modes, ſubſtances, and relations: modes are ſuch complex ideas as are not ſuppoſed to exiſt by themſelves, but are conſidered as dependencies on ſubſtances, as triangle, gratitude, &c. Of theſe there are two kinds, 1. Such as are only variations of the ſame ſimple idea, as ten, a ſcore, &c. 2. Such as are compounded of ſimple ideas of ſeveral ſorts put together, to make a complex one, as beauty, theft, &c.

Subſtances have their ideas from ſuch combinations of ſimple ideas as repreſent diſtinct things ſubſiſting by themſelves; in which the idea of ſubſtance, confuſed as it is, is always the firſt. Relations are complex ideas ariſing from the compariſon of one idea with another. Of theſe ſome only depend on the equality or exceſs of the ſame ſimple idea in ſeveral ſubjects, and theſe may be called proportional relations, ſuch as equal, more, &c. Another occaſion of comparing things is owing to the circumſtances of their original, which, not being afterwards to be altered, make the relations depending thereon as laſting as the ſubjects to which they belong; as father, mother, &c. as alſo in the relations by inſtitution, as prince and people, &c. and as to moral relations, they are the conformity or diſconformity of men's free actions to laws and rules, whether human or divine.

Ideas may alſo be divided into clear or diſtinct, and obſcure or confuſed.

Simple ideas are clear, when they continue ſuch as the objects repreſent them; when our organs of ſenſation are in a good tone, our memories retain them, and can preſent them to the mind, whenever it has occaſion to conſider them; and when the mind alſo ſees that thoſe ſimple ideas are ſeverally different one from another. The contrary to which is, what we call obſcurity and confuſion of ideas.

Again ideas, with regard to their objects, are diſtinguiſhed into real or fantaſtical, true or falſe, adequate or inadequate.

Real Ideas are ſuch as have a foundation in nature, being conformable to that being to which they are referred as their archetypes.

Fantaſtical Ideas, ſuch as have no foundation in nature.

True and Falſe Ideas.—When the mind refers its ideas to any thing extraneous to it, in ſuch a reference, the mind makes a tacit ſuppoſition of their conformity to that thing; which ſuppoſition as it is true or falſe, ſo the ideas themſelves come to be denominated. Real ideas are divided

vided into adequate and inadequate; adequate ideas are thoſe which perfectly repreſent thoſe archetypes which the mind ſuppoſes them taken from, and which it makes them ſtand for; inadequate are ſuch as do but partially repreſent thoſe archetypes.

IDENTITATE NOMINIS, in law, a writ that lies where a perſon is impriſoned inſtead of another of the ſame name, commanding the ſheriff to enquire whether the priſoner be the perſon againſt whom the action was brought, or not; and if not, to diſcharge him.

IDENTITY, or SAMENESS, denotes that by which a thing is itſelf, and not any thing elſe; in which ſenſe, identity differs from ſimilitude as well as diverſity.

IDES, *Idus*, in the Roman calendar; eight days in each month are ſo denominated, commencing in the months of March, May, July, and October, on the fifteenth day, and in the other months on the thirteenth, and reckoned backward, ſo as in the four months above ſpecified to terminate on the eighth day, and in the reſt on the ſixth.

The word is variouſly derived; it ſeems moſt probably to be formed of the Etrurian word *iduo*, for *divido*, to divide; becauſe the ides divided the month into two equal parts.

The ides came between the calends and nones. The fourteenth day of March, May, July, and October, and the twelfth of the other eight months, was *pridie idus*, or the eve of the ides: the thirteenth in the four months, and the eleventh in the other eight, was called 3 idus, or the third of the ides of ſuch months: and ſo on to the eighth and ſixth days, which made the eighth of the ides, 8 idus.

This method of reckoning is ſtill retained in the Roman chancery, and calendar of the breviary.

The ides of May were conſecrated to Mercury; thoſe of March were eſteemed unhappy after Cæſar's murder on that day: the time after the ides of June was reckoned fortunate for thoſe who entered into matrimony; the ides of Auguſt were conſecrated to Diana, and obſerved as a feaſt-day by the ſlaves. On the ides of September auguries were taken for appointing the magiſtrates, who formerly entered upon their offices on the ides of May, afterwards on thoſe of March.

IDIOM, *Idioma*, either the peculiarities of a language, or the particular dialect of ſome province, differing in ſome reſpects from the language of the nation in general, from which it is derived.

The word is Greek, ἰδίωμα, ſignifying the ſame thing, and derived from ἴδιος, proper, or one's own.

IDIOPATHY, in phyſic, a diſorder peculiar to a certain part of the body, and not ariſing from any preceding diſeaſe; in which ſenſe it is oppoſed to ſympathetic. Thus, an epilepſy is idopathic, when it happens merely through ſome fault in the brain; and ſympathetic, when it is the conſequence of ſome other diſorder.

IDIOSYNCRASY, among phyſicians, denotes a peculiar temperament of body, whereby it is rendered more liable to certain diſorders, than perſons of a different conſtitution uſually are. See the article TEMPERAMENT.

IDIOT, in the Engliſh laws, denotes a natural or fool from his birth.

The word is derived from the Greek, ἰδιώτης, which primarily imports a private man, who bears no office in the government; but figuratively it implies a ſuperlative fool, even though concerned in government. It is formed of ἴδιος, proper, or private.

A perſon who has underſtanding enough to meaſure a yard of cloth, number twenty rightly, and tell the days of the week, &c. is not an idiot in the eye of the law.

In other countries, repeating the Lord's prayer ſaves a man from being reckoned an idiot.

IDOLATRY, the adoration paid to idols and falſe gods, which is due to God alone.

The word is derived from the Greek, εἰδωλολατρεια, and compounded of εἰδωλον, idol, and λατρεια, worſhip, from λατρης, a ſervant.

Dr. Owen divides the whole of idolatrous worſhip into Sabaiſm and Helleniſm. Dr. Prideaux imagines the planets, as mediators, to be the firſt objects of idolatrous worſhip: though Helleniſm conſiſts principally in the worſhip of dead men and dæmons, yet the Grecians at firſt adored the ſun, moon, and ſtars, as even Plato owns; for, perceiving all things to run in a continual courſe, they called them θεους, gods, from θειν, to run. The Greek and Roman idolatry took its riſe from that of the Egyptians, Phœnicians, and Syrians. It is a certain maxim, that religion, as well as learning, and mankind itſelf, had its firſt original in the Eaſt. We ſhall therefore conſider that country firſt. Though the Egyptians were reputed the wiſeſt of the Gentiles, yet they appear, in their religious worſhip of beaſts, to have acted contrary to common ſenſe. It is alledged, the worſhip of brutes was the vail, under which were concealed the myſteries of their religion, as their morals were hid under hieroglyphics. But it is abominable to adore ſheep, cats, bulls, dogs, cows, ſtorks, apes, birds of prey, wolves, and ſeveral ſorts of oxen, as the Egyptians did, under any pretence whatever; the very heathens ridiculed this kind of idolatry; each province and diſtrict in Egypt entertained a peculiar devotion for ſome beaſt or other. What was ſignified by this monſtrous Egyptian idolatry is not eaſy to conceive; many fables have been invented to palliate its enormities. This idolatry had footing in Egypt, in the time of Moſes and the Patriarchs. Thus much for the Egyptian idolatry. The Phœnicians were among the moſt ancient nations and firſt idolaters; but all the account we have of their theology is in a little fragment preſerved by Euſebius little to be depended on.

It appears that the ſun, moon, and hoſt of heaven were worſhipped by the Jews, when they turned to idolatry, after the example of neighbouring heathens, without images, by an humble proſtration before them, or their emblems, light or fire: we muſt farther remark, though the Jews were guilty of ſeveral kinds of idolatry, eſpecially before the Babyloniſh captivity, yet the heathens very unjuſtly charged them with ſeveral acts of idolatry of which they were innocent.

However, the long abode of the Iſraelites in Egypt left in them a ſtrange propenſity to idolatry, which neither the miracles of Moſes, nor the rigour of his laws againſt the worſhip of idols, nor the ſplendid marks of God's preſence in the Iſraelitiſh camp, were ſufficient to overcome; they had contracted ſuch an invincible proneneſs to idolatry, that they not only perſiſted in the worſhip of the Egyptian deities, but adopted moreover every new one which came in their way, as they became acquainted with other nations. Moſes has recorded many inſtances of their idolatry; but they were guilty of many more, which have been preſerved by other inſpired writers, who ſeverally upbraid them with ſetting up and carrying about the idols of Remphan, Malkom, and many others of the like nature.

Saul and David, with all their authority, were not able to root out idolatry from among this people; they ſacrificed upon high places, they conſulted divines and magicians. Solomon himſelf, whom God had choſen to build his temple, erected altars to the falſe gods of the Phœnicians, Moabites, and Ammonites, &c. and there were few of the kings his ſucceſſors who did not in this reſpect ſhew a like weakneſs; thus Jeroboam, the ſon of Nebat, king of Iſrael, introduced the worſhip of the golden calves, which took ſo deep root in the kingdom of Iſrael, that it never was entirely extirpated.

Leaving the Eaſtern nations, it is now proper to remove to the Weſt, and conſider the idolatry of the Greeks and Romans, and other Weſtern nations, before Chriſt. Nothing can be more monſtrous than the idolatry of the Greeks and Romans, contained in their poets and claſſics in the hands of every child, where we meet with an incredible number of them.

The ancient Britons had abundance of magical rites, and adored a multiplicity of idols. The Germans had the ſame idols as the Britons: for, from the heathen Saxons, the Engliſh learned their idolatry.

Sozomen, with Origen and others affirm, that, when our Saviour was carried into Egypt, to avoid the perſecution of Herod, the idols of this country, which were very numerous, and worſhipped to the greateſt degree of ſtupidity and exceſs, were moſt of them ſhaken off their baſis; however, though idolatry was not perfectly ſuppreſſed,

preſſed, but was ſtill kept on foot in the ſame meaſure even in Rome, this is certain, that it began to be laid aſide after our Saviour's birth; the emperor Theodoſius, jun. deſirous to put a final end to the great work of aboliſhing idolatry, publiſhed very ſevere edicts, wherein he ordered all things belonging to idolatry to be deſtroyed throughout the Roman empire. At preſent idolatry flouriſhes moſt in China.

IDYLLION, εἰδύλιον, in ancient poetry, is only a diminutive of the word εἶδος, and properly ſignifies any poem of moderate extent, without conſidering the ſubject. But as the collection of Theocritus's poems were called Idyllia, and the paſtoral pieces being by far the beſt in that collection, the term idyllion ſeems to be now appropriated to paſtoral pieces. See the article PASTORAL POETRY.

So very different are our modern idyllions from thoſe of the ancients, by introducing none but allegorical ſhepherds, that a literal tranſlation of Theocritus's idyllions, however well executed, would be reliſhed only by people of taſte, and thoſe too well acquainted with the ſimplicity and manners of the ancients.

JEALOUSY, in general, denotes the fear of a rival; but is more eſpecially underſtood of the ſuſpicion which married people entertain of each other's fidelity and affection.

Bitter Waters of JEALOUSY, in Jewiſh antiquity, certain conſecrated waters, which a woman was obliged to drink, in order to clear herſelf of the crime of adultery, whereof her jealous huſband accuſed her; the conſequence of which draught was, that if innocent ſhe ſuffered no harm, but if guilty her belly ſwelled, &c.

JEARS, in the marine, a certain double tackle or complication of pullies, whereby to raiſe the principal ſail-yards of a ſhip, particularly thoſe of the main, fore, and mizen-ſails.

JECUR, the liver, in anatomy. See the article LIVER.

JEHOVAH, one of the Scripture names of God, ſignifying the Being who is ſelf-exiſtent, and gives exiſtence to others. See the article GOD.

JEJUNUM, in anatomy, the ſecond of the ſmall guts, ſo called becauſe it is uſually found empty. This is owing to the fluidity of the chyle, the greater ſtimulus of the bile in it, and the abundance of the lacteal veſſels with which it is furniſhed. Its ſituation is in the region above the navel; it has a great many connivent glands. Its beginning is where the duodenum ends; and it terminates where theſe valves are obliterated. Its length is different in various ſubjects; but is uſually between thirteen and ſixteen ſpans.

JEOFAILE, or JEOFAYLE, in law, a term uſed for an overſight in pleading, or other proceedings in law.

JESUITS, or the ſociety of Jeſus, a moſt famous religious order in the Romiſh church, founded by Ignatius Loyola, a native of Guipuſcoa in Spain, who in the year 1538, aſſembled ten of his companions at Rome, principally choſen out of the univerſity of Paris, and made a propoſal to them to form a new order; when, after many deliberations, it was agreed to add to the three ordinary vows of chaſtity, poverty, and obedience, a fourth, which was, to go into all countries whither the pope ſhould pleaſe to ſend them, in order to make converts to the Romiſh church. Two years after, pope Paul III. gave them a bull, by which he approved this new order, giving them a power to make ſuch ſtatutes as they ſhould judge convenient; on which, Ignatius was created general of the order; which in a ſhort time ſpread over all the countries of the world, to which Ignatius ſent his companions, while he ſtaid at Rome, from whence he governed the whole ſociety.

The entire ſociety is compoſed of four ſorts of members; novices, ſcholars, ſpiritual and temporal coadjutors, and profeſſed members. The novices continue ſo two years, after which they are admitted to make the three ſimple vows, of chaſtity, poverty, and obedience, in the preſence of their ſuperiors: the ſcholars add ſome ſpiritual exerciſes to their ſtudies. The principal coadjutors aſſiſt the profeſſed members, and alſo make the three ſimple vows: the temporal coadjutors, or lay-brothers, take care of the temporal affairs of the ſociety; and the profeſſed members, which compoſe the body of the ſociety, beſides the three ſimple vows, add a ſpecial vow of obedience to the head of the church in every thing relating to miſſions among idolaters and heretics. They have profeſſed houſes for their profeſſed members and their coadjutors; colleges, in which the ſciences are taught to ſtrangers; and ſeminaries, in which the young jeſuits go through a courſe of philoſophy and theology. They are governed by a general, who has four aſſiſtants, and who appoints rectors, ſuperiors of houſes, provincials, viſitors, and commiſſaries. The diſcipline of theſe houſes, and eſpecially of the colleges, was regulated by Ignatius himſelf.

JET, *Gagates*, in natural hiſtory, a ſolid, dry, opake, inflammable ſubſtance, found in large detached maſſes, of a fine and regular ſtructure, having a grain like that of wood, ſplitting more eaſily horizontally than in any other direction, very light, moderately hard, not fuſible, but readily inflammable, and burning a long time with a fine greeniſh flame.

It is of a fine deep black colour, very gloſſy and ſhining, except upon its ſurface, where it has been fouled by accident. When examined by the microſcope, it is found to be compoſed of a number of parallel plates, very thin, and laid cloſely upon one another. It is not ſoluble in, nor makes any effervеſcence with acids. It ſhould be choſen of the deepeſt black, of a moderate hardneſs, very light, and ſuch as will ſplit moſt evenly in an horizontal direction; this being its great characteriſtic, by which it is diſtinguiſhed from the cannel-coal, which breaks equally eaſy any way.

Jet is of great uſe to perfumers, and is ſometimes preſcribed in medicine.

JET D'EAU, a French term, frequently alſo uſed with us, for a fountain that caſts up water to a conſiderable height in the air. See the articles ADJUTAGE and FOUNTAIN.

JETSON, JETSEN, or JETSAM, in law, is uſed for any thing thrown out of a ſhip or veſſel that is in danger of being a wreck, and which is driven by the waves on ſhore. See FLOTSON.

JEWEL, any precious ſtone or ornament beſet with them. See DIAMOND, RUBY, &c.

JEWEL-BLOCKS, among ſailors, certain pullies hung to the outer-ends or yard-arms of the top-ſail yards: they are uſed to hoiſt the ſtudding-ſails by. See the article STUDDING-SAIL.

JEWEL-OFFICE, an office belonging to the crown, that has the charge of faſhioning and weighing the king's plate, and delivering it out by warrants from the lord chamberlain.

The principal officer is the maſter of the jewel-office, who has a ſalary of four hundred and fifty pounds per annum.

JEWS, thoſe who profeſs obedience to the laws and religion of Moſes, before whom every man worſhipped God according to the inclination of his own heart.

How far the religious ceremonies of the Jews were copied from thoſe of the Egyptians, among whom they had ſo long ſojourned, or how far they were typical of ſomething future, are queſtions which we leave to be diſcuſſed by divines. But as to the religion of the modern Jews, it is a manifeſt abſurdity; ſince being without a temple, ſacrifices, &c. it cannot be conſidered as ſubſiſting any longer.

JEWISH HOURS, in chronology. See the article HOUR.

JEZIDES, among the Mahometans, a term of ſimilar import with heretics among Chriſtians.

IGNIS-AQUA, Helmont's name for the alkaheſt. See ALKAHEST.

IGNIS FATUUS, in meteorology, a meteor, otherwiſe called, will-with-a-wiſp. See the article WILL-*With-a-Wiſp*.

IGNIS GEHENNÆ, the ſame with the univerſal diſſolvent, or alkaheſt. See ALKAHEST.

IGNIS JUDICII, in our old cuſtoms, a purgation by fire. See ORDEAL.

IGNITION, in chemiſtry, the heating metals red-hot,

hot, without melting them. Lead and tin are too ſoft to bear ignition, which takes effect only in the harder metals, as gold and ſilver, but eſpecially iron.

IGNORAMUS, in law, a term which ſignifies we are ignorant. This is uſed when the grand jury impannelled on the inquiſition of criminal cauſes, reject the evidence as too weak to make good the preſentment or indictment brought againſt a perſon, ſo as to bring him upon his trial by a petty jury; in which caſe they indorſe this word on the back of the bill of indictment. In conſequence of which, all further proceedings againſt the party accuſed are ſtopped, and the ſuppoſed offender is delivered without further anſwer.

IGNORANCE, *Ignorantia*, the privation or abſence of knowledge. See the article KNOWLEDGE.

IGNORANCE, in law, is a want of knowledge of the laws, which will not excuſe a perſon from ſuffering the penalty inflicted on the breach of them; for every one is obliged, at his peril, to know the laws of the land.

IGUANA, in zoology, an American ſpecies of lizard, with a long round tail, five toes on each foot, and the creſt of the throat and the dorſal future dentated.

JIB, among ſeamen, the foremoſt ſail of a ſhip, or that which is extended the furtheſt before the prow: it is, like all the other ſtay-ſails, of a triangular form, and is hoiſted from the jib-boom towards the fore-top-maſt head.

JIB-BOOM, a certain pole or ſloping maſt, which is run out on a line with the bowſprit, to bear out the jib to its proper extent: this boom can occaſionally be drawn in, which is always the caſe when they come into a harbour, to prevent breaking amongſt the ſhipping at anchor or paſſing.

ILEX, the holm-oak, or evergreen-oak, in botany, a genus of plants, the leaves of which are for the moſt part indented or ſinuated, and in ſome the edges of the leaves are prickly, and are ever-green; it hath amentaceous flowers, which are produced at remote diſtances from the fruit on the ſame tree; the fruit is an acorn, like the common oak.

Theſe trees are propagated by ſowing their ſeeds: the beſt ſeaſon for this work is in the beginning of March; but then, as the acorns are ripe in autumn, they ſhould be preſerved either in ſand, or dry earth, until the ſpring, otherwiſe they will loſe their growing faculty; which is commonly the caſe with thoſe brought annually from Genoa, ſcarce one ſeed in fifty of them ever riſing; however, ſince we have many large trees now in England, which produce good ſeeds, we need not ſend to Italy for them; but were I to adviſe, I ſhould much rather have them from Portugal than Italy; for the voyage being much ſhorter, they are generally brought from thence in very good condition; eſpecially if they are brought over in the paeket-boat to Plymouth.

The manner in which I would adviſe their being ſown is, for large quantities, in drills at about four feet diſtance; but for a ſmall parcel, they muſt be ſown in rows on a bed much nearer.

The ground on which theſe ſeeds are ſown, ſhould be well dug, and cleanſed from the roots of all noxious weeds, &c. and levelled even, and the great clods broken; then draw the rills with an hoe in a ſtraight line, as is practiſed in the ſowing of kidney beans, about two inches deep, laying the acorns therein three or four inches aſunder; then draw the earth over them with a head of a rake, obſerving that none of them are left uncovered, which would intice the vermin to attack your acorns, eſpecially the mice, whereby your ſeminary will be greatly injured, if not wholly deſtroyed.

Theſe trees are by many greatly eſteemed for hedges to ſurround wilderneſs quarters; but they are ſubject to grow too large for that purpoſe, becauſe we ſhould never hide the tops of the trees in ſuch places from the ſight; for they are, if rightly diſpoſed in the quarters, vaſtly more agreeable to the eye than the fineſt ſheared hedge in the world; but they may do well enough for a large fence, to obſtruct the ſight, or to defend a new plantation of tender trees; for which purpoſe the acorns ſhould be ſown in the place where the hedge is deſigned; and when the plants are come up, they ſhould be thinned, where they are too cloſe; and if the ground is kept clear from weeds, and every ſpring dug about the plants, they will ſoon form a good hedge; but you ſhould obſerve, not to let them grow too much in height before the lower part of the hedge is well ſtrengthened, which would occaſion its bending, and the branches would be ſubject to be diſperſed with ſtrong winds, or great ſnows, and thereby become very unſightly; but if they are regularly trained up they will make a good thick hedge from the ground to the height of thirty feet, and that in leſs time than any other ever-green tree whatever.

The ſoil in which theſe trees thrive beſt, is a hazelly loam, not too ſtrong, nor over light, in which they will grow to a large ſize, and reſiſt the ſevereſt cold of our climate; and retaining their leaves all the winter, afford an agreeable proſpect in that ſeaſon: but they ſhould by no means be planted near ſuch walks, or other parts of the garden, as are intended to be kept clean; for in the month of April, when they caſt their old leaves, they make a great litter, and are apt to blow about with the wind, and become very troubleſome; and in June, when their male flowers fall off, they occaſion no leſs trouble to clean them up daily in ſuch places; and in the pleaſanteſt ſeaſon of the year, they are the moſt unſightly trees in a garden, the old leaves decaying at that ſeaſon, and falling off; and the male flowers, which are generally in great plenty, are then produced, which renders it not ſo valuable in places much frequented; but for larger plantations, at a remote diſtance from the habitation, ſo as to be juſt within the view, they make a very handſome appearance, eſpecially in the winter ſeaſon.

The wood of this tree is accounted very good for many ſorts of tools and utenſils, as mallet-heads, mall-balls, chairs, wedges, beetles, pins, &c. as alſo for palliſadoes; and affords the moſt durable charcoal in the world, and is the common fuel in the ſouthern parts of France and Italy. *Miller's Gard. Dict.*

ILEX COCCIGERA, or holm-oak, is of much lower ſtature than the former ſorts, and ſeldom grows to the height of a tree: this, though a native of the warmeſt parts of France, yet will endure the cold of our climate in the open air. It may be propagated in the ſame manner as the former, and deſerves a place amongſt other ſhrubs of low growth, for its curioſity, as being the plant on which the kermes are bred.

ILIAC PASSION, called alſo *Volvulus*, *Miſerere Mi*, and *Chordapſus*, in phyſic, a ſevere kind of colic.

The word is derived from *ileon*, this inteſtine being uſually affected thereby; or perhaps from ειλεω, to twiſt.

This diſeaſe, by the Greeks named ειλεον, and by Celſus the diſeaſe of the ſmaller gut, is very acute. It is a violent inflammation of the inteſtine, which, unleſs ſpeedy relief be given, ſoon terminates in a gangrene, and death.

Wherefore blood muſt be plentifully drawn with great expedition, not once only, but twice, and generally thrice: then the belly is to be moved; but this is very difficult to be done, becauſe acrid cathartics cauſe too great an irritation, and are thrown up by vomit: therefore it is to be attempted by ſtimulating clyſters, and gentle cathartics, which are moſt likely to give mutual aſſiſtance to each other's operation. Anodynes too are neceſſary, but mixed with the purging medicines. Thus a very proper medicine will be a ſcruple of the cathartic extract, with one grain of the Thebaic extract; and ſome hours after, two ſpoonfuls of infuſion of ſena, with the addition of a fourth part of the tincture of ſena, to be taken either every hour, or every two hours, till the patient has had a ſufficient number of ſtools.

If this courſe prove ineffectual, it will be right to order quickſilver to be ſwallowed down; which has a two-fold uſe in this caſe; to wit, by its ponderoſity, that of reſtoring the natural motion of the inteſtines, which is inverted; and by its ſlipperineſs, that of ſoftening and driving downward the excrements which ſtop the paſſage. Upon theſe accounts it is to be given in large quantities, to a pound weight at leaſt; and generally requires to be repeated. Nor ought the phyſician to uſe any long delay in trying this experiment, for fear of an actual mortifica-

tion

tion of the inflamed parts, whereby the coats of the inteſtines are deſtroyed, and the quickſilver runs into the cavity of the abdomen.

In ſhort, fomentations are of ſome ſervice, particularly warm flannels ſoaked in ſpirits of wine; or what Sydenham preſcribes, a live puppy held conſtantly on the bare belly. But an immerſion up to the breaſt in the warm bath is far more beneficial; and if the pain is not diſcuſſed, it will be proper to apply cupping-glaſſes, with ſlight ſcarifications about the navel.

The ſame method of cure is to be obſerved in that ſevere diſeaſe by the French called *colica pictonum*, and by the Engliſh in the American iſlands, where it is very rife, the dry belly ach: for it is a pain attended with a fever and inflammation, and moſt troubleſome coſtiveneſs. *Mead.*

ILIACUS Musculus, in anatomy, a broad thick muſcle, lying on the inſide of the os ilium. It is fixed by fleſhy fibres to the internal labium of the creſt of the os ilium, to that of the ſlope between the two anterior ſpines, to the inſides of theſe ſpines, to the ſuperior half of the inſide of this bone, and to the adjacent lateral part of the os ſacrum. All theſe fibres, contracting by degrees, run obliquely towards the lower part of the muſculus pſoas, uniting with it; and being fixed by a kind of aponeuroſis to the outſide of its tendon, all the way to the little trochanter.

ILIAD, ιλιας, in literary hiſtory, the name of an ancient epic poem, the firſt and fineſt of thoſe compoſed by Homer.

As there was no true hiſtory before the firſt Olympiad, it is reaſonable to ſuppoſe that Homer took the ſubject of his Iliad from thoſe traditional ſtories which were handed down from father to ſon, reſpecting the Trojan war; adding ſuch other characters, allegories, and circumſtances, as were ſuitable to his deſign, which was evidently that of diſplaying to his countrymen, who were Greeks, the miſchievous effects of their too frequent diſſentions, and the benefits ariſing from a contrary conduct.

It is to be obſerved, that at the time Homer wrote this poem, and for ſome centuries before, the Grecians were divided into as many ſmall independent ſtates as they had large cities: and as their body politic and government were diſtinct and different, ſo was too often their intereſt, whence aroſe animoſities and ſometimes wars among themſelves; yet as theſe people had very powerful neighbours, and inveterate enemies, they were often obliged, notwithſtanding their own petty quarrels, to confederate themſelves together under one general for their mutual ſafety: and when they were thus united, and had no contention among them, they were generally victorious, and an over match even for the Perſians; but on the contrary, when by their own feuds and diſſentions, their armies were divided and weakened, their enemies prevailed over them, and part of their country was deſpoiled.

Homer ſaw this, and knowing that an inſtructive leſſon on the ſubject, diſguiſed under the allegories of an important action, and delivered in an inſinuating pleaſing manner, would do more good with ſuch a people than the moſt powerful oratory and argumentation, he compoſed his Iliad for their uſe; the deſign of which is to ſhew, that unanimity and concord among princes and governors occaſioned the preſervation and proſperity of ſtates, and that diſcord brought on their deſtruction. This therefore is the principal moral of the poem; and this he has exemplified in the anger of Achilles and its conſequences, which forms the action and fable of the poem, which is as follows:

Several Grecian princes, independent of each other, are united againſt the Trojans, to revenge themſelves of an inſult offered to Menelaus, king of Sparta. They elect Agamemnon, brother to the injured prince, their general, who by an act of violence affronts Achilles, the moſt valiant of all the confederates; upon which this prince breaks the union, withdraws from the army, and obſtinately refuſes to fight for the common cauſe; whereupon there are contentions among the troops, who grow mutinous, and the Trojans taking advantage of the abſence of Achilles, and of their diſputes and diviſions, recover new ſpirits, deſtroy a great number of the Greeks, and preſs them ſo cloſe, that they are obliged to raiſe fortifications to ſecure their fleet, are about to quit the Phrygian coaſt, and to return home with diſhonour. Agamemnon, by the advice of the other princes, ſolicits a reconciliation with Achilles, but in vain. He continues inexorable, and refuſes them aid, even at a time when all their beſt generals were wounded, their fortifications deſtroyed, and the fleet ſet on fire; at laſt, however, he permits his deareſt friend Patroclus to fight for the Greeks in his armour, who is killed by Hector; this draws the fury of Achilles on the Trojans; and Agamemnon and he having both ſeverely ſuffered for their folly, are made friends: Achilles returning again to the army, kills Hector with his own hand, and the Trojans are vanquiſhed: ſo that in this poem, which does not extend to the deſtruction of Troy, but ends with the death of Hector, becauſe that puts an end to the anger of Achilles, and the action is complete, the poet has fully inculcated his intended moral, by ſhewing the terrible effects which enſued from a diviſion among their princes, and the good effects which attended their union and friendſhip.

To excite curioſity, and raiſe our admiration to the higheſt pitch, he has inſerted many things that are wonderful, and out of nature; but they are generally introduced with the pomp of celeſtial machinery, and by favour of the gods and goddeſſes, in order that they may appear probable, and obtain belief. We are alſo to obſerve, that as valour was a darling paſſion among the Greeks, he has magnified their deeds, that they might read his work with the greater pleaſure, and that the moral might be more effectually fixed upon the mind.

Homer had ſuch a comprehenſive genius, ſuch a fertile fancy, and was ſo well acquainted with perſons and things, and eſpecially with the paſſions and humours of mankind, that the ancients eſteemed him as the great high-prieſt of nature, who was admitted into her inmoſt choir, and inſtructed in her moſt ſolemn myſteries. The characters of his perſons, though very numerous, are drawn with ſo much judgment, with ſuch a ſurpriſing variety, and ſo diſtinguiſhed by their manners and ſentiments; that every one has ſomething peculiar to himſelf, by which he is diſcovered even in his ſpeeches from all the reſt.

The diſtinctions he has obſerved in the different degrees of virtues and vices are extremely exact; and the ſingle quality of courage, which he has given to moſt of his heroes, is ſo wonderfully diverſified, that it appears different in each. Thus in a fine piece of painting, where ſome particular paſſion is repreſented, every face appears affected; but the attitude and turn of the features ſhew, that each is affected in a different manner, or in a different degree.

If we may credit Strabo the hiſtorian and geographer, Homer has been as exact in his deſcription of countries and cities, as in that of his perſons: but what more particularly recommends him to readers of taſte and genius, is his amazing imagination, his fertility of invention, which is indeed the very fountain of all poetry, and diſcovers itſelf in a miraculous manner, not only in his fable, allegories, machinery, and characters, but even in his deſcriptions, images, and ſimilies, which are even bold and animated. Every thing is alive in Homer. There is little of narration; for the perſons appear, as it were, before you, and ſpeak for themſelves. He has, as Ariſtotle obſerves, found out living words, and, by daring tropes and figures, conveys his ſentiments in an unuſual and ſurpriſing manner.

In him a weapon thirſts to drink the blood of an enemy; an arrow is impatient to be on the wing; his heroes are cloathed with courage and fortitude. Even his epithets diſcover his ſtrength of invention, and in many caſes anſwer the end of elaborate deſcriptions, eſpecially when compounded in his manner, as the Cloud-compelling Thunderer, the Far-darting Phœbus, &c. Nor is the force of his invention much leſs obvious in the ſtructure of his verſe, and the dignity and harmony of his numbers, which flow from Homer with ſo much eaſe, ſays Mr. Pope, that one would "imagine he had no other care than to tranſcribe as faſt as the muſes dictated; and at the ſame time with ſo much force and inſpiring vigour, that they awaken and raiſe us like the ſound of a trumpet.

They

They roll along as a plentiful river, always in motion, and always full; while we are borne away by a tide of verſe, the moſt rapid, and yet the moſt ſmooth imaginable.

"Thus on whatever ſide we contemplate Homer, what principally ſtrikes us is his invention. It is that which forms the character of each part of his work; and accordingly we find it to have made his fable more extenſive and copious than any other, his manners more lively and ſtrongly marked, his ſpeeches more affecting and tranſported, his ſentiments more warm and ſublime, his images and deſcriptions more full and animated, his expreſſion more raiſed and daring, and his numbers more rapid and various.

"What he writes is of the moſt animated nature imaginable; every thing moves, every thing lives, and is put in action. If a council be called, or a battle fought, you are not coldly informed of what was ſaid or done as from a third perſon; the reader is hurried out of himſelf by the force of the poet's imagination, and turns in one place to a hearer, in another to a ſpectator. The courſe of his verſes reſembles that of the army he deſcribes. They pour along like a fire that ſweeps the whole earth before it. It is, however, remarkable, that his fancy, which is every where vigorous, is not diſcovered immediately at the beginning of his poem in its fulleſt ſplendor. It grows in the progreſs, both upon himſelf and others, and becomes on fire like a chariot wheel, by its own rapidity. Exact diſpoſition, juſt thought, correct elocution, poliſhed numbers, may have been found in a thouſand; but this poetical fire, this *vivida vis animi*, in a very few. Even in works, where all thoſe are imperfect or neglected, this can overpower criticiſm, and makes us admire even while we diſapprove. Nay, where this appears, though attended with abſurdities, it brightens all the rubbiſh about it, till we ſee nothing but its own ſplendor. This fire is diſcerned in Virgil, but diſcerned as in a glaſs, reflected from Homer, more ſhining than fierce, but every where equal and conſtant. In Lucan and Statius, it burſts out in ſudden, ſhort, and interrupted flaſhes. In Milton, it glows like a furnace kept up to an uncommon ardour by the force of art. In Shakeſpear, it ſtrikes before we are aware, like an accidental fire from heaven: but in Homer, and in him only, it burns every where clearly, and every where irreſiſtibly.

"This ſtrong and ruling faculty was like a powerful ſtar, which, in the violence of its courſe, drew all things within its vortex. It ſeemed not enough to have taken in the whole circle of arts, and the whole compaſs of nature; all the inward paſſions and affections of mankind, to ſupply his characters; and all the outward forms and images of things for his deſcriptions; but, wanting yet an ampler ſphere to expatiate in, he opened a new and boundleſs walk for his imagination, and created a world for himſelf in the invention of fable; for that which Ariſtotle calls the ſoul of poetry, was firſt breathed into it by Homer."

ILIUM, in anatomy, the third and laſt of the ſmall guts, is ſituated principally below the navel, near the oſſa ilii; whence its name. Its length is various: ſometimes not more than fifteen, ſometimes twenty ſpans or more. Its beginning is where the valves of the jejunum ceaſe to be conſpicuous, and its end is where the larger inteſtines begin; in which place it is, in a very ſingular manner, inſerted into the left ſide of the colon. It has no other valves except that great one at the end, which is called, by many, valvula coli Bauhini: its glands are, in general, more numerous towards the end than in any other part.

ILIUM OS. See INNOMINATA OSSA.

IMAGE, in a religious ſenſe, is an artificial repreſentation or ſimilitude of ſome perſon or thing, uſed either by way of decoration and ornament, or as an object of religious worſhip and veneration; in which laſt ſenſe, it is uſed indifferently with the word idol. See the article IDOLATRY.

IMAGINATION, a power or faculty of the mind, whereby it conceives and forms ideas of things communicated to it by the outward organs of ſenſe.

IMAM, a name applied by the Mahometans to him who is head of the congregations in their moſques; and by way of eminence to him who has the ſupreme authority both in reſpect to ſpirituals and temporals.

There are ſubordinate imams in each town who repreſent the chief imam, but only with reſpect to religion. When the imam of the Muſſulman religion is mentioned without diſtinction, it is always reſtricted to the rightful and lawful ſucceſſor of Mahomet, the fountain both of ſecular and ſacred juriſdiction. The Mahometans are not perfectly agreed concerning the dignity of ſome of the circumſtances of this office: ſome hold the imamate to be ſettled by divine right, like the Aaronical prieſthood, in one family: others think it not ſo unalterably tied to genealogy and deſcent, as to hinder its paſſing from one family to another; and they ſay that an imam may be depoſed for vicious conduct, and his office conferred on another.

The Schiites, or diſciples of Ali, maintain, that this privilege belongs to the family of Ali excluſive of all others; Ali being ſole heir to Mahomet: hence, they own no perſon for the head of religion, who cannot prove his deſcent in a right line from this firſt imam. There are imams belonging to particular moſques, who are in the nature of our pariſh-prieſts.

IMBECILITY, a languid, infirm ſtate of body; which, being greatly impaired, is not able to perform its uſual exerciſes and functions.

IMBIBING, the action of a dry porous body, that abſorbs or takes up a moiſt or fluid one: thus, ſugar imbibes water; a ſponge, the moiſture of the air, &c. See MOISTURE, HYGROMETER, &c.

IMBRICATED, among botaniſts, an appellation given to ſuch leaves of plants, as are placed over one another like the tiles of a houſe.

The term imbricated is likewiſe applied to ſome of the heart ſhells, from their being ridged tranſverſely in the ſame manner.

IMITATION, in literary matters, the act of doing or ſtriving to copy after, or become like to another perſon or thing.

IMITATION, in muſic, a particular way of compoſition wherein each part is made to imitate the other, either throughout the whole piece, which is one of the kinds of canon; or only during ſome meaſures, which is a ſimple imitation.

Sometimes the motion or figure of the notes is only imitated, and that often by a contrary motion, which makes what they call a retrograde imitation.

IMMACULATE, ſomething without ſtain, chiefly applied to the conception of the holy virgin. See CONCEPTION.

IMMANENT, in logic. The ſchoolmen diſtinguiſh two kinds of actions, the one tranſient, which paſs from the agent to the patient; the other immanent, which continue in the agent. See ACT.

IMMATERIAL, ſomething devoid of matter, or that is pure ſpirit: thus God, angels, and the human ſoul, are immaterial beings. See the articles GOD, ANGEL, and SOUL.

IMMEDIATE, whatever is capable of producing an effect without the intervention of external means; thus we ſay, an immediate cauſe, in oppoſition to a mediate or remote one. See CAUSE.

IMMEMORIAL, in law, an epithet given to the time or duration of any thing, whoſe beginning we know nothing of.

IMMENSITY, an unlimited extenſion, or which no finite and determinate ſpace, repeated ever ſo often, can equal. See INFINITY.

IMMERSION, that act by which any thing is plunged into water, or other fluid. See FLUID.

Immerſion, in aſtronomy, is when a ſtar or planet is ſo near the ſun with regard to our obſervations, that we cannot ſee it; being, as it were, enveloped and hid in the rays of that luminary. It alſo denotes the beginning of an eclipſe of the moon, or that moment when the moon begins to be darkened, and to enter into the ſhadow of the earth; and the ſame term is alſo uſed with regard to an eclipſe of the ſun, when the diſk of the moon begins to cover it. In this ſenſe emerſion ſtands oppoſed to immerſion, and ſignifies the moment wherein the moon begins to come out of the ſhadow of the earth, or the ſun

ſun begins to ſhew the parts of his diſk which were hid before. See the article ECLIPSE.

Immerſion is frequently applied to the ſatellites of Jupiter, and eſpecially to the firſt ſatellite; the obſervation whereof is of ſo much uſe for diſcovering the longitude. The immerſion of that ſatellite is the moment in which it appears to enter within the diſk of Jupiter, and its emerſion the moment when it appears to come out.

The immerſions are obſerved from the time of the conjunction of Jupiter with the ſun, to the time of his oppoſition; and the emerſions from the time of his oppoſition to his conjunction.

The peculiar advantage of theſe obſervations is, that during eleven months of the year, they may be made at leaſt every other day. The perfection of this theory, and the praxis thereon, we owe to Mr. Caſſini.

IMMORTAL, that which will laſt to all eternity; as having in it no principle of alteration or corruption: thus God and the human ſoul are immortal. See the articles GOD and SOUL.

IMMUNITY, a privilege or exemption from ſome office, duty, or impoſition, as an exemption from tolls, &c.

IMMUTABILITY, one of the divine attributes, founded on the abſolute perfection of the Deity. See GOD.

IMPALED, in heraldry; when the coat of a man and his wife who is not an heireſs are borne in the ſame eſcutcheon, they muſt be marſhalled in pale; the huſband's on the right ſide, and the wife's on the left: and this the heralds call baron and feme, two coats impaled.

If a man has had two wives, he may impale his coat in the middle between theirs; and if he has had more than two, they are to be marſhalled on each ſide of his in their proper order.

IMPALPABLE, that whoſe parts are ſo extremely minute that they cannot be diſtinguiſhed by the ſenſes, particularly by that of feeling.

IMPANELLING, in law, ſignifies the writing down or entering into a parchment, liſt or ſchedule, the names of a jury ſummoned by the ſheriff to appear for ſuch public ſervices as juries are employed in. See the article PANNEL.

IMPARLANCE, in law, a petition in court for a day to conſider or adviſe what anſwer the defendant ſhall make to the plaintiff's action; and is the continuance of the cauſe till another day, or a longer time given by the court.

IMPASSIBLE, that which is exempt from ſuffering, or cannot undergo pain or alteration.

IMPASTATION, in maſonry, a term uſed for a work made of ſtuc, or ſtone, beaten and wrought up in manner of a paſte.

IMPASTING, or EMPASTING, in painting. See EMPASTING.

IMPEACHMENT, an accuſation and proſecution for treaſon and other crimes and miſdemeanors.

IMPEACHMENT *of Waſte*, is a prohibition or reſtraint from committing of waſte upon lands or tenements.

IMPEDIMENTS, in law, are ſuch hindrances as put a ſtop, or ſtay, to a perſon's ſeeking for his right by due courſe of law.

IMPENETRABILITY, in philoſophy, that property of body, whereby it cannot be pierced by another: thus, a body, which ſo fills a ſpace as to exclude all others, is ſaid to be impenetrable. See the articles BODY, EXTENSION, &c.

IMPERATIVE, one of the moods of a verb, uſed when we would command, entreat or adviſe: thus, *go*, *read*, *take pity*, *be adviſed*, are imperatives in our language; but in the learned languages, this mood has a peculiar termination to diſtinguiſh it from others, as *i*, or *ito*, *go*; *lege*, or *legito*, *read*, &c. and not only ſo, but the termination varies, according as you addreſs one or more perſons, as *audi* and *audite*; ακκε[ω, ακκε[ων, ακκε-τωσαν, &c.

IMPERATOR, in Roman antiquity, a title of honour conferred on victorious generals by their armies, and afterwards confirmed by the ſenate.

IMPERATORIA, maſter-wort, in botany, an umbelliferous plant, with large winged leaves, divided into three indented ſegments; producing thick oblong ſtriated ſeeds, ſurrounded with a narrow leafy margin: the roots are oblong, thick, knobby, jointed, with ſeveral lateral fibres, brown on the outſide, and whitiſh within. It is perennial, a native of the Alps and Pyrenees; from whence we are ſupplied with roots ſuppoſed to be ſuperior to thoſe which are raiſed in our gardens.

IMPERFECT, ſomething that is defective, or that wants ſome of the properties found in other beings of the ſame kind: thus moſſes are called imperfect plants, becauſe almoſt all the plants of fructification are wanting in them; and for the like reaſon, is the appellation imperfect given to the fungi and ſubmarine plants.

IMPERFECT FLOWERS, thoſe otherwiſe called ſtamineous. See the article STAMINEOUS.

IMPERFECT NUMBERS, ſuch whoſe aliquot parts taken together, do either exceed or fall ſhort of that whole number of which they are parts: they are either abundant or deficient. See the articles ABUNDANT and DEFICIENT.

IMPERFECT TENSE, in grammar, a tenſe that regards ſome præterite tenſe, or denotes the thing to be at that time preſent, and not quite finiſhed; as *ſcribebam*, *I was writing*.

IMPERIAL, ſomething belonging to an emperor or empire, as imperial crown, imperial chamber, imperial cities, imperial diet, &c.

IMPERSONAL VERB, in grammar, a verb to which the nominative of any certain perſon cannot be prefixed; or, as others define it, a verb deſtitute of the two firſt and primary perſons, as *decet*, *oportet*, &c. The imperſonal verbs of the active voice end in *t*, and thoſe of the paſſive in *tur*; they are conjugated through the third perſon ſingular of almoſt all the tenſes and moods: they want the imperative, inſtead of which we uſe the preſent of the ſubjunctive; as *pæniteat*, *pugnetur*; nor, but a few excepted, are they to be met with in the ſupines, participles, or gerunds.

IMPERVIOUS, a thing not to be pervaded, nor paſſed through, either by reaſon of the cloſeneſs of its pores, or the particular configuration of its parts.

IMPETIGO, in medicine, a name by which the leproſy of the Greeks is ſometimes called. See the article LEPROSY.

IMPETIGO is alſo a ſpecies of itch attended with dry ſcales or ſcurf, and an uneaſy pruriginous itching. See ITCH.

IMPETUS, in mechanics, the force with which one body impels or ſtrikes another. See MOMENTUM, GUNNERY, &c.

IMPING, in falconry, the inverting of a feather in the wing of an hawk, in the place of one that is broken.

IMPLEAD ſignifies to ſue or proſecute by due courſe of law.

IMPLEMENTS is uſed for all things neceſſary for a trade, or the furniture of an houſhold; in which ſenſe it is frequently uſed in wills, conveyances of moveables, &c.

IMPLICATION, in law, is where ſomething is implied that is not expreſſed by the parties themſelves in their deeds, contracts, and agreements.

IMPORTATION, in commerce, the bringing merchandize into a kingdom from foreign countries; in contradiſtinction to exportation. See the article EXPORTATION.

IMPOSITION *of Hands*, a religious ceremony, in which the biſhop lays his hand upon the head of a perſon, in ordination, confirmation, or in uttering a bleſſing. This practice is alſo generally obſerved by the diſſenters at the ordination of their miniſters, when all the miniſters preſent place their hands upon the head of him whom they are ordaining, while one of the body prays for a bleſſing on him and his future labours.

IMPOSSIBLE, that which cannot be done or effected.

A propoſition is ſaid to be impoſſible, when it contains two ideas, which mutually deſtroy each other, and which can neither be conceived nor united together in the mind: thus, it is impoſſible that a circle ſhould be a ſquare,

becauſe we conceive clearly that ſquareneſs and roundneſs deſtroy each other by the contrariety of their figure.

IMPOST, in law, ſignifies in general a tribute or cuſtom; but is more particularly applied to ſignify that tax which the crown receives for merchandizes imported into any port or haven. See DUTY.

Some notwithſtanding, diſtinguiſh impoſts from cuſtoms, which laſt are rather the profits ariſing to the king from goods exported. See the article CUSTOMS.

IMPOSTS, in architecture, the capitals of pillars, or pilaſters, which ſupport arches.

An impoſt, ſometimes called chaptrel, is a ſort of plinth, or little corniche, which crowns a pier, and ſupports the firſt ſtone whence an arch or vault commences. The impoſts are conformable to their proper orders. The Tuſcan has only a plinth; the Doric has two faces crowned; the Ionic, a larmier, or crown over the two faces, and its mouldings may be carved; the Corinthian and Compoſite have a larmier, frieze, and other mouldings.

The projectures of the impoſts muſt not exceed the naked of the pilaſter: ſometimes the entablature of the order ſerves for the impoſt of the arch, and this has a very grand and ſtately appearance. The impoſt is a thing very eſſential to the compoſition of the ordonnances, inſomuch that without it, in the place where the curve-line of the arch meets with the perpendicular line of the pillar, there always ſeems a kind of elbow.

IMPOSTHUME, in ſurgery, &c. the ſame with abſceſs. See ABSCESS.

IMPOTENCE, or IMPOTENCY, in general, denotes want of ſtrength, power, or means to perform any thing.

IMPRACTICABLE CASE, in algebra, that otherwiſe called irreducible. See IRREDUCIBLE.

IMPRECATION, a curſe, or wiſh that evil may befal any one. See EXECRATION.

IMPRESSION is applied to the ſpecies of objects, which are ſuppoſed to make ſome mark or impreſſion on the ſenſes, the mind, and the memory.

IMPRESSION alſo denotes the edition of a book, regarding the mechanical part only; whereas edition, beſides this, takes in the care of the editor, who corrected or augmented the copy, adding notes, &c. to render the work more uſeful. See EDITOR.

IMPRISONMENT, the ſtate of a perſon reſtrained of his liberty, and detained under the cuſtody of another.

IMPROPRIATION, a parſonage or eccleſiaſtical living, the profits of which are in the hands of a layman; in which ſenſe, it ſtands diſtinguiſhed from appropriation, which is where the profits of a benefice are in the hands of a biſhop, college, &c. though theſe terms are now often uſed promiſcuouſly. See the article APPROPRIATION.

IMPUTATION, in general, the charging ſomething to the account of one, which belonged to another: thus, the aſſertors of original ſin maintain, that Adam's ſin is imputed to all his poſterity. See the article ORIGINAL SIN.

In the ſame ſenſe, the righteouſneſs and merits of Chriſt are imputed to true believers. See the article JUSTIFICATION.

INACCESSIBLE, ſomething that cannot be come at, or approached, by reaſon of intervening obſtacles, as a river, rock, &c. It is chiefly uſed in ſpeaking of heights and diſtances. See HEIGHT and DISTANCE.

INACTIVITY *of Matter*. See INERTIA.

INADEQUATE IDEA. See IDEA.

INALIENABLE, that which cannot be legally alienated or made over to another: thus the dominions of the king, the revenues of the church, the eſtates of a minor, &c. are inalienable, otherwiſe than with a reſerve of the right of redemption.

INAMELLING, or ENAMELLING. See the article ENAMELLING.

INANIMATE, a body that has either loſt its ſoul, or that is not of a nature capable of having any.

INANITION, among phyſicians, denotes the ſtate of the ſtomach when empty, in oppoſition to repletion.

INARCHING, in gardening, is a method of grafting, commonly called grafting by approach. See GRAFTING *by Approach*.

INAUGURATION, the coronation of an emperor or king, or the conſecration of a prelate: ſo called from the ceremonies uſed by the Romans, when they were received into the college of augurs. See CORONATION, CONSECRATION, &c.

INCA, or YNCA, a name given by the natives of Peru to their kings, and the princes of the blood. Pedro de Ciéça, in his Chronicle of Peru, gives the origin of the incas, and ſays, that that country was, for a long time, the theatre of all manner of crimes, of war, diſſention, and the moſt dreadful diſorders, till at laſt two brothers appeared, one of whom was called Manco Capac; of this perſon, the Peruvians relate many wonderful ſtories. He built the city of Cuſco, made laws, eſtabliſhed order and harmony by his wiſe regulations, and he and his deſcendants took the name of inca, which ſignifies king or great lord. Theſe incas became ſo powerful, that they rendered themſelves maſters of all the country from Paſto to Chili, and from the river Maule on the ſouth, to the river Augaſmago on the north; theſe two rivers forming the bounds of their empire, which extended above thirteen hundred leagues in length. This they enjoyed till the diviſions between inca Guaſcar and Atabalipa, which the Spaniards laying hold of, made themſelves maſters of the country, and deſtroyed the empire of the incas.

INCAMERATION, a term uſed in the chancery of Rome, for the uniting of lands, revenues, or other rights, to the pope's domain.

INCANTATION, denotes certain ceremonies, accompanied with a formula of words, and ſuppoſed to be capable of raiſing devils, ſpirits, &c.

INCAPACITY, in the canon-law, is of two kinds: 1. The want of a diſpenſation for age in a minor, for legitimation in a baſtard, and the like: this renders the proviſion of a benefice void in its original. 2. Crimes and heinous offences, which annul proviſions at firſt valid.

INCARNATION, in theology, the act whereby the ſecond perſon of the Holy Trinity aſſumed the human nature, viz. a true body and reaſonable ſoul, in order to accompliſh the redemption of fallen man-kind. See TRINITY and REDEMPTION.

This fundamental doctrine of Chriſtianity is very expreſly taught in Scripture: thus, in Gal. iv. 4. it is ſaid, "God ſent forth his ſon, made of a woman:" and 1 John iv. 14. "And we have ſeen and do teſtify, that "the Father ſent the Son to be the Saviour of the "world."

The generation of Chriſt was miraculous, as being conceived by the power of the Holy Ghoſt, and born of the Virgin Mary; from the time of which bleſſed nativity, the chriſtian æra commences. See the article EPOCHA.

INCARNATIVES, in ſurgery, medicines which aſſiſt nature in filling up wounds or ulcers with fleſh; or rather remove the obſtructions thereto. See the article VULNERARY.

Internal incarnatives are aliments which ſupply a balſamic chyle, and conſequently generate fleſh, and produce a full or plump habit.

INCARTATION, among chemiſts, the ſame with depart. See DEPART.

INCENSE, or FRANK-INCENSE, in the materia medica. See the article THUS.

INCEPTIVE, a term uſed by Dr. Wallis to expreſs ſuch moments, or firſt principles, which, though of no magnitude themſelves, are notwithſtanding capable of producing it. Thus, a point is inceptive of a line, and a line inceptive of ſurface, &c.

INCEST, the crime of venereal commerce between perſons who are related in a degree wherein marriage is prohibited by the law of the country.

INCEST SPIRITUAL, a crime committed in like manner between perſons who have a ſpiritual alliance by means of baptiſm or confirmation.

INCH, a well known meaſure of length; being the twelfth part of a foot, and equal to three barley corns in length. See FOOT and MEASURE.

5 JA 59

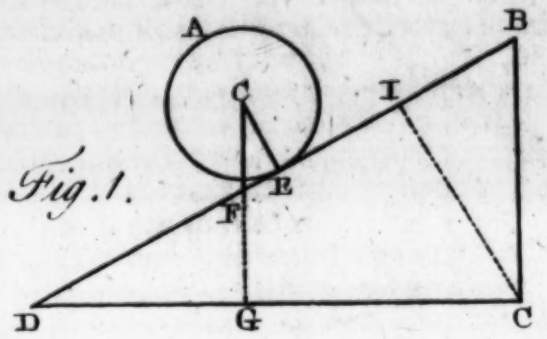
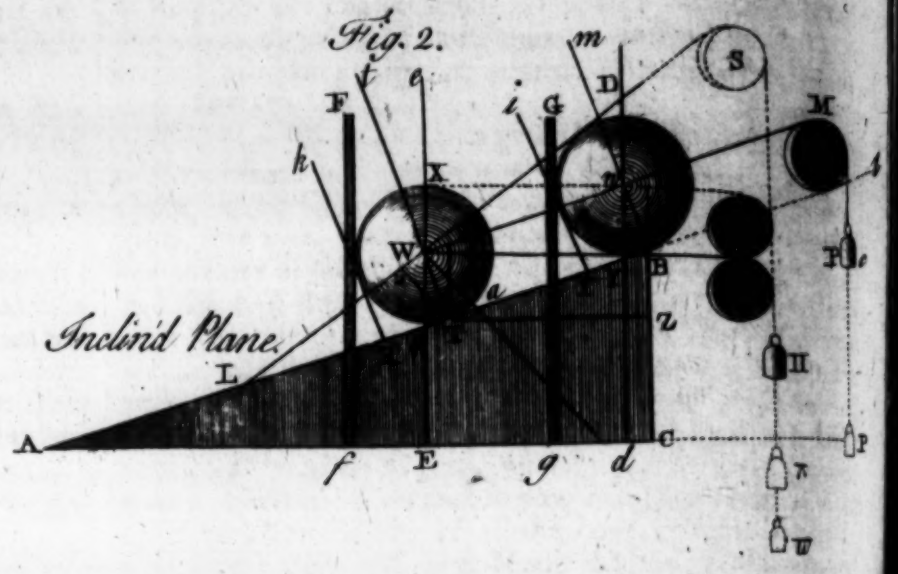


Fig. 1.



Infinite in Mathematicks.

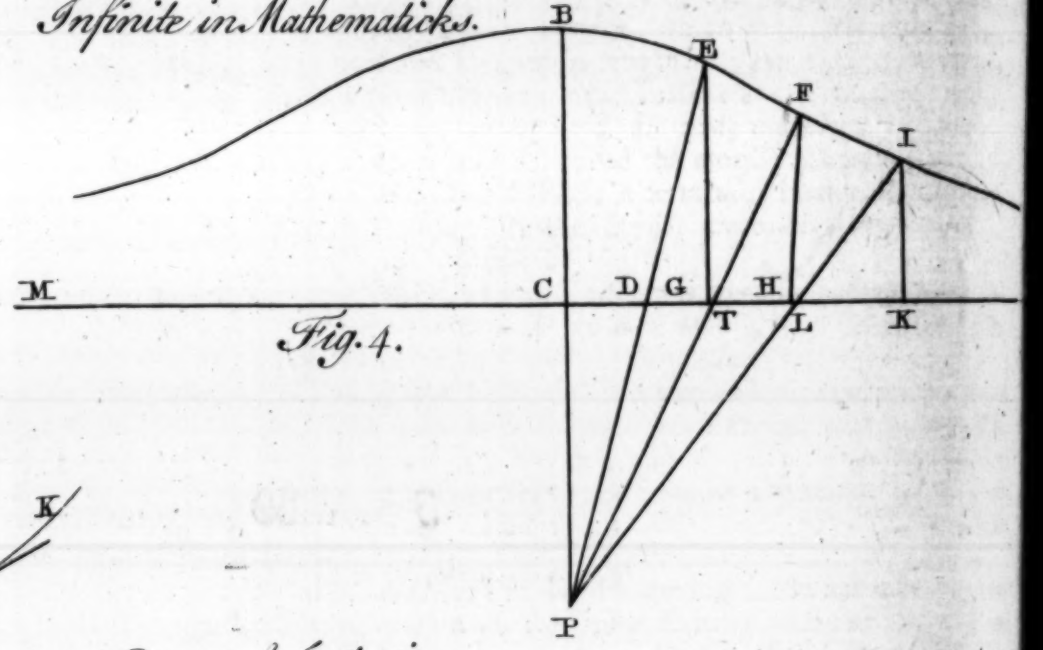


Fig. 4.

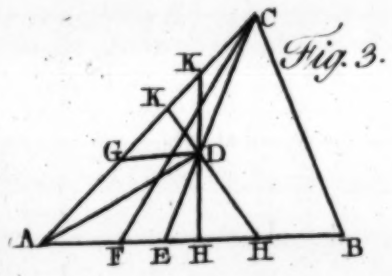


Fig. 3.

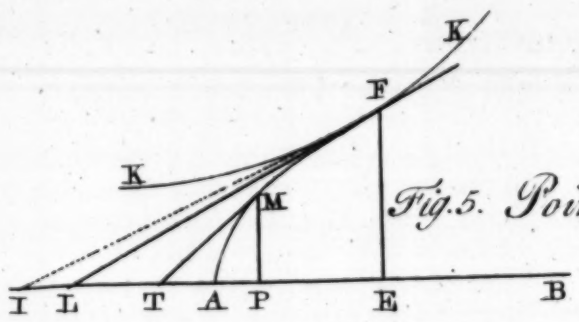


Fig. 5. Point of Inflection.

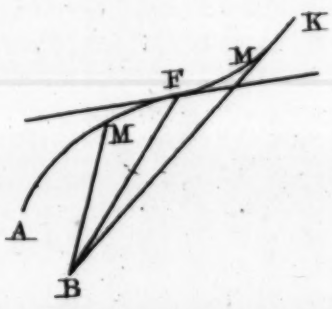


Fig. 6.

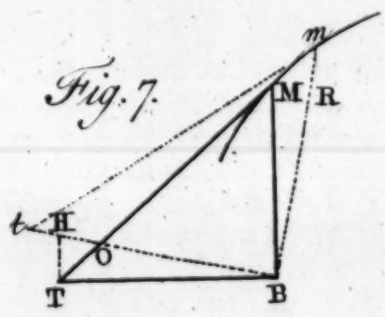


Fig. 7.

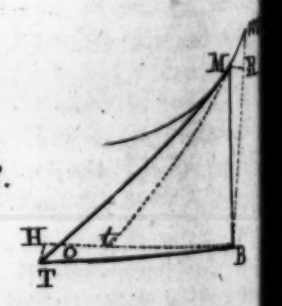


Fig. 8.

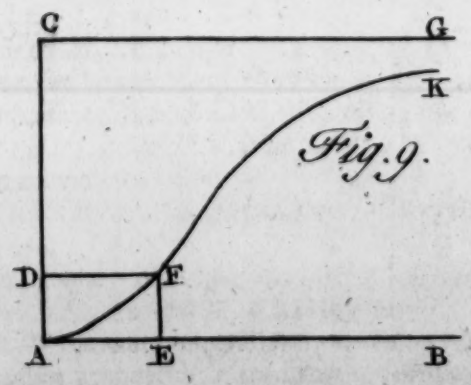


Fig. 9.

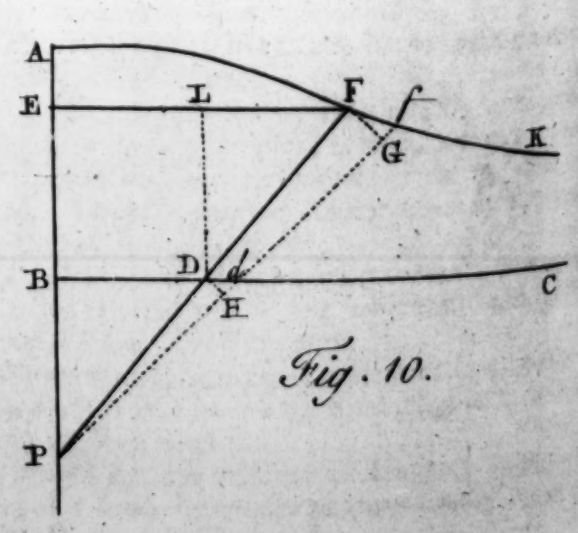


Fig. 10.

INCH *of Candle*, or ſale by inch of candle. See the article CANDLE.

INCIDENCE, in mechanics and optics, denotes the direction in which one body ſtrikes on another. See ANGLE.

INCIDENT, in law, ſomething that inſeparably belongs to another: thus, a court baron is incident to a manor.

INCIDENT, in poetry, denotes much the ſame with epiſode. See EPISODE.

INCISIVE, an appellation given to whatever cuts or divides: thus, the fore-teeth are called *dentes inciſivi*, or cutters; and medicines of an attenuating nature, incidents, or inciſive medicines. See the articles TEETH, and ATTENUANTS.

INCLE, a kind of tape made of linen-yarn.

INCLINATION is a word frequently uſed by mathematicians, and ſignifies the mutual approach, tendency or leaning of two lines, or two planes, towards each other, ſo as to make an angle.

Inclination of a right line to a plane, is the acute angle which that line makes with another right line drawn in the plane through the point where the inclined line interſects it, and through the point where it is alſo cut by a perpendicular drawn from any point of the inclined plane.

Inclination of the axis of the earth, is the angle which it makes with the plane of the ecliptic; or the angle contained between the planes of the equator and ecliptic.

Inclination of a planet, is an arch of the circle of inclination, comprehended between the ecliptic and the plane of a planet in its orbit.

The greateſt inclination of Saturn, according to Kepler, is 2° 32′; of Jupiter, 1° 20′; of Mars, 1° 50′ 30″; of Venus, 3° 22′; of Mercury, 6° 54′. According to de la Hire, the greateſt inclination of Saturn is 2° 33′ 30″; of Jupiter, 1° 19′ 20″; of Mars, 1° 51′ 00″; of Venus, 3° 25′ 5″; of Mercury, 6° 52′ 00″.

INCLINATION *of a Plane*, in dialling, is the arch of a vertical circle, perpendicular both to the plane and the horizon, and intercepted between them.

INCLINED PLANE, in mechanics, that which makes an oblique angle with the horizon.

That an inclined plane is a mechanical power appears ſufficiently in its diminiſhing the weight of a body laid upon it in regard to the power which holds it in æquilibrio. Let A (plate LXXVI. *fig.* 1.) be a body ſuſtained on the inclined plane B D; from the center C draw C F perpendicular to the horizon or baſe D C, and C E perpendicular to the plane; then C F will repreſent the whole weight or force of gravity of the body A, which is reſolvable into the two forces C E and E F; but the force C E, being perpendicular to the plane, acts wholly upon it, and is equally re-acted on or ſuſtained by the plane; the other force E F, being parallel to the plane, is that by which the body deſcends, or is kept from deſcending by an equal power acting in a contrary direction. Therefore the whole weight of the body is to the power which keeps it in æquilibrio on the plane as C F to F E, or (becauſe the triangles C F E and B D C are ſimilar) as B D to B C, that is, as the length of the plane to its height.

If it ſhould be required to lift up a very heavy body as W or *w* (*fig.* 2.) the height C B, it would be impracticable to raiſe it up in the line C B without a power whoſe intenſity is equal to that of the weight; and even in that caſe very inconvenient to do it, eſpecially in building. But if an inclined plane A B be laid ariſing from the horizontal line A C, from whence the weight is to be raiſed, a leſs power than the weight will ſerve for that purpoſe, unleſs it puſhes the body directly againſt the plane (as in the direction W T) or draws the body away from the plane (as from W towards *e*, *t*, or L) or in any direction on that ſide of the line E *e*.

The direction in which the body can moſt eaſily be drawn or puſhed up the plane is the line W *w* M, parallel to the plane, and paſſing through the center of the weight; for whether the power divides a plane *k* K (in a direction perpendicular to it) along the line W M, or the power (by its deſcent to *p*) draws it in the ſame line, the velocity of the power will be equal to the line W *w*, the ſpace deſcribed by the center of gravity of the weight, whilſt the ſame weight riſes only the perpendicular height Z B (= *n* W) or has the ſaid line properly to expreſs its velocity. If the body was a cylinder, as a rolling ſtone, and the plane T *t* were to paſs through the gudgeons or axis of the ſaid ſtone; it is evident that the caſe would be the ſame; and as the weight P has its rope running over the roller (or upper pulley) M, the line P *p* will be the velocity of the power. Therefore in this caſe the weight (if kept in æquilibrio) will be to the power, as W *w* (= T B) to *w* Y (= B Z) or as the hypothenuſe A B is to the perpendicular B C, which (by Eucl. 4. 6) are in the ſame proportion; and conſequently, if the power be never ſo little increaſed, it will draw the weight up the plane.

That the power acts with the greateſt advantage, whilſt it draws in the line of direction W *w* (parallel to the plane) is evident, becauſe if one end of the ſaid plane of direction remaining fixed at W, the other ſhould move towards B, or beyond it, then the body would be partly drawn againſt the plane, and therefore the power muſt be increaſed in proportion to the greateſt difficulty of traction: and if the end *w* of the line abovementioned ſhould be carried to D, or beyond it, the power muſt be alſo increaſed, inaſmuch as it endeavours to lift the body off from the plane.

If the power draws in a line of direction W B (*fig.* 2.) parallel to the baſe of the plane; then, in order to keep the weight W in æquilibrio by the power Π, the ſaid power muſt be to the weight, as Z B to Z T, or as the perpendicular B C to the baſe A C of the triangle A C B. For if we ſuppoſe the pulley R at ſo great a diſtance from W, that the line of direction W R may not ſenſibly alter its horizontal poſition, whilſt the body W riſes the height B Z, in ſuch manner that Π *ϖ* (= W Y, and not W *w*) will be the velocity of the power. So that the velocity of the power to that of the weight will not be as the hypothenuſe to the perpendicular, as in the former caſe, but as the baſe to the perpendicular in the triangle A C B.

If the powers be increaſed juſt enough to overcome the friction of the plane and draw up the body W, let the pulley R be lifted up gradually to *r*, ſo as to keep the line W R parallel to itſelf till it comes to *w r*, and the power will be deſcended to *π*, when the weight is come to *w* B. But Π *π*, together with the diſtance R *r*, is equal to Π *ϖ*, or W Y, &c. And this traction, being conſtantly made in the angle W B T, is the caſe.

INCLINERS, or INCLINING DIALS. See the article DIALLING.

INCLOSURE, in huſbandry, the fence or hedge made to incloſe lands. See the articles FENCE and HEDGE.

A very good incloſure may be of made elder-ſticks, or truncheons, cutten or twelve feet long, and ſtuck into the bank ſlopewiſe, ſo as to make a chequer-work. Theſe make the ſpeedieſt ſhelter of any; and when the trees are grown up, they are valuable for the turner's uſe. They ſucceed extremely well in watery places; and when planted on the banks of rivers, they prevent them from being undermined by the current.

The throwing down incloſures is an offence puniſhable by our ancient ſtatutes; yet if the lord of a manor incloſes part of the waſte, and does not leave ſufficient room for the commoners, they may break down ſuch incloſures, or have a writ of aſſize.

INCOGNITIO, or INCOG, is applied to a perſon that is in any place where he would not be known: but it is more particularly applied to princes, or great men, who enter towns, or walk the ſtreets without their ordinary train, or the uſual marks of their diſtinction and quality.

INCOMBUSTIBLE, ſomething that cannot be burnt or conſumed by fire.

INCOMMENSURABLE, a term in geometry, uſed where two lines, when compared to each other, have no common meaſure, how ſmall ſoever, that will exactly meaſure them both. And in general, two quantities are ſaid to be incommenſurable, when no third quantity can be found that is an aliquot part of both.

Such are the diagonal and ſide of a ſquare; for though each of thoſe lines have infinite aliquot parts, as the half, the third, &c. yet not any part of the one, be it ever ſo little, can poſſibly meaſure the other, as is demonſtrated in prop. 17. lib. x. of Euclid.

Rappus, lib. iv. prop. 17. ſpeaks alſo of incommenſurable angles. As to ſurfaces which cannot be meaſured by a common ſurface, they are ſaid to be incommenſurable in power.

INCOMMENSURABLE NUMBERS are ſuch as have no common diviſor that will divide them both equally.

INCOMPATIBLE, that which cannot ſubſiſt with another without deſtroying it: thus cold and heat are incompatible in the ſame ſubject, the ſtrongeſt overcoming and expelling the weakeſt.

INCORPOREAL, a thing, or ſubſtance, which has no body; as God, angels, and the ſoul of man.

INCORRUPTIBLE, that which cannot be corrupted.

INCORRUPTIBILES, or INCORRUPTICOLÆ, in church-hiſtory, heretics which had their original at Alexandria, in the time of the emperor Juſtinian. Their diſtinguiſhing tenet was, that the body of Jeſus Chriſt was incorruptible from his conception, by which they meant that after and from the time he was formed in the womb of his holy mother, he was not ſuſceptible of any change or alteration, not even of any natural and innocent paſſions, as hunger, thirſt, &c. ſo that he eat without any occaſion before his death, as well as after his reſurrection.

INCRASSATING, in pharmacy, &c. the rendering fluids thicker by the mixture of other ſubſtances leſs fluid; or by the evaporation of the thinner parts.

INCREMENT, and DECREMENT, the increaſe and decreaſe of a quantity. See the article SERIES.

INCRUSTATION, in ſurgery, the induction of a cruſt or eſchar upon any part.

Among maſons, incruſtation ſignifies the lining or coating of a wall, either with gloſſy ſtones, ruſtics, marble, pottery, or ſtucco-work, and that either equably or in panels and compartiments.

INCRUSTED, or INCRUSTATED COLUMN, is a column conſiſting of ſeveral pieces, or ſlips of ſome precious marble maſticated or cemented round a mould of brick, or other matter.

INCUBATION, the action of a hen, or other fowl brooding on her eggs.

INCUBUS, or EPHIALTES, in phyſic, commonly called the night-mare, a diſorder under which the patient cannot ſtir himſelf, but with the utmoſt difficulty; is ſeized with a numbneſs and ſenſe of weight, with a dread of ſuffocation, and an oppreſſion, as from ſome body falling ſuddenly upon him.

The word is derived from the Latin *incumbo*, in regard the patients fancy they feel ſomething aſcending and ſitting upon their breaſt.

This appears to be a diſeaſe of ſtricture, from the ſenſe of weight attending it; and of the chronical kind, from the length of time; and it is not always without danger, for ſome have died under the violence of the ſuffocation.

The incubus is of a bad kind, when it ſeizes the patient, though awake, in the night; but worſt of all, when, after moleſting him in his ſleep, it leaves him to awake under a cold ſweat and palpitation of the heart. Such as have been long and often ſubject to it, have reaſon to apprehend ſome dangerous diſtempers of the head, as a vertigo, apoplexy, &c.

The cure conſiſts in evacuations by phlebotomy and cathartics. The patient muſt be kept to a thin diet, and avoid all flatulent food.

INCUMBENT, a clerk, or miniſter, who is reſident on his benefice: he is called incumbent, becauſe he does, or at leaſt ought to bend his whole ſtudy to diſcharge the cure of his church.

INCURVATION *of the Rays of Light*, their bending out of a rectilinear or ſtraight courſe, occaſioned by refraction. See REFRACTION.

INCUS, in anatomy, a bone of the internal ear. See the article EAR.

INDEFEISIBLE, or INDEFEAZABLE, a term in law, for what cannot be defeated or made void; as an indefeiſible eſtate of inheritance, &c.

INDEFINITE, or INDETERMINATE, that which has no certain bounds, at leaſt aſſignable by the human mind.

Deſcartes uſes the word inſtead of infinite, in numbers and quantities, to ſignify a number ſo great, that an unit cannot be added to it; and a quantity ſo great, as not to be capable of any addition.

INDEFINITE, in the ſchools, alſo denotes a thing that has but one extreme; for inſtance, a line drawn from any point and extended infinitely, as alſo eternity *a parte ante*, or eternity *a parte poſt*.

INDEFINITE *Propoſition*. See the article PROPOSITION.

INDEFINITE, in grammar, implies ſuch nouns, pronouns, verbs, participles, &c. which are left in an uncertain indeterminate ſenſe, and not fixed to any particular time, or other circumſtance.

INDELIBLE, ſomething that cannot be cancelled or effaced.

INDEMNITY, in law, the ſaving harmleſs; or a writing to ſecure one from all damage and danger that may enſue from any act. An indemnity in regard to eſtates, is called a warranty. See the article WARRANTY.

Act of INDEMNITY, the ſame with act of grace. See *Act of* GRACE.

INDENTED, in heraldry, is when the out-line of an ordinary is notched like the teeth of a ſaw.

INDENTED LINE, in fortification, the ſame with what the French engineers call redent; being a trench and parapet running out and in, like the teeth of a ſaw; and is much uſed in irregular fortification. See FORTIFICATION.

INDENTED LEAF, among botaniſts, is one notched round its verge. See SERRATED.

INDEPENDENTS, a ſect of proteſtants in England and Holland, ſo called from their independency on other churches, and their maintaining that each church or congregation has ſufficient power to act and perform every thing relating to religious government within itſelf, and is no way ſubject or accountable to other churches or their deputies.

The preſent independents differ from the preſbyterians only in their church government, in being generally more attached to the doctrines diſtinguiſhed by the term orthodoxy, &c. and in adminiſtering the Lord's Supper at the cloſe of the afternoon's ſervice. See PRESBYTERIANS.

The ſeveral ſects of baptiſts are all independents with reſpect to church government.

INDETERMINATE, in general, an appellation given to whatever is not certain, fixed, and limited; in which ſenſe, it is the ſame with indefinite.

INDETERMINATE PROBLEM, in algebra, one which is capable of an indefinite number of ſolutions.

INDEX, in anatomy, the ſame with the fore-finger. See FINGER.

INDEX, in arithmetic and algebra, ſhews to what power any quantity is involved, and is otherwiſe called exponent. See EXPONENT.

INDEX *of a Logarithm*, that which ſhews of how many places the abſolute number belonging to a logarithm doth conſiſt; and of what nature it is, whether an integer or fraction. Thus, in this logarithm 2.523421, the number 2 ſtanding on the left hand of the point is called the index; becauſe it ſhews that the abſolute number anſwering to the above logarithm, conſiſts of three places: for the number is always one more than the index.

If the abſolute number be a fraction, then the index of the logarithm hath a negative ſign, marked thus $\bar{2}.523421$. See the article LOGARITHM.

INDEX *of a Globe*, the little ſtyle or gnomon, which being fixed on the pole of the globe, and turning round with it, points out the hours upon the hour circle. See the article GLOBE.

Expurgatory INDEX, a catalogue of prohibited books by the church of Rome.

INDIA PROPER, or HITHER INDIA, a large peninſu-

in Aſia, bounded on the north by Uſbec Tartary, and Thibet; on the eaſt, by another part of Thibet, the kingdom of Aſem, Ava, and Pegu; on the ſouth by the bay of Bengal, and the Indian ocean; and by the ſame ocean and Perſia on the weſt: ſituated between 66° and 92° of eaſt longitude, and between 7 and 40° of north latitude; being about 2000 miles in length from north to ſouth, and 1500 miles in breadth from eaſt to weſt, where broadeſt; though the ſouthern part of the peninſula is not 300 miles broad. All the country within theſe limits is either ſubject or tributary to the great Mogul. It is frequently called Indoſtan, a name ſuppoſed to be derived from the river Indus, on its weſtern frontiers: it is alſo called the Mogulſtan, from the imperial family now upon the throne, who trace their pedigree from Tamerlane, a Mogul Tartar.

The produce of this country, and what the Europeans import from thence, is chiefly chints, callicoes, muſlins, ſome ſilk, pepper, and diamonds, which are purchaſed by moſt nations with ſilver; but the Dutch frequently barter ſpices for them, which makes the India trade doubly advantageous to them.

INDIA beyond the Ganges, is a country bounded by Thibet and Boutan on the north; by China, Tonquin, and Cochin-China on the eaſt; by the Indian Ocean on the ſouth; and by the Hither India, the Bay of Bengal, and the Straits of Malacca on the weſt: it is ſituated between 92 and 104° of eaſt longitude, and between the equator and 30° degrees of north latitude: being near 2000 miles in length from north to ſouth; but of a very unequal breadth; in which limits are comprehended the kingdoms of Aſem, Ava, Pegu, Laos, Siam, Cambodia, and Malacca, governed by as many Indian princes; only the Dutch have uſurped the dominion of Malacca. In this country there are a vaſt number of elephants, and conſequently a great deal of ivory; our merchants alſo meet with gold and precious ſtones, canes, opium, and ſuch other articles as are uſually found within the tropics.

INDIAN BERRY, *Cocculus Indicus*, in commerce, &c. See COCCULUS.

INDIAN LEAF, *Malabathrum*, in botany, the leaf of a tree brought from the Eaſt-Indies. It is of a firm texture; of an oblong oval figure, pointed at both ends; ſmooth and gloſſy on one ſide, which is the upper, and leſs ſo on the lower; of a yelloviſh green colour on the former, and a pale browniſh on the latter; furniſhed with three ribs, running its whole length, very protuberant on the lower ſide, and two ſmaller ones which bound the edges.

Theſe leaves have a remarkable affinity, in one reſpect, with the caſia or bark of the tree of the cinnamon kind, both the leaves themſelves and their pedicles being, like it, extremely mucilaginous: chewed, they render the ſaliva ſlimy and glutinous: infuſed in water, they give out a large proportion of a ſtrong tenacious mucilage. But of the aromatic flavour, which is ſtrong in the bark, the leaves, as brought to us, have very little: they ſcarcely diſcover any warmth or pungency to the taſte, and have little or no ſmell, unleſs well rubbed, when they yield an agreeable, though weak, ſpicy odour. They are no otherwiſe made uſe of than as an ingredient in mithridate and theriaca; and are, when in their greateſt perfection, far inferior to the mace.

INDICATION, in phyſic, whatever ſerves to direct the phyſician how to act.

INDICATIVE, in grammar, the firſt mood, or manner, of conjugating a verb, by which we ſimply affirm, deny, or aſk ſomething; as, *amant*, they love; *non amant*, they do not love; *amas tu*, doſt thou love?

INDICATIVE *Column*. See COLUMN.

INDICTION, in chronology, a cycle of fifteen years. See CYCLE.

INDICTMENT, in law, is a bill or declaration of complaint, at the ſuit of the king, drawn up in form of law, and exhibited againſt a perſon, and afterwards preferred to the grand jury or inqueſt, who are to find whether the complaint be true or not. An indictment differs from an accuſation only in this, that the preferrer of the bill is not tied to the proof thereof, under any penalty, except there appear to be a conſpiracy.

INDIES, Eaſt and Weſt. See INDIA and AMERICA.

INDIGESTION, *Indigeſtio*, a want of due coction, either in the food, the humours of the body, or excrements.

INDIGNATORIUS MUSCULUS, a muſcle of the eye, otherwiſe called abducens, and rectus exterior: it has this appellation from its drawing the eye outwards, thereby occaſioning the appearance of ſcorn. See the article EYE.

INDIGO, in commerce, a preparation of the juice of a plant, whoſe leaves are ſmall, fleſhy, and ſoft, of a greeniſh brown colour on the upper-ſide, pale and as it were ſilver-coloured underneath. This plant, by ſome called anil, or nil, has ſeveral ſlender knotty ſtalks, which ſpread into ſmall branches, clothed each with from four to ten pair of theſe leaves, and an odd one at the end: it riſes to the height of about two feet, and produces reddiſh flowers, in ſhape reſembling thoſe of broom, but ſmaller, followed by oblong pods, containing the ſeeds.

Labat has given a particular account of the culture of the plant, and the preparation of the indigo. The ground being thoroughly cleared from weeds, one of the principal points in the culture, a number of ſlaves, ranged in a line, march acroſs, making little trenches of the width of their hoes, and two or three inches deep, about a foot diſtance from one another every way: then returning, they drop ſome ſeeds in each trench, and afterwards cover them with the earth taken out. In moiſt weather, the plant comes up in three or four days; and in about two months after, it is fit for cutting: if ſuffered to ſtand till it runs into flower, the leaves become too dry and hard, and the indigo obtained from them proves leſs in quantity, and leſs beautiful: the due point of maturity is known, by the leaves beginning to grow leſs ſupple, or more brittle. In rainy ſeaſons the cutting may be repeated every ſix weeks: cutting in dry weather kills the plant, which, if that is avoided, continues to afford freſh crops for two years.

A large quantity of the herb is put into a vat or ciſtern of ſtrong maſon work, with ſo much water as is ſufficient to cover it, and ſome wood laid above to prevent its riſing up. The matter begins to ferment, ſooner or later, according to the warmth of the weather and the maturity of the plant, ſometimes in ſix or eight hours, and ſometimes not in leſs than twenty. The liquor grows hot, throws up a plentiful froth, thickens by degrees, and acquires a blue colour inclining to violet. At this time, without touching the herb, the liquor impregnated with its tincture is let out, by cocks in the bottom, into another vat placed for that purpoſe, ſo as to be commanded by the firſt.

In the ſecond vat the liquor is ſtrongly and inceſſantly beat and agitated, with a kind of buckets fixed to poles, till the colouring matter is united into a body. A good deal of nicety is requiſite in hitting this point: if the beating is ceaſed too ſoon, a part of the tinging matter remains diſſolved in the liquor; if continued a little too long, a part of that which had ſeparated is diſſolved afreſh. The exact time for diſcontinuing the proceſs is determined, by taking up ſome of the liquor occaſionally in a little cup, and obſerving whether the blue fecula is diſpoſed to ſeparate and ſubſide.

The whole being now ſuffered to reſt till the blue matter has ſettled, the clear water is let off by cocks in the ſides at different heights; and the blue part diſcharged by a cock in the bottom, into another vat: here it is ſuffered to ſettle for ſome time longer; then further drained in cloth bags, and expoſed in ſhallow wooden boxes to the air, till thoroughly dry.

The author abovementioned, from whom the whole of the foregoing account is extracted, obſerves further, that the goodneſs of the indigo depends greatly upon the age of the plant; that before it has grown fully ripe, the quantity it yields is leſs, but the colour proportionably more beautiful; that probably the ſecret of thoſe, whoſe indigo has been moſt eſteemed, is no other than cutting the herb at the time when it yields the fineſt colour; that the ſuperiority of ſome of the indigoes of the Eaſt-Indies to thoſe of America, is perhaps owing to the former being prepared more curiouſly from only the leaves of the plant; and that by beating the herb in the ſteeping vat, which has been practiſed by ſome with a view to increaſe the

quantity, great part of the ſubſtance of the leaves and bark is blended with the water along with the colouring matter, and the indigo extremely debaſed.

It is ſaid that lime or lime-water is ſometimes employed in the beating vat, to promote the ſeparation of the tinging particles from the water; and that the hardneſs or flintineſs of ſome ſorts of indigo is owing to an over-proportion of this addition.

Indigo is commonly divided, from the colour which it exhibits upon breaking, into three kinds, copper-coloured, purple, and blue. It is ſaid that the dyers uſe chiefly the firſt; and the calico-printers, for this drug gives a durable ſtain to linen as well as woollen, the laſt. On what particular circumſtances theſe different appearances depend, we know not; nor is it certainly known, whether the real quality of the indigo has any connexion with them. The deepeſt and livelieſt indigo, rubbed with the nail, looks like poliſhed copper; and ſolutions of all the ſorts, made in alkaline lixivia, aſſume alike a copper-coloured ſkin upon the ſurface.

Good indigo is moderately light, breaks of a ſhining ſurface, and burns almoſt wholly away upon a red-hot iron. It is quickly penetrated by water, and reduced into a kind of paſte: a conſiderable part is at the ſame time diffuſed through the liquor, and very ſlowly ſubſides. This is probably what Labat and Hellot mean by its diſſolving in water; for no part of the indigo really diſſolves; it cannot indeed be expected that it ſhould from the proceſs by which it is obtained.

Indigo requires an equal quantity or more of fixed alkaline ſalt to render it totally ſoluble in water. On digeſting the indigo, with a gentle heat, in the ſolution of the alkaline ſalt, a ſhining copper-coloured ſkin begins to appear, and gradually covers the whole ſurface: on agitating the matter, a large blue flower or froth ariſes, and the liquor underneath appears of a deep green. If woollen cloth, without any other preparation than moiſtening it with warm water, be dipped in this hot liquor, it comes out perfectly green, and changes almoſt inſtantly in the air to a fine blue. This is the common proceſs of dying blue.

Mr. Hellot deſcribes two indigo vats with urine; one of which is uſed hot like the foregoing, and the other cold. The hot vat conſiſts of equal parts of indigo, alum, and tartar, digeſted in urine till the liquor becomes green. The cold one is prepared, by digeſting powdered indigo with vinegar for twenty-four hours, in the proportion of four pounds to about three quarts; then mixing the matter with about fifty gallons of urine, and ſtirring the whole together every night and morning, till the liquor turns green, and gathers a head like the common vat.

Indigo is fitted for printing on linen, by diluting it with water into the conſiſtence of a ſyrup; then adding ſome powdered pearl-aſhes, green vitriol, and lime newly ſlaked; with ſo much water, occaſionally, as will reduce them into the conſiſtence of thin paint; mixing the whole thoroughly together, and ſtirring the matter every now and then, till it gains a copper-colour on the ſurface. The proportions uſed by the workmen are, two parts of indigo, one of pearl-aſhes, three of vitriol, and two of lime.

The ſame compoſition, diluted with a ſufficient quantity of water, about ſix gallons to a pound of indigo, and boiled, gives a durable blue to tanned ſkins, whether dipped in hot or cold.

Indigo, digeſted in a moderate heat, with different volatile alkaline ſpirits, gave only yelloviſh and browniſh red tinctures; with rectified ſpirit of wine, a reddiſh one: to lime-water, and to water acidulated with the vitriolic, nitrous, and marine acids, it gave no tincture at all.

The concentrated vitriolic acid unites with it into a ſmooth paſte, eſpecially if the indigo is previouſly well ground with powdered glaſs, ſand, or other like ſubſtances; the indigo is thus rendered ſoluble in boiling water along with the acid, ſo as to paſs through the pores of a filter: the ſolution, whilſt hot, appears of a deep bright green colour, like that made by fixed alkalies, but fades as it grows cold, and changes at laſt to a browniſh.

Theſe experiments, which were many times repeated with the ſame event, ſeem to overturn Mr. Hellot's ingenious theory; which deduces the green colour of ſolutions of indigo, from the common property of blue juices of being turned green by the alkalies; and the blue colour which the cloth acquires ſoon after it is taken out of the vat, from a ſeparation of the alkali. We here find, that a green ſolution of this concrete is obtainable by the ſtrongeſt of the acids, and that with volatile alkalies it diſcovers no tendency to greenneſs.

The ſolution of indigo in oil of vitriol does not appear green till boiled. The thick compound, dropped into water no hotter than the hand can bear, communicates a bright blue colour: woollen cloth or ſilk, prepared with alum and tartar, acquire from this liquor the beautiful but periſhable blue dye, called Saxon blue. The Saxon green is dyed, by dipping the ſtuff a ſecond time in the yellow decoction of fuſtick; or more compendiouſly, by mixing the acid blue compoſition with that decoction at once, till the liquor has gained the depth of colour required.

It is ſaid that the dyers of Norwich, who purchaſed this ſecret from Saxony, prepare the blue compoſition by grinding nine parts of indigo with twenty of red arſenic; then adding to them, in a glazed veſſel, forty-eight parts of oil of vitriol, and ſtirring them well together: after the mixture has ſtood for twenty-four hours, it is fit for uſe. In Mr. Hellot's proceſs, received likewiſe from Germany, the proportions are ſomewhat different; and inſtead of red arſenic, cobalt and orpiment are uſed. Theſe differences are immaterial: the only uſe of the additional matter ſeems to be, to divide the indigo, and render it more eaſily miſcible with the acid. It will ſucceed, in ſmall ſpecimens, with red and with white arſenic, with orpiment and with cobalt, with ſulphur, with antimony, with powdered glaſs, with powdered ſand, and with flint.

The indigo, in the diluted blue liquors, is perfectly diſſolved, ſo as to paſs through a filter. The ſolutions, haſtily evaporated to the conſiſtence of a ſyrup, become turbid and green. On ſlow evaporation, they continue uniform and blue, and readily mingle again with freſh water, paſſing the filter as before, of a fine blue colour.

INDIVIDUAL, *Individuum*, in logic, a particular being of any ſpecies, or that which cannot be divided into two or more beings equal or alike.

INDIVISIBLE, among metaphyſicians. A thing is ſaid to be indiviſible abſolute, abſolutely indiviſible, that is a ſimple being, and conſiſts of no parts into which it may be divided. Thus God is indiviſible in all reſpects, as is alſo the human mind, not having extenſion or other properties of body.

INDIVISIBLE *Secundum quid eſt*, indiviſible with reſpect to what it now is, a ſubſtance which, though it conſiſts of parts into which it may be divided, yet never can be ſo divided as to remain the ſame: thus a meaſure or number is ſaid to be indiviſible, for if from a foot-line, for example, any thing is deducted, it is no more a foot-line; and if from the number three any thing is ſubſtracted, it is no longer the ſame number. See the next article.

INDIVISIBLES, in geometry, the elements or principles into which any body or figure may be ultimately reſolved; which elements are ſuppoſed infinitely ſmall: thus a line may be ſaid to conſiſt of points, a ſurface of parallel lines, and a ſolid of parallel and ſimilar ſurfaces; and then, becauſe each of theſe elements is ſuppoſed indiviſible, if in any figure a line be drawn through the elements perpendicularly, the number of points in that line will be the ſame as the number of the elements; whence we may ſee that a parallelogram, priſm, or cylinder, is reſolvible into elements or indiviſibles, all equal to each other, parallel and like to the baſe; a triangle into lines parallel to the baſe, but decreaſing in arithmetical proportion, and ſo are the circles which conſtitute the parabolic conoid, and thoſe which conſtitute the plane of a circle, or ſurface of an iſoſceles-cone. See the article INFINITESIMALS.

INDORSEMENT, in law, any thing written on the back of a deed, as a receipt for money received. See the article BILL.

INDUCEMENT, in law, ſignifies what may be alledged as a motive; and, in our law, it is uſed ſpecially in ſeveral caſes; as, there is an inducement to actions, to a traverſe in pleading, and to an offence committed, &c.

IN-

INDUCTION, in law, is putting a clerk or clergyman in poſſeſſion of a benefice or living to which he is collated or preſented. See PRESENTATION.

INDULGENCES, in the Romiſh church, are a remiſſion of the puniſhment due to ſins, granted by the church, and ſuppoſed to ſave the ſinner from purgatory. Clement VI. in his decretal, which is generally received by the church of Rome, declares, that our Saviour has left an infinite treaſure of merits, ariſing from his own ſufferings, beſides thoſe of the bleſſed virgin and the ſaints; and that the paſtors and guides of the church, and more eſpecially the popes, who are the ſovereign diſpoſers of this treaſure, have authority to apply it to the living, by virtue of the keys, and to the dead, by way of ſuffrage, to diſcharge them from their reſpective proportions of puniſhment, by taking juſt ſo much merit out of this general treaſure, as they conceive the debt requires, and offering it to God.

It was the great abuſe of indulgences that contributed not a little to the firſt reformation of religion in Germany, where Martin Luther began firſt to declaim againſt the preachers of indulgences, and afterwards againſt indulgences themſelves: for ſince that time the popes have been more ſparing in the exerciſe of this power; however, they ſtill carry on a great trade with them in the Indies, where they are purchaſed at two reals a piece, and ſometimes more.

INDULT, in the church of Rome, the power of preſenting to benefices granted to certain perſons by the pope.

INDULTO, a duty, tax, or cuſtom paid to the king of Spain, for all ſuch commodities as are imported from the Weſt-Indies in the galleons. See the article GALLEONS.

INERTIA *of Matter*, in philoſophy, is defined by Sir Iſaac Newton to be a paſſive principle by which bodies perſiſt in their motion or reſt, receive motion in proportion to the force impreſſing it, and reſiſt as much as they are reſiſted. It is alſo defined by the ſame author to be a power implanted in all matter whereby it reſiſts any change endeavoured to be made in its ſtate.

This power then coincides with the *vis reſiſtendi*, or power of reſiſting, whereby every body endeavours, as much as it can, to perſevere in its own ſtate, whether of reſt or uniform rectilinear motion; which power is ſtill proportionable to the quantity of matter in any body: for ſince natural bodies conſiſt of a maſs of matter, that, of itſelf, is not able to induce any change in its ſtate, if bodies were once at reſt, it is neceſſary that they ſhould always remain in that ſtate of reſt, unleſs there is applied a new force to produce motion in them: but if they were in motion, the ſame energy or force would always preſerve the motion; and therefore bodies would always retain their motion, and would always proceed forward in the ſame right line with the ſame tenor, ſince they cannot of themſelves acquire either reſt or a retardation, or a change of their direction to turn on one ſide or the other.

There are ſome philoſophers who readily enough acknowledge, that no body can move of itſelf, that is, paſs from reſt to motion of itſelf, but then they are not as willing to grant, that bodies once moved cannot of themſelves arrive at reſt, by reaſon they ſee the motions of projectiles languiſh by degrees, and at laſt the moving bodies themſelves come to reſt. See the article PROJECTILES.

But as no mode or accident can of its own accord, or by itſelf, be deſtroyed, and as all effects produced by tranſient cauſes do remain always, unleſs there be ſome new and extraneous cauſe that deſtroys them; ſo likewiſe motion once commenced, will be continued always, unleſs it be hindered by ſome external cauſe: nor is it more in the power of a body once moved, to lay aſide its motion or energy to move, and return of itſelf to reſt, than it can put off the figure that it has been once formed into, and acquire a new one, without ſome extrinſic cauſe. Therefore, there is in all bodies a certain force, or rather inactivity, whereby they oppoſe every change; from which cauſe it proceeds, that they are very difficultly put out of their ſtate, whatever it is: but that inactivity is the ſame in moving bodies as in thoſe at reſt, nor do bodies leſs reſiſt the action, whereby they are brought from motion to reſt, than that whereby they paſs from reſt to motion; that is, there is not required a leſs force to put a ſtop to the motion of any body, than was before neceſſary to impreſs that motion on the ſame body. Whence ſince the *vis inertiæ*, or inactivity of matter, always equally reſiſts equal changes, it will not be leſs powerful to continue a body in motion, which has begun to move, than to preſerve a quieſcent body in the ſame ſtate of reſt.

There are ſome philoſophers who ſuppoſe body of its own nature to be as indifferent to motion as to reſt; but by this indifference they do not, we ſuppoſe, mean ſuch a diſpoſition in bodies, whereby they do not in the leaſt reſiſt reſt or motion: for on this ſuppoſition it would follow, that any body, however great, and moved with the ſwifteſt velocity, might be ſtopped by any the ſmalleſt force; or if the great body was at reſt, it might be moved by any body, however ſmall, without the leaſt loſs of velocity in the impelling body: that is, any ſmall body impinging on a greater one, would carry that greater body along with it, without the leaſt loſs of its motion; and each body after the impulſe, would be jointly carried along with that celerity that the ſmall body had at firſt, which we all know is abſurd. This indifference, therefore, is not placed in a non-reſiſtance to motion from a ſtate of reſt, or to reſt from a ſtate of motion; but in this only, that a body of its own nature is not more propenſe to motion than to reſt, nor more reſiſts to paſs from a ſtate of reſt to motion, than to return again from that motion to the ſame ſtate of reſt: beſides, any quieſcent body may be moved by any force; and an equal force, acting in a contrary direction, will be able to deſtroy that motion; and in this, this indifference conſiſts.

Since, according to this law, a body once in motion always continues in that motion, the philoſophers aſk, Why all projectiles loſe by degrees their motion? Why do they not proceed in infinitum? If motion did not of its own nature decay, a ſtone thrown at the beginning of the world, would by this time have gone through an immenſe and almoſt infinite ſpace. And ſo indeed it would, if its motion had been in vacuo, or in free ſpaces, and without any gravity. But ſince all projectiles are carried either through the air, or on the rough ſurfaces of other bodies, they muſt be neceſſarily retarded: for ſince all bodies in motion muſt drive and thruſt out of its place the reſiſting air, or overcome the roughneſs of the ſuperficies upon which they are moved, they will loſe all that force and motion that is conſtantly employed in overcoming theſe obſtacles, and conſequently the motion of projectiles will be continually diminiſhed: but if there was no reſiſtance in the medium, no roughneſs in the ſuperficies on which they were moved, no gravity that continually forces the bodies towards the earth, motion would always continue the ſame, without any retardation at all. So in the heavens, where the medium is exceedingly rare, the planets do continue their motions for a very long time; and upon ice, or any other very ſmooth ſurface without any roughneſs, heavy bodies in motion are not ſoon brought to reſt.

INFALLIBLE, what cannot deceive, nor be deceived.

The word is Latin, and formed of *in*, taken privately, and *fallo*, to deceive.

INFAMOUS, in general, denotes ſomething notoriouſly contrary to virtue or honour.

The word is derived from the Latin *in*, and *fama*, report.

INFAMOUS, in law, denotes a perſon of no repute in the world. There are two kinds of infamy; ſome perſons being infamous *de jure*, or ſtigmatized by public judgments: others are infamous *de facto*, as being of a ſcandalous profeſſion, as a catchpole, hangman, informer, &c.

INFANT, *Infans*, in medicine, denotes a young child. See the articles CHILD and DELIVERY.

The diſeaſes incident to little children, and thoſe newly born, are the thruſh, pukings, coughs, watchings, ſtartings, inflammations of the navel, runnings of the ears, and gripes. When they begin to breed teeth, troubleſome itchings of the gums, fevers, convulſions, diarrhœas happen, eſpecially when they put forth the canine teeth,

and

and in thoſe particularly who are very groſs and inclinable to be coſtive. When advanced from two to ten years and longer, they labour under inflammations of the tonſils, inward luxations of the vertebra next the head, aſthmas, ſtone, round belly-worms, aſcarides, penſile warts, ſatyriaſes, ſtranguries, ſcrophulous tumors, and other tubercles.

Of all the afflictions which torture tender infants, violent pains of the abdomen and inflations moſt frequently occur. The principal intention of the phyſician, in order to cure theſe, is to abſorb, correct, and gently evacuate the corroſive acid of the primæ viæ. If the diſorder, as it generally happens, ariſes from vitiated milk, the nurſe is either to be changed, or care muſt be taken that ſhe do not at that time indulge herſelf with flatulent food; and gentle laxatives, if ſhe be coſtive, are proper for the nurſe. Among theſe, the preparations of rhubarb are the moſt eligible; nor are carminative medicines leſs beneficial to the nurſe. But nothing relieves infants more than clyſters and the internal exhibition of preparations of rhubarb, as alſo a ſcruple of aniſeed groſly pounded, if given with the firſt ſpoonful of ſugared-pap.

If there be a ſuſpicion of worms, it is proper to give the remedies accommodated to kill and diſlodge theſe hoſtile animals. External remedies ſhould alſo be applied againſt the violence of this diſorder, as emollients.

Epilepſies and convulſions are generally more incident to childhood, which continues from the firſt to the ſeventh year, becauſe, in infants, the nervous, membranous, and exquiſitely ſenſible parts conſiſt of very tender and very moveable ſmall fibres, which being irritated, though in the ſlighteſt manner, are very eaſily thrown into ſpaſmodic commotions.

If this diſorder take its riſe from a fright or violent paſſion of the nurſe, it is proper to give what gently curbs the inordinate and ſpaſmaſtic motions of the nervous ſyſtem, ſuch as emollient and carminative clyſters, and antiſpaſmodic powders either exhibited alone, or in ſome water of a ſedative quality. If it ariſe from the milk rendered corroſive in the infant, beſides demulcent clyſters, abſorbent powders exhibited with ſaffron, muſk, or a ſmall quantity of the extract of caſtor, are of ſingular ſervice, eſpecially if a pretty rich decoction of harts-horn be uſed for drink: but if the primæ viæ are to be purged, this end is anſwered by a decoction impregnated with manna, ſucceſſively exhibited with a few drops of the oil of tartar per deliquium dropped into it. If the diſorder proceeds from too large a quantity of groſs milk, the infant ſhould be fed with leſs, and ſuch aliments given, as render it more fluid. Likewiſe a third or fourth part of a grain of emetic tartar, mixed with ſyrup of violets and ſome proper diſtilled water, is often ſerviceable, when given out of the paroxyſm. When the meconium produces this diſorder, it ought to be evacuated by gentle laxatives mixed with abſorbents. If an epilepſy proceed from a repulſion of the itch, a ſcald head, &c. thoſe things ſhould be uſed which may recal the impure matter to the ſurface of the body, and veſicatories applied to the nape of the neck, have been found very beneficial.

As to an atrophy in children, where there is a gradual conſumption of the whole body, attended commonly with an inflation of the abdomen, and an extraordinary injury of the ſeveral functions, we are, in general, to take care, that, after weaning, they be ſupplied with food of ſuch a kind, as adds nutriment and ſtrength to the emaciated body, as broths of bruiſed fowls, or capons prepared without the fat, paps of apples prepared with the yolks of eggs and ſugar, together with a little cinnamon, mace, and wine. When obſtructions happen in the mouths of the lacteals, proper deobſtruents are to be uſed.

A cardialgia in children principally diſcovers itſelf by an uncommon ſtraitneſs over the breaſt, joined with difficult reſpiration, by inflations of the abdomen and præcordia, by inquietudes and eructations; to which ſlight fevers and convulſions are frequently joined.

During the fit, but little milk ſhould be given the infant, and antiſpaſmodic abſorbent powders, with ſome carminative water, ſhould be adminiſtered both to the nurſe and infant: and for their drink, gelatinous decoctions of the harts-horn and correcting emulſions. To diſcharge the flatulencies, gently carminative and emollient clyſters ſhould be given: an outward application of paregorics is likewiſe very beneficial.

After the fit, in order to remove the ſomes of the diſtemper, not only the nurſe, but alſo the infant ought to be gently freed from the ſordes lodged in the ſtomach and inteſtines, not omitting at the ſame time the uſe of corroborating and ſtomachic medicines.

To cure the iſchury or retention of urine in children, the nurſe, while ſhe gives ſuck, and the infant, when weaned, muſt avoid all improper aliments and unwholeſome drinks: but if the diſorder be ſupported by an obſtructed evacuation by ſtool, reſins impregnated with rhubarb ſhould be taken in proper aliments, or clyſters ſhould be duly injected. When the diſcharge of urine is ſuppreſſed by calculous fragments obſtructing the urethra, emollient clyſters are in like manner of ſervice. Internally antiſpaſmodics ſhould be adminiſtered; and externally baths, in which emollient ſubſtances have been boiled, are highly beneficial; as alſo bags fitted with the ſame things applied warm to the region of the pubes, the anointing which with the oil of ſcorpions is alſo productive of happy effects.

For the cure of a cough and aſthma in infants, abſorbent powders, the root of Florentine orris, ſpermaceti, and ſugar-candy, internally exhibited, are highly beneficial, and all the methods uſed whereby tranſpiration may not only be promoted, but a reſolution of the inſpiſſated fluids commodiouſly obtained.

If an aſthma attended with a cough, proceed from acid and viſcid crudities in the ſtomach, a mild emetic is often ſucceſsful, and this end is likewiſe very well anſwered by emollient and carminative clyſters. If a repelled, acrid, and excrementitious matter give birth to the diſorder, beſides internal diaphoretics, gentle veſicatories, applied to the nape of the neck, often produce a happy effect.

For ulcerous tubercles and catarrhous defluxions, ſuch infuſions ſhould be exhibited to the nurſe as dilute the blood and lymph; the infant ſhould have laxatives adminiſtered. Inflammations of the parotid glands are, beſides the internal uſe of reſolvents, to be treated externally with the ſimple diachylon plaſter, mixed with camphire; and, if the tumor cannot be diſcuſſed, it is to be maturated by emollient cataplaſms.

As to the cure of hiccups and vomitings in infants, if milk taken plentifully offend, its quantity ought to be leſſened; but if the diſorder proceed from its depraved quality, we ought to procure a proper excretion of it both from the nurſe and infant.

As to coſtiveneſs in children, the nurſe ſhould uſe a light and reſolving diet, exhibiting, at intervals, currants, either in the form of an electuary, with rhubarb and ſugar, or boiled with apples. But the infant is relieved either by ſyrup of ſuccory with rhubarb, and a few grains of white mechoacan at proper intervals, or clyſters of a decoction of oats with honey and butter, or of whey and Venice ſope. The navel ſhould alſo be anointed with oil of ſweet almonds, mixed with a due quantity of the trochiſci alhandal, reduced to powder.

A diarrhœa or exceſſive flux ought not to be ſuddenly checked, eſpecially if children bear it well, and if its ſuppreſſion be not indicated as proper. But when this happens, we muſt have a regard to the nurſe's milk, and if ſhe lay a foundation for the diſtemper, ſhe muſt be changed, uſing at the ſame time a proper ptiſan. The diſordered infant may be relieved by taking internally powders of Armenian bole and crabs-eyes, with a few grains of the bark of caſcarilla, to which may be added, as circumſtances require, amber and a third part of the theriaca cæleſtis for a doſe; and externally the belly is to be anointed with a proper liniment. And beſides theſe, in ſuch a ſtate of the diſeaſe, great advantages accrue from the uſe of clyſters. *Hoffman.*

INFANT, in law, ſignifies a perſon under the age of one and twenty.

INFANTE and INFANTA, all the ſons and daughters of the kings of Spain and Portugal, except the eldeſt; the princes being called infantes, and the princeſſes infantas.

INFANTRY, in military affairs, denotes the whole body of foot-ſoldiers. See the articles FOOT and SOLDIERS.

INFECTION, among phyſicians, the ſame with contagion. See CONTAGION.

INFERNAL-STONE, *Lapis infernalis*. See the article LAPIS.

INFINITE, that which has neither beginning nor end: in which ſenſe God alone is infinite. See the article GOD.

Infinite is alſo uſed to ſignify that which has had a beginning, but will have no end, as angels and human ſouls. This makes what the ſchoolmen call *infinitum a parte poſt*; as, on the contrary, by *infinitum a parte ante*, they mean that which has an end but had no beginning.

INFINITE, in mathematics, are ſuch quantities as are either greater or ſmaller than any aſſignable one, being the ſame with indefinite or indeterminate, to which no certain limits are preſcribed.

The doctrine of infinites has given occaſion for many diſputes; but the true ſtate of the caſe is this: So long as we reaſon upon wrong ſuppoſitions, we muſt never expect to arrive at truth; but the nearer our ſuppoſitions are to truth, the nearer will be the concluſion; and if theſe ſuppoſitions be infinitely near the truth, the errors in the concluſion will be infinitely ſmall, which being at laſt thrown out of the account, the concluſion will be the ſame as if we had proceeded upon principles accurately true. This is the true riſe of infinitely ſmall quantities in all mathematical computations, and the true reaſon for rejecting them, when the operation is over; but it may be reaſonably demanded, How do we know that theſe infinitely ſmall errors in the concluſion ariſe from ſimilar errors in the premiſes? And the anſwer is, becauſe theſe two ſorts of errors have ſo mutual a dependence one upon another, that one cannot be made to vaniſh, but the other will neceſſarily vaniſh with it. If it be further demanded, What the wrong ſuppoſitions are from which theſe infinitely ſmall errors ſpring? I anſwer, in the firſt place, the ſuppoſing magnitudes to have quantity, which in reality have none at all, but have entirely loſt it, either by running into infinity on the one hand, or into nothing on the other. Thus, if we ſuppoſe the point D to actually coincide with the angular point C (plate LXXVI. *fig.* 3.) the line DC will not only comparatively, but abſolutely be equal to nothing; that is, it will be no line at all, nor can any uſe be made of it: but by allowing the ſaid line to have ſome quantity, though extremely ſmall, or leſs than any that can be aſſigned, we tacitly ſuppoſe the point D not to be actually in the angular point C, but infinitely near it.

A quantity, after it is reduced to nothing, ceaſes to be a quantity; and if 0 have no quantity, neither can its reciprocal $\frac{1}{0}$, or any magnitude expreſſed by it, be ſaid to have any: but the reciprocal of nothing ſignifies a magnitude infinitely great in the ſtricteſt ſenſe of the word, and can no more be ſaid to have quantity than abſolute nothing can; and to compare ſuch magnitudes in reſpect of their quantity, which actually have none, is contrary to the definition both of ratios, and the object of proportion: nay, I know not whether the greateſt part if not all the difficulties that are ſaid to attend the idea of infinity, and our inability to comprehend it, ought not rather to be charged upon the abſurdity of comparing things together which in their own natures are incapable of all compariſon. It is ſaid indeed that infinite parallelopipeds, ſtanding perpendicular upon finite baſes, and upon the ſame plane, are in proportion as their baſes; which is true; but this is not comparing magnitudes in reſpect of the quantity they have not, but in reſpect of the quantity they have; one of theſe parallelopipeds may be ſaid to be broader or thicker than another, though not higher. Thus, if r be any quantity whereof the multiples $2r$ and $3r$ are taken, $2r$ may be ſaid to be to $3r$ as 2 to 3, whether r be finite or infinitely great or ſmall; nay, though r ſhould ſignify an impoſſible quantity; as $\sqrt{-1}$, $\sqrt{-2}$, &c. But then the quantity of this proportion does not depend upon the quantity r, but upon the coefficients 2 and 3: but I muſt here take notice however, that if r be actually infinite, I mean in the ſtricteſt ſenſe of the word, by $2r$ and $3r$ muſt then be meant, not quantities twice or thrice as big as r, in the ſame reſpect wherein it is infinite, but twice or thrice taken, which is no way abſurd; for if it be poſſible for any one infinite quantity to exiſt, that is not every way infinite, it will be as poſſible for others to exiſt of the ſame kind, independently of the former: a parallelopiped, that is infinitely extended only as to its length, and that both forwards and backwards, may however receive any addition, or be increaſed or diminiſhed in any proportion in reſpect of its finite dimenſions, but not in reſpect to its infinite dimenſions; and this is all the proportion I can conceive infinite quantities capable of. See *Philoſophical Tranſactions*, N°. 195.

That lines or quantities may continually decreaſe, and yet never become nothing, may be eaſily ſhewn in the following manner.—Let MCLK (*fig.* 4.) be an indefinite right line, P a given point out of that line; from P draw PCB perpendicular to MCLK, and of any length at pleaſure; from P draw PE, PF, PI, &c. obſerving always to make the ſegments DE, TF, LI, &c. of thoſe lines conſtantly equal to CB: from the points E, F, I, &c. let fall upon MCK the perpendiculars EG, FH, IK, &c. It is very evident that each following perpendicular is ſhorter than any of the preceding ones; and it is as evident, that were the number of them ever ſo great, the laſt perpendicular would be of a finite length, becauſe its correſponding hypothenuſe does, by the hypotheſis, form a finite angle with the indefinite line MCLK, and does alſo conſtantly riſe above it.

Mathematicians, and more eſpecially thoſe who underſtand this ſubject, are, generally ſpeaking, reſerved enough upon it, and chuſe rather to be deficient than redundant in their expreſſions upon theſe occaſions; not from any diffidence in their own principles, but knowing very well how liable matters of this nature are to be drawn into diſputes by ſuch as lie upon the catch, and make it their chief buſineſs to oppoſe the truths which they themſelves could never have diſcovered, nor perhaps will ever be able to underſtand.

INFINITE *Series*. See SERIES.

INFIRMARY, a kind of hoſpital, where the weak and ſickly are properly taken care of. See the article HOSPITAL.

INFLAMMABILITY, that property of bodies, which diſpoſes them to kindle, or catch fire. See the articles FIRE, FLAME, HEAT, &c.

INFLAMMATION, in ſurgery and medicine, is defined to be a preſſure and attrition of the red arterial blood, ſtagnating in the ſmalleſt canals, produced by the motion of the reſt of the blood, thrown into a violent and forcible commotion, by means of a fever. See the article FEVER.

This definition of an inflammation is taken from its cauſes. Others define it from its ſymptoms to be a ſpecies of tumour attended with a burning heat, pain, redneſs, reſiſtance, and a continual pulſation and pricking. See TUMOUR.

Inflammations are either external, being ſuch as fall properly under the buſineſs of ſurgery, and are cured by manual operations and topical remedies; or internal, being ſuch whoſe cure is to be expected chiefly from the uſe of internal remedies.

General Diviſion of external INFLAMMATIONS. External inflammations, ſeated in the common integuments, are generally termed phlegmons; but when ſlighter, they are called furuncles. The inflammation which is not fixed deep, but only ſpreads ſuperficially on the ſkin, is uſually diſtinguiſhed by the name of an eryſipelas; and the inflammatory tumour that ariſes at the finger-ends, is termed paronychia; when the inflammation fixes in the groin or armpits, the tumour is called a bubo; when under the ears, parotis. If an inflammation ſeizes the hands and feet from extreme cold, chilblains ariſe: other inflammations have alſo particular names, according to the particular part of the body they poſſeſs.

General Cauſes of external INFLAMMATIONS. The cauſe of a phlegmon, or an external inflammation, ariſes generally from too thick or viſcid a ſtate of the blood, ſtagnating in the anaſtomoſes of the ſmalleſt arteries and veins; ſo that the blood being ſent in larger quantities than it can paſs through thoſe veſſels, muſt of conſequence excite the fore-mentioned general ſymptoms of an inflammation, and muſt occaſion great diſorders at every part where ſuch ſtagnation is made. And though no part of the body, whether external or internal, nor the bones

themſelves are exempt from this kind of inflammation, yet it more frequently happens in the fat and glands than any where alſe.

With regard to the cauſe whence that inſpiſſation and ſtagnation in thoſe veſſels proceeds, they are, according to Heiſter, of two kinds, of which the firſt may be called external, and the latter internal. Among the external cauſes are placed in the firſt rank all wounds, fractures, luxations, contuſions, punctures by thorns and ſplinters, with a too great compreſſion of the veſſels, whether by too ſtrict a bandage, or otherwiſe. To theſe cauſes may be added burns of all ſorts, extreme cold, too violent a motion of the body; the external or internal application of too ſharp and ſtimulating ſubſtances, ſticking plaſters, oily and fat things, with abundance of the like nature, which ſtop up the pores of the ſkin, and impede the free courſe of the blood.

Among the internal cauſes, the ſame author reckons any thing acrimonious in the fluids, as in the ſcurvy; as alſo from the blood's abounding in too great quantities, or being of too thick a conſiſtence; or laſtly, when it circulates in the body with too violent a motion: for by this means the groſſer particles of the blood are drove, and, as it were, wedged into ſmaller veſſels, than they can readily find a paſſage through, and this, more eſpecially, when a ſudden cold is ſpread over a body that is in a great heat. In ſhort, every thing will produce an obſtruction which makes the parts of the blood too groſs and bulky, or too much contracts the mouths of the ſmall veſſels.

General Criſes and Cure of INFLAMMATIONS. Inflammations terminate variouſly, according to their different degrees of violence, the cauſes from whence they ariſe, the parts which they affect, and the particular conſtitution of the patient, with ſeveral other circumſtances which alſo preſage to us what ſhall be the end of the inflammation. But the ſeveral ways wherein an inflammation terminates are chiefly four. It is either 1. ſo diſperſed and reſolved as to vaniſh without leaving any conſiderable injury in the part affected, and which afterwards recovers its former vigour, and is of all others, the beſt courſe it can take; or elſe, 2. the inflammation ſuppurates, and degenerates into an abſceſs, ſo as to leave ever after ſome damage in the organ; or elſe, 3. the inflammation degenerates into a gangrene, or ſphacelus; or laſtly, into a hard tumor, commonly called a ſcirrhus, which grows more compact in the part affected, as the inflammation remits or goes off.

As to the reſolution and diſperſion of an inflammation, that is uſually practicable, where it is only of a milder kind, in a ſound habit of body, when the blood is not yet too viſcid nor vehement in its motion. See the article DISPERSION.

But ſuppuration follows, when the inflammation is more violent, the circulation more rapid, but yet the maſs of blood ſomewhat temperate, and without much acrimony: the treatment of an inflammation that terminates in a ſuppuration, the reader will find delivered under the articles SUPPURATION, ABSCESS, &c.

When the forementioned ſymptoms are much more violent, and when the blood is at the ſame time more acrimonious and rapid than it ought to be, the inflammation generally terminates in a gangrene. See the article GANGRENE.

But if the inflamed part be full of glands, and the blood very thick, glutinous, and inſpiſſated, the ſmall blood veſſels are then ſo ſtrongly ſtuffed up with glutinous blood, that they are compacted together, the parts loſe their ſenſation, and are converted into a hard tumour, which is thence called a ſcirrhus. See the article SCIRRHUS.

INFLAMMATION *in the Breaſts*, a diſorder moſt incident to child-bearing women, and almoſt conſtantly happens in a few days after their delivery.

If the milk ſhould be propelled too plentifully and forcibly into the breaſt, which at ſuch times frequently happens; and if the mother ſhould then be ſeized with cold, fear, anger, or a ſudden perturbation of mind, the ſanguiferous and lactiferous veſſels being thence obſtructed, the breaſts muſt then become inevitably tumified, which will be attended with great heat, redneſs, reſiſtance, and violent pain. The ſame accident often happens to women that give ſuck even a long time after their lying-in, and is ſometimes the caſe of thoſe who have no milk, all proceeding from the cauſes already mentioned; and Heiſter gives us an inſtance of a man's breaſt being inflamed by means of a great fright. Theſe inflammations do not, according to that author, always happen to be equally intenſe and violent; for ſometimes it ſeizes the whole breaſt; ſometimes only one ſide; and at other times occupies only a ſmall part of the breaſt: ſometimes the inflammation lies very near the ſkin; at other times very deep; and at one time it has urgent ſymptoms, and at another, it ſits eaſy on the part.

This diſorder may be ſpeedily removed in women of condition, and ſuch as do not ſuckle their children, if ſome of the plaſter of ſperma ceti ſpread on linnen be applied warm all round the breaſt ſoon after parturition; being perforated in the middle, to tranſmit the papilla or nipple; the acceſſion of the milk being alſo repelled by a very ſtrait bandage. Among the internal remedies, the moſt proper are ſuch as bring down the lochia puerperarum, when they do not flow in ſufficient plenty of themſelves: the principal remedies for this purpoſe are the eſſence of myrrh, amber, the eſſence of ſaffron, elixir proprietatis, &c. Laſtly, with reſpect to the proper drink, it muſt be carefully obſerved to diminiſh the quantity of milk by the ſmallneſs and poverty of the meat and drink, upon which account the patient ſhould be recommended to drink ſmall broth, tea, or the like watery liquors: and if the mother be deſirous of ſuckling the infant, there can be no better preſervative againſt the inflammations of the breaſts. But when the inflammation is fixed, the cure muſt be attempted either by diſperſion or ſuppuration, for the method of which ſee DISPERSION and SUPPURATION.

But if it happens that the tumour will neither yield to diſperſion nor ſuppuration, and is in danger of turning to a ſcirrhus, or cancer, the patient muſt be kept in good ſpirits, and the plaſter of ſperma ceti be conſtantly retained on the tumour, by which means it will probably either grow leſs, or elſe vaniſh.

INFLAMMATION *of the Bladder*, that attended with an acute, burning, preſſing pain, in the region of the pubes, a fever, and a continual teneſmus, or deſire of going to ſtool, and a perpetual ſtriving to make water.

Other ſymptoms of this diſeaſe are a rumbling of the bowels, griping pains, great anxiety of the præcordia, difficult breathing, want of appetite, and vomiting, coldneſs of the extreme parts, a hard, quick, unequal, contracted pulſe, inquietude, and ſometimes convulſions. There is another kind which is more ſuperficial, and is either rheumatic or eryſipetalous, in which the fever is more eaſily and ſpeedily cured, by promoting a diaphoreſis; and perſons in years, who are affected with the ſcurvy, gout, rheumatiſm, or violent head-achs, are moſt ſubject to it, eſpecially if they catch cold from a north wind. The former ariſes commonly from the ſtoppage of the menſes, bleeding piles, or other uſual ſanguinary evacuations, and not ſeldom from a virulent gonorrhœa, unſkilfully ſuppreſſed by aſtringents; or when treated by medicines of too ſharp and hot a nature.

This diſeaſe is mortal, if it terminates in an ulcer, or mortification: the latter is immediate death.

The cure muſt be attempted, ſays Hoffman, with bleeding in the foot, if a ſuppreſſion of the menſes or hæmorrhoidal flux be the cauſe. If it proceeds from the ſcurvy, &c. recourſe muſt be had to gentle diaphoretics, diluents, and remedies which obtund the acrimony of the humours, ſuch as decoctions of the root of ſcorzonera, china, ſkirrets, and fennel. Alſo infuſions in the manner of tea of the tops of yarrow, flowers of mallows, winter cherries, and ſeed of daucus, made with milk, and ſweetened with ſyrup of marſh-mallows. To theſe may be added emulſions of the four cold ſeeds. If the patient is coſtive, manna will be proper with antimoniated nitre, to which rhubarb may be joined, as occaſion requires. If the diſeaſe is violent, diaphoretic powders with nitre, in a larger proportion than ordinary, as alſo five grains of ſaffron, and two of camphire, with the emulſions aforeſaid. External antiſpaſmodics, and gentle diſcutients will be proper; for which purpoſe it was Hoffman's me-

thod to apply bladders, filled with a decoction of emollient flowers. If the teneſmus and difficulty of urine ariſe from ſpaſms, there is nothing better than the vapours of a decoction in milk of the flowers of melilot, elder, chamomile and mallows, and the tops of yarrow. This decoction may be put into a cloſe-ſtool, and the patient ſit over it.

INFLAMMATION *of the Brain.* See PHRENSY.

INFLAMMATION *of the Diaphragm.* See the article PARAPHRENITIS.

INFLAMMATION *of the Eyes.* See the article OPHTHALMIA.

INFLAMMATION *of the Fauces.* See the article QUINSEY.

INFLAMMATION *of the Inteſtines*, according to Boerhaave, is an inflammation contracting the inteſtines, and ſtopping up the paſſage through them; attended with a vehement, fixed, burning pain, which is irritated by things taken inwardly. When the inflammation is in the upper part of the inteſtines, the ſtomach will be greatly diſtended with wind. When the pain is exaſperated, it produces convulſions of the diaphragm and abdominal muſcles; vomiting, and painful inflations, with rumblings and ſharp griping pains, which may bring on the iliac paſſion, or twiſting of the guts. Hoffman ſays, that when there is a burning pain in the abdomen, with a preternatural heat of the whole body, as alſo a quick pulſe, loſs of ſtrength, anxiety and inquietude, the ſeat of the diſeaſe may juſtly be ſuſpected to be in the inteſtines. If the pain is above the navel, and below the ſtomach, attended with a fever, nauſea, and reaching, it is a ſign that that part of the colon is affected which lies beneath the ſtomach, and is extended from the right to the left ſide. If the pain lies in the right hypochondrium, under the ſpurious ribs, it ſhews that part of the colon to be inflamed where it joins with the ilium. When the complaint is on the left ſide, under the loins, where the pſoas muſcle is placed, it is a ſign that the colon, and that part of the meſentery joined thereto, is the ſeat of the diſeaſe, eſpecially when it adheres to the peritonæum: but when the pain is in the middle of the abdomen about the navel, it ſhews the ſmall guts are certainly affected; in all which caſes the pain is ſuppoſed to be attended with a fever.

Arbuthnot adviſes, that this diſeaſe be carefully diſtinguiſhed from a colic, proceeding from a cold cauſe; becauſe what is good for the latter is poiſon in the former. It muſt have a ſpeedy remedy, or it will ſoon, according to that writer, end in the iliac paſſion, or a mortification. Beſides copious bleeding, he thinks there is ſcarcely any other method of cure than fomenting and relaxing the bowels with emollient liquids taken warm, both by the mouth and in clyſters, and this every hour: warm fomentations, or young, vigorous, and ſound animals applied to the body are extremely beneficial.

Boerhaave directs, that the patient ſhould only be nouriſhed with broth, in which gently detergent roots have been boiled.

After bleeding and clyſters, if the pain continues violent, Hoffman is of opinion that there will be no manner of danger in giving opiates, by which means the excruciating pain will be alleviated, and the ſpaſms appeaſed, and a breathing ſweat will follow. When this is done, and the fever abated, there will be no occaſion to continue the dilating, relaxing, and moiſtening medicines, but rather the nervous and corroborating; ſuch as the preparations of amber, eſpecially the ſalt and tincture; the former of which may be given in a bolus from ſix to ſixteen grains, and the latter from twenty to eighty drops, in any convenient vehicle.

If the patient ſurvives three days, and the acuteneſs of the pain abates with a chilneſs and ſhivering throughout the body, it is a ſign of a ſuppuration; and within fourteen days the impoſthume will break, and if it falls into the cavity of the abdomen, it will corrupt the whole maſs of fluids, putrify the viſcera, and turn to an aſcites; whence the patient will die of a conſumption. In this caſe, Boerhaave and Arbuthnot recommend whey and chalybeat waters, as likely to prove moſt beneficial. The impoſthume may alſo turn either to a gangrene or ſcirrhus, both which are mortal.

INFLAMMATION *of the Kidneys.* See the article NEPHRITIS.

INFLAMMATION *of the Liver.* When the liver is inflamed, it compreſſes the ſtomach, diaphragm, and the neighbouring viſcera of the abdomen; it ſtops the circulation of the fluids, hinders the generation and excretion of the gall, and all digeſtion; it produces a great many bad ſymptoms, as the jaundice, with all the diſeaſes depending thereon. See HEPATITIS.

A fever, an inflammation, and pungent pain on the region of the liver; and diaphragm, a tenſion of the hypochondria, yellowneſs of the ſkin and eyes, and a ſaffron-coloured urine, are ſigns of an inflammatory diſpoſition of the liver. See JAUNDICE.

This diſeaſe terminates as other inflammations; being cured by reſolution, concoction, and excretion, of the morbid matter; or it terminates in an abſceſs, ſcirrhus, or gangrene. See ABSCESS, &c.

During the firſt ſtate, Arbuthnot tells us, that a warm regimen and ſaffron, which ſome reckon a ſpecific, are improper. On the other hand, that cooling, reſolving liquors, taken inwardly, as whey and ſorrel boiled in it, outward fomentations, and frequent injections of clyſters, bathing and frictions, relax and render the matter fluid. Honey, with a little rheniſh wine and vinegar, the juices and jellies of ſome ripe garden fruits, and thoſe of ſome lacteſcent plants, as endive, dandelion, and lettuce, are reſolvent. Violent purging hurts; gently relaxing the belly relieves, diluents with nitrous ſalts are beneficial; or tamarinds boiled in warm water, or whey. The feveriſh matter is often carried off by urine, and therefore diuretics not highly ſtimulating are proper.

If the inflammation be recent, extremely violent, and without any ſigns or hopes of reſolution, concoction, and excretion, Boerhaave adviſes, that the caſe be treated with the ſame cautions and remedies as is directed in pleuriſies, and other ſimilar inflammatory diſorders; ſuch remedies only excepted, as the ſituation of the part affected cannot admit of, except only, that all antiphlogiſtic fluids, either drank or injected by clyſters, are particularly ſerviceable in the caſe before us.

INFLAMMATION *of the Lungs.* See the article PERIPNEUMONY.

INFLAMMATION *of the Pleura.* See the article PLEURISY.

INFLAMMATION *of the Stomach* is known by a burning, fixed, and pungent pain in the ſtomach, which is exaſperated at the inſtant any thing is taken into it, and is ſucceeded by a moſt painful vomiting and hiccough. There is, beſides, an inward heat, anxiety, and a tenſive pain about the præcordia, an acute continual fever, great thirſt, difficult breathing, inquietude, toſſing of the body, coldneſs of the extreme parts, a hard, contracted, quick, and ſometimes, unequal pulſe. In the medical eſſays, we have an inſtance of this diſeaſe being attended with a hydrophobia. See the article HYDROPHOBIA.

Boerhaave ſays, that this diſeaſe, if not ſuddenly cured, is generally mortal: therefore, that as ſoon as it is diſcovered, plentiful bleeding is neceſſary; that the patient's drink ſhould be very ſoft, antiphlogiſtic, and emollient; and alſo that clyſters of the ſame kind ſhould be adminiſtred.

Arbuthnot adviſes, that the patient ſhould totally abſtain from every thing that has acrimony in it; even the cooling nitrous ſalts, which are beneficial in other inflammations, irritate too much. Vomits, cordials, and ſpirituous liquors, are little better than poiſon: milk generally curdles. Aliments muſt be given frequently, and by a ſpoonful at a time, for any diſtenſion increaſes the inflammation. A thin gruel of barley, oatmeal, whey, with a very little ſugar, or honey, or chicken broths, are proper aliments: whey emulſions, barley-water, and emollient decoctions are proper drinks. If poiſons of the cauſtic kind or metallic medicines ill prepared cauſe the inflammation, oily fat things are proper, as new milk, cream, oil of ſweet almonds, or oil of olives taken often and plentifully, according to Hoffman. If in the cholera morbus an inflammation is apprehended, he adviſes abſorbents and burnt hart's horn, with gelatinous decoctions of calves and neats feet, or hartſhorn-jellies, and

water-gruel. Outwardly he recommends the following liniment as uſeful in all caſes; take oil of ſweet almonds, two ounces; camphire, one dram; make a liniment, with which anoint frequently the precordia, applying a hot linen-cloth over it. The following epithem he recommends as an excellent diſcutient and ſudorific. Take of the vinegar of roſes, two ounces; ſpirit of wine camphorated, two drams; tincture of ſaffron, and tincture of caſtor, of each one dram; nitre, half a dram: let this epithem be applied warm to the region of the ſtomach.

If there happens an impoſthume, honey, and even honey of roſes, taken inwardly, is, according to Arbuthnot, a good cleanſer; and decoctions of comfrey-roots, healing.

INFLAMMATION *of the Womb or Uterus*, appears from extraordinary heat and a fixed pain in the groin, with an acute fever, a pain in the loins and belly, an inflation of the abdomen, a ſtimulus to make water and to go to ſtool, heat, and a difficulty of urine.

Other ſymptoms, according to Aſtruc, are a tumor, pain, heat, tenſion of the hypogaſtric region, redneſs of the os uteri, and great heat of the vagina. If the fore part of the uterus is affected, there is a dyſury; if the back part, a teneſmus; frequent faintings and cardialgia, a burning fever; or, if the inflammation is violent, a lipyria, in which the external parts or extremities are cold, and the internal burn, and the pulſe is imperceptible; a delirium and phrenſy; the breaſts ſwell, in proportion as the inflamed uterus.

Hoffman diſtinguiſhes this diſeaſe into the ſuperficial and more profound. He ſays, that it is eaſily formed in child-bed women, and frequently accompanies the milk-fever, and may be cured in a few days if rightly managed. But that when it is more intenſe, and attended with grievous ſymptoms without remiſſion, it kills on the ſeventh, ninth, or eleventh day; a white miliary fever generally ſupervenes, which is the worſt omen, as it ſhews a mortification of the uterus. See the article MILIARY FEVER.

INFLAMMATORY DISEASES. To theſe may be referred the ſeveral diſeaſes mentioned in the preceding article, either attended with a fever, as leſſer inflammation without a fever; beſides all chronic diſorders ariſing from inflammations, the chief of which are old coughs, conſumptions, and the rheumatiſm, without a fever. See COUGH.

INFLAMMATORY FEVERS are diſtinguiſhed into two ſtages; the firſt, whilſt the pulſe continues hard, in which it is proper to bleed; the ſecond, when the inflammatory ſymptoms ſtill remaining, the pulſe is too low for that evacuation; in this ſtate bliſters are the chief remedy, and which, except in a few ſingular caſes, are not to be uſed ſooner. If the bliſters are large, it is better to apply them gradually, than many at a time. See FEVER and INFLAMMATION.

Point of INFLECTION. When a curve AFK (plate LXXVI. *fig.* 5.) is partly convex, and partly concave, to a right line AB or point B; the point F dividing the convex from the concave part, or the end of the one, and the beginning of the other, is called the point of inflection, when the curve being come to F, continues its courſe towards the ſame parts; and the point of retrogreſſion, when the curve returns back again towards the place of its beginning.

Let us ſuppoſe the curve AFK to have the right line AB as a diameter, and the ordinates PM, EF, &c. parallel to each other. Now if you draw the ordinate FE from the point F, and the tangent FL; alſo another ordinate MP from the point M in the concave part AF of the curve, likewiſe a tangent MT; then it is evident that, in curves having a point of inflection, while the abſciſs AP conſtantly increaſes, the part AT of the diameter, intercepted between the vertex of the diameter A and the point T, where the tangent meets the diameter, does likewiſe increaſe until the point P falls in E, after which it continually decreaſes; therefore AT muſt become a maximum AL, when the point P falls in E the point ſought.

In thoſe curves that have a point of retrogreſſion, the part AT continually increaſes, and the abſciſs AP till the point T coincides with L, and afterwards it continually decreaſes; whence AE muſt be a maximum, when the point T coincides with L. Now call AE, x; EF, y; then will $AL = \frac{y\dot{x}}{\dot{y}} - x$, and the fluxion of this will be $\frac{\dot{y}\dot{y}\dot{x} - y\dot{x}\ddot{y}}{\dot{y}\dot{y}} - \dot{x}$, ſuppoſing $\dot{x}$ invariable; which (being divided by $\dot{x}$ the fluxion of AE) muſt be equal to nothing, or infinite: whence $-\frac{y\ddot{y}}{\dot{y}\dot{y}} = 0$, or infinity; and ſo multiplying by $\dot{y}\dot{y}$, and dividing by $-y$, there comes out $\dot{y} = 0$, or infinite. Now with this laſt expreſſion, and the general equation of a curve, the point of inflection or retrogreſſion F may be found: for the nature of the curve AFK being given, we ſhall have a value of $\dot{y}$ in $\dot{x}$, and putting that value into fluxions, with $\dot{x}$ conſtant, we ſhall obtain a value of $\ddot{y}$ in terms of $\dot{x}\dot{x}$; which being made equal to 0, and afterwards to infinity, by means thereof, in either of theſe ſuppoſitions, we may find AE ſo expreſſed, that its correſpondent ordinate EF ſhall interſect the curve in the point of inflection or retrogreſſion F.

Let the ordinates BM, BF, BM of the curve AFK, all meet in the ſame point B: if any ordinate BM (*fig.* 6.) be drawn, and the tangent MT meeting BT (*fig.* 7.) perpendicular to BM in the point T; and if m (*fig.* 8.) be taken infinitely near M, and the ordinate Bm, tangent mt, the perpendicular Bt to Bm meeting MT in O, be all drawn: then ſuppoſing the ordinate BM, becoming Bm to increaſe, it is plain, in the concave part of the curve, that Bt is greater than BO; and in the convex part the ſame is leſs. So that under the point of inflection or retrogreſſion F, Ot muſt change from negative to poſitive.

This being premiſed, about the center B deſcribe the ſmall arches MR, TH, and there will be formed the ſimilar triangles mRM, MBT, THO, and the little ſimilar ſectors BMR, BTH. Now put BM $= y$; MR $= \dot{x}$; then mR $(\dot{y})$: RM $(\dot{x})$ :: BM (y) : BT $= \frac{y\dot{x}}{\dot{y}}$: MR $(\dot{x})$: TH $= \left(\frac{\dot{x}\dot{x}}{\dot{y}}\right)$ :: TH $\left(\frac{\dot{x}\dot{x}}{\dot{y}}\right)$: HO $= \frac{\dot{x}\dot{x}\dot{x}}{\dot{y}\dot{y}}$. Now take the fluxion of BT $\left(\frac{y\dot{x}}{\dot{y}}\right)$ with $\dot{x}$ invariable, and there will ariſe Bt − BT or H$t = \frac{\dot{x}\dot{y}\dot{y} - y\dot{x}\ddot{y}}{\dot{y}\dot{y}}$; and therefore OH + H$t$ or O$t = \frac{\dot{x}^3 + x\dot{y}^2 - y\dot{x}\ddot{y}}{\dot{y}^2}$. Whence multiplying by $\dot{y}^2$, and dividing by $\dot{x}$, the expreſſion $\dot{x}^2 + \dot{y}^2 - y\ddot{y}$ muſt be nothing or infinite in the point of inflection or retrogreſſion F. Now by the nature of the curve given, we ſhall have values of $\dot{y}$ in $\dot{x}$, and of $\ddot{y}$ in $\dot{x}$, which being ſubſtituted in $\dot{x}^2 + \dot{y}^2 - y\ddot{y}$, there will be produced a quantity, which being made equal firſt to nothing, and afterwards to infinity; by means thereof we may get ſuch a value of BF, that if a circle be deſcribed from B, with the ſame as a radius, it ſhall cut the curve AFK, (*fig.* 5.) in the point of inflection or retrogreſſion F.

Example 1. Let AFK (*fig.* 9.) be a curve, the right line AB being a diameter of it, and let the relation of any abſciſs AE (x) to its correſponding ordinate EF (y) be expreſſed by this equation, $ax^2 = yx^2 + a^2y$. It is required to find ſuch an expreſſion for AE, that the ordinate EF ſhall interſect the curve AFK in the point of inflection F.

The equation of the curve gives $y = \frac{ax^2}{x^2 + a^2}$, and therefore $\dot{y} = \frac{2a^3x\dot{x}}{x^2 + a^2}$, and by taking the fluxion of this quantity with $\dot{x}$ conſtant, there will ariſe $\frac{2a^3\dot{x}^2 \times \overline{x^2 + a^2}^2 - 8ax^2\dot{x}^2 \times \overline{x^2 + a^2}}{\overline{x^2 + a^2}^4}$, which being made equal to nothing, and divided by $2a^3\dot{x}^2 \times \overline{x^2 + a^2}$, will produce $x^2 + a^2 - 4x^2 = 0$. Whence AE $(x) = \frac{a}{\sqrt{3}}$.

If $\frac{1}{3}aa$ be put for its equal xx in the equation of the curve $y = \frac{ax^2}{x^2 + a^2}$, we ſhall have $y = \frac{a}{4}$; ſo that the point of

of inflection F may be determined without ſuppoſing the curve AFK to be deſcribed.

If AC be drawn parallel to the ordinates EF, and made equal to the given right line a, and CG be drawn parallel to AB, the ſame will be an aſymptote to the curve AFK. For if x be made infinite, we may take xx for $xx+aa$, and therefore the value of y will then become equal to a.

Example 2. Let AFK (*fig.* 10.) be the conchoid of Nicomedes, and the point P the pole, the right line BC the aſymptote. It is required to find the point of inflection F; the nature of the curve being ſuch, that a right line PF, drawn from any point F in it to the pole P, meeting the aſymptote BC in D, the part DF thereof is always equal to a given and conſtant quantity a.

Draw PA perpendicular, and EF parallel to BC, alſo DL parallel to BA. Put $BE=x$, $EF=y$, then by the ſimilar triangles DLF, PEF, $DL\ (x) : LF\ (\sqrt{a^2-x^2})$ $::PE\ (b+x) : EF\ (y) = \frac{b+x\times\sqrt{a^2-x^2}}{x}$. The fluxion of this will be $\dot{y} = \frac{x^3\dot{x}+a^2b\dot{x}}{x^2\sqrt{a^2-x^2}}$. Now if you take the fluxion of it again, and make the ſame equal to nothing, there will ariſe $\frac{2a^4b-a^2x^3-3a^2bx^2\times\dot{x}^2}{a^2x^3-x^5\times\sqrt{a^2-x^2}} = 0$, which may be reduced to $x^3+3bx^2-2a^2b=0$; and one of the roots thereof will be the quantity of BE ſought.

If $a=b$, the equation aforegoing will become $x^3+3ax^2-2a^3=0$, which divided by $x+a$, gives $xx+2ax-2aa=0$; and thence x or BE equal to $\sqrt{3a^2}-a$.

Inflection, in grammar, the variation of nouns and verbs, by declenſion and conjugation. See Declension and Conjugation.

Inflex Leaf, among botaniſts, one whoſe point bends inward, towards the ſtem of the plant. See the article Leaf.

Influence, a quality ſuppoſed to flow from the heavenly bodies, either with their light or heat; to which aſtrologers idly aſcribe all ſublunary events.

Influent Fever, the ſame with a nervous one. See the article Fever.

Inforced and Inforcement. See Reinforced and Reinforcement.

In forma Pauperis, in law. See the article Forma.

Information, in law, is nearly the ſame in the crown-office, as what in our other courts is called a declaration. It is ſometimes brought by the king, or his attorney-general, or the clerk of the crown-office; and at other times by a private perſon, who informs or ſues, as well for the king as himſelf, upon the breach of ſome popular ſtatute, in which a penalty is given to the party that will ſue for it. It differs from an indictment, which muſt be found by the oaths of ten men at leaſt; for an information is only the allegation of the perſon that brings it.

Informer, a perſon that informs againſt or proſecutes another, upon any penal ſtatute.

Informis, ſomething irregular in its form, or figure. See the articles Figure and Form.

Hence, *ſtellæ informes*, in aſtronomy, are ſuch of the fixed ſtars as are not reduced into any conſtellation. See the articles Conſtellation and Star.

Infralapsarians, in church-hiſtory, an appellation given to ſuch predeſtinarians, as think the decrees of God, in regard to the ſalvation and damnation of mankind, were formed in conſequence of Adam's fall. See Predestination.

Infrascapularis, in anatomy, one of the depreſſor-muſcles of the arm which has its origin from the whole internal ſurface of the ſcapula, and its termination in the interior part of the humerus. See the article Depressor.

Infraspinatus, in anatomy, one of the abductor-muſcles of the arm, which has its origin in the cavity below the ſpine of the ſcapula. See the article Abductor.

Infundibuliform, in botany, an appellation given to ſuch monopetalous or one-leafed flowers, as reſemble a funnel in ſhape, or which have a narrow tube at one end, and gradually widen towards the limb or mouth. There are two kinds of infundibuliform, or funnel-faſhioned flowers; one of which is like an inverted hollow cone, and the other ſomewhat like a ſaucer, and thence called hypocrateriform. See the article Flower.

Infusion, in pharmacy, a method of obtaining the virtues of plants, roots, &c. by ſteeping them in a hot or cold liquid.

Hot infuſions are made by pouring boiling water, or any other menſtruum, on the drugs whoſe virtues we would extract: thus, in order to obtain the common infuſion of ſena, take the leaves of ſena, an ounce and a half; of cryſtals of tartar, three drams; of the leſſer cardamom-ſeeds huſked, two drams: boil the cryſtals of tartar in a pint of water till they are diſſolved, then pour the water, while boiling hot, upon the ſena and the reſt; and when the liquor is cold, ſtrain it off.

Inganno, in muſic, is when having done every thing proper for ending a cadence, a mark of ſilence is placed inſtead of the final, which the ear naturally expects, and is deceived. See Cadence.

Ingluvies, the crop or craw of granivorous birds, ſerving for the immediate reception of the food, where it is macerated for ſome time, before it is tranſmitted to the true ſtomach.

Ingot, a maſs of gold or ſilver, melted down and caſt in a mould, but not coined or wrought. See Gold and Silver.

Ingraving, or Engraving. See the article Engraving.

Ingredients, in pharmacy, whatever ſimple medicines enter the compoſition of a compound one.

Ingress, in aſtronomy, ſignifies the ſun's entering the firſt ſcruple of one of the four cardinal ſigns, eſpecially aries.

Ingress, Egress, and Regress, in law, words frequently uſed in leaſes of lands, which ſignify a free entry into, a going out of, and returning from ſome part of the premiſes leaſed to another.

Ingrosser, one who buys up great quantities of any commodity, before it comes to market, in order to raiſe the price.

Ingrosser alſo ſignifies a clerk or perſon who copies records, deeds, or other inſtruments of law, on ſkins of parchment.

Inguen, in anatomy, the ſame with what is otherwiſe called groin, or pubes. See Pubes.

Inguinal, in anatomy, &c. any thing belonging to the groin. Hence,

Inguinal Hernia is a hernia in that part, called by ſurgeons bubonocele. See Bubonocele.

Inharmonical Relation, in muſic, is much the ſame with diſcord. See the articles Discord and Relation.

Inheritance, a perpetual right or intereſt in lands, inveſted in a perſon and his heirs.

Inhibition, a writ to forbid a judge's proceeding in a cauſe that lies before him.

Inhumation, in chemiſtry, a method of digeſting ſubſtances by burying the veſſel, in which they are contained, in horſe-dung or earth. See the article Digestion.

Injection, in ſurgery, the forcibly throwing certain liquid medicines into the body by means of a ſyringe, tube, clyſter pipe, or the like.

Many diſorders are very difficultly, if at all curable, unleſs ſome proper liquid be injected into the parts affected; which is performed by drawing the liquor into the ſyringe, and forcing it out again into the diſordered parts. In doing this, one caution is extremely neceſſary, viz. to apply the inſtrument very carefully, and to be mindful that the liquor you inject be not too hot or cold.

Anatomical Injection, the filling the veſſels with ſome coloured ſubſtance, in order to make their figures and ramifications viſible.

For this purpoſe, a fine red injection is prepared thus: pour a pint of oil of turpentine on three ounces of vermilion, ſtir them well together, and then ſtrain all through a fine linen cloth. If a green injection is

wanted, diſtilled verdigriſe may be uſed inſtead of the vermilion.

A coarſe injection may be made of one pound of tallow, five ounces of white wax, three ounces of oil of olives, melted together, and adding two ounces of Venice turpentine; and when this is diſſolved, three ounces of vermilion or verdigriſe, are to be thoroughly mixed with the other ingredients, and the whole ſtrained through a linen cloth.

For the manner of preparing bodies to be injected, ſee the article PREPARATION.

INITIATED, in antiquity, a term chiefly uſed in ſpeaking of perſons who were admitted to a participation of the ſacred myſteries among the heathens. See the article MYSTERY.

INJUNCTION, in law, is a writ or kind of prohibition granted in ſeveral caſes; and for the moſt part grounded on an interlocutory order or decree, made in the court of chancery or exchequer, for ſtaying proceedings either in courts of law, or eccleſiaſtical courts.

INJURY, any wrong done to a man's perſon, reputation, or goods. See the articles ASSAULT, TRESPASS, &c.

INK, *Atramentum*, a black liquor generally made of an infuſion of galls, copperas, and a little gum-arabic. See the articles GALLS, COPPERAS, &c.

Compoſition of common Black INK.—"Take one gallon of ſoft water, and pour it boiling hot on one pound of powdered galls, put into a proper veſſel; ſtop the mouth of the veſſel; and ſet it in the ſun in ſummer, or in winter where it may be warmed by any fire; and let it ſtand two or three days. Add then half a pound of green vitriol powdered; and having ſtirred the mixture well together with a wooden ſpatula, let it ſtand again for two or three days, repeating the ſtirring; when add further to it five ounces of gum-arabic diſſolved in a quart of boiling water; and, laſtly, two ounces of alum; after which the ink ſhould be ſtrained through a coarſe linen cloth for uſe."

The galls ſhould be good, or the ink will fail; as it very frequently does from an error in this point. The marks of their goodneſs is, the appearing of a bluiſh colour, and feeling heavy. Where they are light in weight, and of a whitiſh brown colour, without any blue, they ſhould be rejected; or a greater proportion ſhould be uſed.

In moſt of the recipes for the making of ink, gum-arabic is ordered to be put undiſſolved into the mixture of water, galls, and vitriol; but however common, it is certainly a very injudicious practice; for as the gum-arabic is with ſome difficulty diſſolved in ſimple water, and much more ſo in ſuch as is acidulated by ſalts like the vitriol, and clogged likewiſe with the ſolid part of the galls, it is certainly much better to make a ſolution of it in part of the water of which the ink is to be formed, previouſly to its being commixed with the other ingredients; which would otherwiſe, in ſpite of the moſt frequent ſtirrings, keep it at the bottom of the veſſel; and prevent its being ever wholly freed from them, and diſſolved.

Boiling either the infuſion of the galls, or the mixture after the addition of the vitriol, has likewiſe been frequently ordered, and practiſed: but it is not only needleſs, but injurious to the preparation of the ink; as it can have no effect on the vitriol, beſides conducing to the ſolution of it, which is eaſily effected, in the proportion of water proper to be uſed, without any heat; and with reſpect to the galls, their tinging power reſiding in an eſſential oil that is volatile, and will riſe with leſs heat than that of boiling water, it is neceſſarily leſſened by the evaporation; and conſequently, though more of it may be extracted from the galls, yet leſs will be retained in the fluid, than if infuſion with a gentle heat be uſed, inſtead of decoction.

Improved Compoſition of Black-writing INK.—"Take a gallon of ſoft water; and boil it in a pound of chips of logwood for about half an hour. Take the decoction when off the fire, and pour it from the chips while boiling hot on a pound of the beſt Aleppo galls beaten to a powder, and two ounces of pomegranate peels, being put into a proper veſſel. After having ſtirred them well together with a wooden ſpatula for ſome time, place it in the ſun-ſhine in ſummer, or within the warmth of any fire if in winter, for three or four days, ſtirring the mixture again as often as may be convenient. At the end of that time add half a pound of green vitriol powdered; and let the mixture remain four or five days more, ſtirring it as frequently as may be neceſſary: and then add further four ounces of gum-arabic diſſolved in a quart of boiling water; and after giving the ink ſome time to ſettle, ſtrain it off from the dregs, through a coarſe linen cloth; and keep it well ſtopped for uſe."

If the ink be deſired to ſhine more, the proportion of the pomegranate peel muſt be increaſed; and in the country, where the logwood cannot be ſo eaſily procured, a pound of the ripe privet berries may be ſubſtituted for it.

In order to ſecure this ink from growing mouldy, a quarter of a pint or more of ſpirit of wine may be added: but to prevent its containing any acid, which may injure the ink, a little ſalt of tartar or pearl-aſhes ſhould be added previouſly, and the ſpirit poured off from it; which will render it innocent with regard to the colour of the ink.

Preparation of a Powder for forming good Black INK *extemporaneouſly by the addition of Water.*—"Infuſe a pound of galls powdered, and three ounces of pomegranate peels, in a gallon of ſoft water for a week, in a gentle heat; and then ſtrain off the fluid through a coarſe linen cloth: add then to it eight ounces of vitriol diſſolved in a quart of water, and let them remain for a day or two; preparing in the mean time a decoction of logwood, by boiling a pound of the chips in a gallon of water, till one third be waſted; and then ſtraining the remaining fluid while it is hot. Mix the decoction and the ſolution of galls and vitriol together; and add five ounces of gum-arabic; and then evaporate the mixture over a common fire, to about two quarts; when the remaining fluid muſt be put into a veſſel proper for that purpoſe, and reduced to dryneſs in *balneo mariæ*; that is, by hanging the veſſel in boiling water. The maſs left, after the fluid is wholly exhaled, muſt be well powdered; and when wanted for uſe, may be converted into ink by the addition of water."

It was formerly the practice in compounding the portable inks, to mix the galls in ſubſtance with the other ingredients; and form the compoſition only of them with vitriol and gum-arabic, powdered together; but beſides the clogging and fouling it with the ligneous matter of the galls, there could be no dependance on the ſtanding of ink ſo imperfectly formed.

Preparation of Red-writing INK.—"Take of the raſpings of Brazil-wood a quarter of a pound; and infuſe them two or three days in vinegar, which ſhould be colourleſs, where it can be ſo procured. Boil the infuſion then an hour over a gentle fire; and afterwards filter it, while hot, through paper, laid in an earthen cullender. Put it again over the fire, and diſſolve in it, firſt half an ounce of gum-arabic; and afterwards of alum, and white ſugar, each half an ounce."

Care ſhould be taken that the Brazil-wood be not adulterated with the Braziletto or Campeachy, commonly called peachy-wood; which is moſtly the caſe when it is ground: and though a very detrimental fraud, in all inſtances of the application of Brazil-wood to the forming bright red colours, cannot yet be perceived after the mixture of the raſpings, but by trial in uſing them; it is therefore much the beſt way, when it is wanted for purpoſes like this, to procure the true Brazil-wood in pieces; and to ſcrape it with a knife, or raſp it with a very bright file; but all ruſt of iron muſt be carefully avoided, by which means all poſſibility of ſophiſtication is of courſe prevented.

Red ink may likewiſe be prepared, by the above proceſs, of white wine inſtead of vinegar: but it ſhould be four, or be diſpoſed to be ſo; otherwiſe, a third or fourth of vinegar ſhould be added, in order to its taking the ſtronger tincture from the wood. Small beer has been ſometimes uſed for the ſame purpoſe; but the ink will not be ſo bright: and when it is uſed, vinegar ſhould be added, and the quantity of gum-arabic diminiſhed and the ſugar wholly omitted.

Preparation of Red INK *from Vermilion.*—"Take the glair

glair of four eggs, a tea ſpoonful of white ſugar or ſugar-candy beaten to powder, and as much ſpirit of wine; and beat them together till they be of the conſiſtence of oil: then add ſuch a proportion of vermilion as will produce a red colour, ſufficiently ſtrong; and keep the mixture in a ſmall phial, or well ſtopped ink bottle for uſe. The compoſition ſhould be well ſhaken together before it be uſed."

Inſtead of the glair of eggs, gum-water is frequently uſed: but thin ſize made of iſinglaſs with a little honey, is much better for the purpoſe.

Preparation of Black-printing INK *for engraving on Copper, or other nice Purpoſes.* — "Take any quantity of the beſt nut oil, and put it into an iron pot with a cover well fitted to it; of which pot it muſt fill only two thirds. Place it on a fire, and put on the cover till it makes an ebullition; when it muſt be very well ſtirred to prevent its boiling over. Suffer it then to catch fire, or kindle it by a lighted paper; and when it flames, take it from the fire, and place it in a corner of the chimney; where let it continue to burn half an hour; frequently ſtirring it. Extinguiſh then the flame, by putting the cover on the pot; or if that be not effectual, by putting a wet cloth over it. This produces the weak oil which has the principal part in the compoſition of the ink; but a ſtrong oil muſt alſo be prepared by the ſame means, only inſtead of extinguiſhing the flame at the end of half an hour, it muſt be continued till the oil be rendered very thick and glutinous, which muſt be examined by taking a little out of the pot, and ſuffering it to cool; when, if it be found to be extremely adheſive and ropy, ſo as to be drawn out in long threads, it is ſufficiently burnt; and the flame muſt be put out. This is the ſtrong oil, of which a proportion is to be uſed along with the other in the printing ink. Having prepared theſe oils, take half a pound of the Francfort, or any other good black; and grind it with the addition of only ſo much of the weak oil as is neceſſary to make it work on the ſtone, which will be generally ſomething leſs than half the weight. The whole being incorporated together, and afterwards thoroughly well mixed by a ſecond grinding, having only a ſmall quantity on the ſtone at a time, a quantity of the ſtrong oil muſt be added; which may be as much as is equal to the ſize of a ſmall hen's egg. It will then be fit for uſe; and muſt be put into a proper pot, and covered with paper or leather."

There are ſome who add an onion or cruſt of bread to the oil while boiling, in order to take off the greaſineſs; but the burning will ſufficiently do that office when properly managed.

Inſtead of Francfort, or other black commonly uſed, the following compoſition may be ſubſtituted; and will form a much deeper and more beautiful black than can be obtained by any other method.

"Take of the deepeſt Pruſſian blue five parts, and of the deepeſt coloured lake and brown pink, each one part. Grind them well with oil of turpentine: and afterwards with the ſtrong and weak oils in the manner and proportion before directed."

The colours need not be bright for this purpoſe; but they ſhould be the deepeſt of the kind, and perfectly tranſparent in oil, as the whole effect depends on that quality.

Secret or Sympathetic INK. — A great variety of methods have been invented for making ſecret letters; but the moſt common are to write with a colourleſs fluid, which may be made to aſſume the quality of ink, either by embrocating or moiſtening the paper containing the writing with ſome other fluid; or by putting it into a gentle heat; or by immerſing it in water: but many other expedients may be found for forming inviſible letters, which may be occaſionally rendered legible, by applying the proper means.

For preparing ink which may be made to appear occaſionally, the following methods may be purſued.

"Take an ounce of galls powdered; and infuſe them three or four days in half a pint of water. Pour off the clear fluid; and diſſolve in it a dram of gum-arabic: write with this fluid; and when it is deſired to render the writing viſible, rub the paper over with a ſolution of green vitriol or copperas, formed by diſſolving half an ounce of the vitriol in half a pint of water."

Or otherwiſe, "Take two ounces of quick-lime, and one ounce of orpiment; and add to them a pint of water. Let them ſtand in a gentle heat, often ſhaking the veſſel, for ſome hours, or longer if it be convenient; and then pour off the fluid. Make, in the mean time, a ſolution of ſugar of lead, by diſſolving three drams of it in two ounces of water; and with this ſolution write on paper what is required. When it is deſired to render this writing viſible, embrocate or rub over the paper with the fluid taken off from the lime and orpiment, and the letters will immediately appear of a ſtrong blackiſh colour."

In order to make it more eaſy to write with the colourleſs fluids, they may be mixed with burnt corks, ivory black, or charcoal ground to a fine powder; which will render the writing as viſible, as if ink had been uſed; but the paper may be again made to appear blank, by rubbing off the black powder; which may be eaſily done by a ſoft bruſh or linen rag; where, nevertheleſs, any black powder is mixed with the fluid, the gum-arabic, as directed in the firſt recipe, muſt be omitted; otherwiſe the powder will be ſo cemented to the paper, as not to be eaſily taken off from it, without injuring the inviſible writing under it.

Inviſible letters, which may occaſionally be rendered apparent, by holding the paper on which they are written to the fire, may be made by writing with the juice of lemons, or of onions; or with ſal ammoniacum finely powdered and tempered with water, or by the fluid which may be preſſed from the mixture of onion, urine, and ſalt, ground together till they become of an unctuous conſiſtence.

Letters may alſo be formed, which are inviſible till the paper on which they are written be immerſed in water. The eaſieſt method of doing which is, by writing with a ſolution of roach alum; and when it is deſired to have the letters appear, placing the paper in an horizontal ſituation, in a baſon full of water; where, after it has remained ſome time, the writing will ſhew itſelf in a white character very diſtinctly. There are other methods of doing the ſame; but as they are more complex and troubleſome than this, it is needleſs to inſert them.

There is a very neat and eaſy method of uſing a blank writing, that may be made viſible occaſionally; which is, the applying the manner of gilding with the gold armoniac, as it was formerly called, to this purpoſe. It muſt be done by diſſolving gum-armoniacum in water, to which ſome juice of garlic, and a little gum-arabic ſhould be added; and then writing with the mixture: which writing may be rendered viſible at any time by breathing on the paper, and then laying a leaf over the part written upon, which being compreſſed to the paper, and afterwards gently rubbed with a camel's hair-bruſh, or a little cotton, will leave the writing perfectly gilt.

Indian INK is a black pigment brought hither from China, which on being rubbed with water, diſſolves, and forms a ſubſtance reſembling ink; but of a conſiſtence extremely well adapted to the working with a pencil: on which account it is not only much uſed as a black colour in miniature painting, but is the black now generally made uſe of for all ſmaller drawings in chiaro obſcuro, or where the effect is to be produced from light and ſhade only.

The preparation of Indian ink, as well as of the other compoſitions uſed by the Chineſe as paints, is not hitherto revealed on any good authority: but it appears clearly from experiments to be the coal of fiſh-bones, or ſome other vegetable ſubſtance, mixed with iſinglaſs ſize, or other ſize; and, moſt probably, honey or ſugar-candy, to prevent its cracking. A ſubſtance therefore, much of the ſame nature, and applicable to the ſame purpoſes, may be formed in the following manner:

"Take of iſinglaſs ſix ounces, reduce it to a ſize, by diſſolving it over the fire in double its weight of water. Take then of Spaniſh liquorice one ounce; and diſſolve it alſo in double its weight of water; and grind up with it an ounce of ivory black: add this mixture to the ſize while hot; and ſtir the whole together till all the ingredients

dients be thoroughly incorporated: then evaporate away the water in balneo mariæ, and caſt the remaining compoſition into leaden moulds greaſed; or make it up in any other mould."

The colour of this compoſition will be equally good with that of the Indian ink: the iſinglaſs ſize, mixed with the colours, works with the pencil equally well with the Indian ink: and the Spaniſh liquorice will both render it eaſily diſſolvible on the rubbing with water, to which the iſinglaſs alone is ſomewhat reluctant; and alſo prevent its cracking and peeling off from the ground on which it is laid.

INLAYING, the art of marquetry. See MARQUETRY.

INNATE IDEAS, thoſe ſuppoſed to be ſtamped on the mind, from the firſt moment of its exiſtence, and which it conſtantly brings into the world with it: a doctrine which Mr. Locke has abundantly refuted. See the article IDEA.

INNOCENTS DAY, a feſtival of the Chriſtian church, obſerved on December twenty-eight, in memory of the maſſacre of the innocent children by the command of Herod, king of Judea; who being alarmed at hearing that an infant was born king of the Jews, and imagining that his own kingdom was in danger, ſent orders to have all the children ſlain that were in Bethlehem, and the adjacent country.

The Greek church in their calendar, and the Abyſſinians of Ethiopia in their offices, commemorate fourteen thouſand infants on this occaſion.

INNOMINATA OSSA, in anatomy, three bones, which compoſe the extreme part of the trunk of a human body. Theſe, though ſingle in adults, are in infants three perfectly diſtinct bones, each of which has its peculiar name; the upper one is called the ileum; the anterior one, the os pubis, or os pectinis; and the poſterior one, the os pubis, or os iſchium. Theſe are joined by the intervention of a cartilage, as it were in the middle of that ſingular cavity called the acetabulum, and continue viſibly diſtinct to the age of puberty; after which they coaleſce, and form one entire bone ſo perfectly, that there is not the leaſt veſtige remaining that they ever were ſeparate.

The innominata oſſa are joined on each ſide, in the hinder part, to the os ſacrum, by ligaments and cartilages, and form a very firm and ſtrong, though ſomewhat moveable articulation with it; and with this bone they alſo form the cavity called the pelvis; they alſo cohere with the os ſacrum on each ſide, by means of two peculiar and very robuſt ligaments, each being a finger's breadth broad, and two or three fingers breadth long.

The uſe of theſe bones are to ſupport and ſuſtain the ſpina dorſi, and indeed all the parts above themſelves; to make a firm and proper juncture of the other parts of the body with the thighs; to ſerve for the place of origin to ſeveral muſcles; to form the cavity of the pelvis, and to defend its contents from external injuries.

INNUENDO, a word that was frequently uſed in declarations of ſlander, and law pleadings, when theſe were in Latin, in order to aſcertain a perſon or thing beforementioned; but now, inſtead of the word innuendo, we ſay, meaning ſo and ſo.

INOCULATION, in medicine, the art of tranſplanting a diſtemper from one ſubject to another, by inciſion, particularly uſed for engrafting the ſmall-pox. See the article Pox.

The deſign of this operation is to communicate by art a milder ſpecies of the ſmall-pox to the infant or adult patient, than that received by the natural infection; and this by engrafting ſome of the variolous matter, in order to which a ſmall inciſion is to be firſt made, with a ſcalpel or lancet, through the ſkin of the arm; and having inſerted a ſmall particle of the purulent matter, taken from a mild kind of the pock, the little wound is then to be dreſſed with ſome dry lint, and covered with a plaſter. After the operation, the patient muſt conſtantly keep his chamber, the air of which ſhould be moderately warm, and his diet regulated by ſome prudent phyſician, by which means this diſorder will ſhew itſelf in ſeven or eight days, without any malignant ſymptoms and if aſſiſted by a proper regimen, and a moderate warmth, it uſually runs gently through its ſeveral ſtages. When the patient has once had the diſorder this way, though ever ſo mild, it is certain, from experience, that they never have it again; and therefore the opinion of thoſe ſeems to be well grounded, who think that the propagation of the ſmall-pox by inoculation might be of general uſe and benefit to mankind in preſerving the lives of ſome, and the moſt important members of others, as the face, eyes, hearing, viſcera, &c.

Hiſtory informs us, that the diſorder was this way propagated many hundred years ago, among the Greeks, Turks, and Chineſe; whereas it is but of late years that the European nations have come into it, among which the Engliſh ſeem to have approved and followed it moſt. The experiment ſucceeded ſo well in the hands of the Britiſh phyſicians, that king George I. countenanced the ſame in all his dominions, and from thence the practice prevailed with ſucceſs in Germany, particularly in the dominions of Hanover.

It muſt, however, be confeſſed, that there were many, both among the French and Engliſh, who endeavoured to ſuppreſs and vilify the practice in their writings; but it is thought by Heiſter, that all their objections have been ſufficiently anſwered and obviated by Dr. Jurin and other able phyſicians.

Heiſter declares himſelf of opinion, that ſo far from thinking the practice fatal or miſchievous, he rather firmly believes it might, under a proper management, be of the greateſt uſe and benefit to the lives and healths of mankind; for, as he judges, the ſmall pox ariſe from a peſtilential virus or matter lodged in the blood, from the very firſt day of the birth, which breaks out almoſt in every perſon, ſooner or later, and the more early uſually the better, as it is ſeldom we obſerve the pox favourable in thoſe more advanced in years; ſo that the matter ſeems to multiply itſelf in the blood, and augment with the patient's age. If, therefore, the diſorder be procured of a mild kind by this operation, and the blood cleared of its latent virus, while ſmall in quantity, and the infant young, he doubts not but many might by this means be not only preſerved from death, but even conducted ſafely through the ſeveral ſtages of the diſeaſe, without the inſults of its moſt malignant ſymptoms. We are convinced from experience, as well as reaſon, that the diſorder which breaks out from a natural infection, is generally more ſevere and fatal than that produced by art; and no wonder it ſhould be ſo, ſince in the laſt, the phyſician has the opportunity of chooſing the moſt favourable ſeaſon, and of preparing his patient before-hand, by a proper regimen, diet, and medicines.

In the Phil. Tranſ. vol. xlvii. we have a new method of inoculation, diſcovered by Mr. Brooke, and communicated by him, in a letter read before the Royal Society, May 14, 1752, to Dr. Parſons, ſecretary to the ſociety for foreign correſpondence, ſhewing by experiments, that the pock may be engrafted without making any inciſion, only by the application of a little lint impregnated with variolous matter, and confining it with an adheſive plaſter. Mr. Brooke tried the experiment upon ſeveral patients, and always with ſucceſs; the abſorbent veſſels, he believes, in young ſubjects eſpecially, will always take in a ſufficient quantity of the matter to contaminate the whole maſs of the circulating fluids; and though the denſity of the pores, or ſcaly inſpiſſations of the materia perſpirabilis, in adults, may in ſome meaſure prevent the diſorder from being communicated by contact; yet friction will eaſily remove that obſtacle; for by this means the cuticle is made as thin as is required, and the warmth induced by friction will dilate the mouths of the abſorbent veſſels, and draw a moderate flux of juices to that part, ſo that they may take in a ſufficient quantity of variolous matter to bring on the diſorder.

INOCULATION, or BUDDING, in gardening, is commonly practiſed upon all ſorts of ſtone-fruit, as nectarines, peaches, apricots, plums, cherries, as alſo upon oranges and jaſmines; and, indeed, this is preferable to any ſort of grafting for moſt ſorts of fruit. The method of performing it is as follows: you muſt be provided with a ſharp penkniſe with a flat haft, which is to raiſe the bark of

of the ſtock, to admit the bud; and ſome ſound baſs mat, which ſhould be ſoaked in water, to increaſe its ſtrength, and render it more pliable; then having taken off the cuttings from the trees you would propagate, you muſt chooſe a ſmooth part of the ſtock, about five or ſix inches above the ſurface of the ground, if deſigned for dwarfs; but if for ſtandards, they ſhould be budded ſix feet above ground. Then with your knife make an horizontal cut acroſs the rind of the ſtock, and from the middle of that cut make a ſlit downwards, about two inches in length, ſo that it may be in the form of a T; but you muſt be careful not to cut too deep, leſt you wound the ſtock; then having cut off the leaf from the bud, leaving the foot ſtalk remaining, you ſhould make a croſs cut, about half an inch below the eye, and with your knife ſlit off the bud, with part of the wood to it: this done, you muſt with your knife pull off that part of the wood which was taken with the bud, obſerving whether the eye of the bud be left to it or not; for all thoſe buds which loſe their eyes in ſtripping, are good for nothing: then having gently raiſed the bark of the ſtock with the flat haſt of your penknife clear to the wood, thruſt the bud therein, obſerving to place it ſmooth between the rind and wood of the ſtock, cutting off any part of the rind belonging to the bud, that may be too long for the ſlit made in the ſtock; and ſo having exactly fitted the bud to the ſtock, tie them cloſely round with baſs mat, beginning at the under part of the ſlit, and ſo proceeding to the top, taking care not to bind round the eye of the bud, which ſhould be left open.

When your buds have been inoculated three weeks or a month, thoſe which are freſh and plump, you may be ſure are joined; and at this time you ſhould looſen the bandage, which if it be not done in time, will injure if not deſtroy the bud. The March following cut off the ſtock ſloping, about three inches above the bud, and to what is left faſten the ſhoot which proceeds from the bud: but this muſt continue no longer than one year; after which the ſtock muſt be cut off cloſe above the bud. The time for inoculating is from the middle of June to the middle of Auguſt; but the moſt general rule is, when you obſerve the buds formed at the extremity of the ſame year's ſhoot, which is a ſign of their having finiſhed their ſpring growth. The firſt ſort commonly inoculated is the apricot, and the laſt the orange-tree, which ſhould never be done till the latter end of Auguſt: and in doing this work, you ſhould always make choice of cloudy weather; for if it be done in the middle of the day, when the weather is hot, the ſhoots will perſpire ſo faſt, as to leave the buds deſtitute of moiſture.

INORDINATE PROPORTION is where there are three magnitudes in one rank, and three others proportional to them in another, and you compare them in a different order. Thus, ſuppoſe the numbers in one rank to be 2, 3, 9; and thoſe of the other rank 8, 24, 36; which are compared in a different order, viz. 2 : 3 :: 24 : 36; and 3 : 9 :: 8 : 24. Then rejecting the mean terms of each rank, you conclude 2 : 9 :: 8 : 36.

INOSCULATION, in anatomy, the ſame with anaſtomaſis. See ANASTOMASIS.

INQUEST, in law, ſignifies an enquiry made by a jury, in a civil or criminal cauſe, by examining witneſſes. See the article JURY.

INQUIRENDO, in law, an authority given to one or more perſons, to enquire into ſomething for the advantage of the king.

INQUISITION, in law, a manner of proceeding by way of ſearch or examination uſed on the king's behalf, in caſes of out-lawry, treaſon, felony, ſelf-murder, &c. to diſcover lands, goods, and the like, forfeited to the crown.

INQUISITION, in the church of Rome, a tribunal in ſeveral Roman-catholic countries, erected by the popes for the examination and puniſhment of heretics.

This court was founded in the twelfth century by father Dominic and his followers, who were ſent by pope Innocent III. with orders to excite the Catholic princes and people to extirpate heretics, to ſearch into their number and quality, and to tranſmit a faithful account thereof to Rome. Hence they were called inquiſitors; and this gave birth to the formidable tribunal of the inquiſition, which was received in all Italy, and the dominions of Spain, except the kingdom of Naples and the Low-Countries.

This diabolical tribunal takes cognizance of hereſy, judaiſm, mahometaniſm, ſodomy, and polygamy; and the people ſtand in ſo much fear of it, that parents deliver up their children, huſbands their wives, and maſters their ſervants, to its officers, without daring in the leaſt to murmur. The priſoners are kept for a long time, till they themſelves turn their own accuſers, and declare the cauſe of their impriſonment; for they are neither told their crime, nor confronted with witneſſes. As ſoon as they are impriſoned their friends go into mourning, and ſpeak of them as dead, not daring to ſollicit their pardon, leſt they ſhould be brought in as accomplices. When there is no ſhadow of proof againſt the pretended criminal, he is diſcharged, after ſuffering the moſt cruel tortures, a tedious and dreadful impriſonment, and the loſs of the greateſt part of his effects. The ſentence againſt the priſoners is pronounced publicly, and with extraordinary ſolemnity. In Portugal they erect a theatre capable of holding three thouſand perſons, in which they place a rich altar, and raiſe ſeats on each ſide in the form of an amphitheatre. There the priſoners are placed, and over-againſt them is a high chair, whither they are called, one by one, to hear their doom, from one of the inquiſitors.

Theſe unhappy people know what they are to ſuffer, by the cloaths they wear that day. Thoſe who appear in their own cloaths, are diſcharged upon payment of a fine: thoſe who have a ſanto benito, or ſtrait yellow coat without ſleeves, charged with St. Andrew's croſs, have their lives, but forfeit all their effects: thoſe who have the reſemblance of flames, made of red ſerge, ſewed upon their ſanto benito, without any croſs, are pardoned, but threatened to be burnt if ever they relapſe: but thoſe who, beſides theſe flames, have on their ſanto benito, their own picture, ſurrounded with figures of devils, are condemned to expire in the flames. The inquiſitors, who are eccleſiaſtics, do not pronouce the ſentence of death; but form and read an act, in which they ſay, that the criminal being convicted of ſuch a crime, by his own confeſſion, is with much reluctance delivered to the ſecular power to be puniſhed according to his demerits: and this writing they give to the ſeven judges, who attend at the right ſide of the altar, who immediately paſs ſentence. For the concluſion of this horrid ſcene, ſee the article ACT *of Faith*.

INQUISITORS, in law, perſons who have power by their office to make inquiry in certain caſes; as ſheriffs, and coroners on view of the body, &c.

INROLLMENT, in law, is regiſtering any lawful act, as a ſtatute or recognizance acknowledged, a deed of bargain and ſale, &c. in the rolls of chancery, king's bench, common pleas, or exchequer, at the huſtings of Guildhall, London, or at the quarter-ſeſſions.

INSCONSED, in the military art, part of an army that have fortified themſelves with a ſconce or ſmall fort, in order to defend ſome paſs, &c.

INSCRIBED, in geometry. A figure is ſaid to be inſcribed in another, when all its angles touch the ſides or planes of the other figure. See HEXAGON, PENTAGON, &c.

INSCRIPTION, a title or writing carved, engraved, or affixed to any thing, to give a more diſtinct knowledge of it, or to tranſmit ſome important truth to poſterity.

INSECTS, *Inſecta*, in natural hiſtory, a ſmaller kind of animals, that commonly are exſanguinous.

The word is Latin, and derived from *in*, and *ſeco*, to cut, becauſe in ſome inſects, as ants, the body ſeems divided into two; or becauſe the bodies of ſeveral of them, as worms, &c. conſiſt of divers rings, which are a ſort of inciſure.

Mr. Ray, in his *Methodus Inſectorum*, divides inſects into ſuch as do not change their form; and into ſuch as really do.

Inſects which do not change their form are either without feet, or with feet: and of theſe there are ſome kinds that caſt their ſkins, and others that do not.

Inſects without feet are either terreſtrial or aquatic. The terreſtrial are ſuch as are produced on the earth, as

the lumbrici terreſtres, which are either of the larger ſort, and called dew-worms, or of a ſmaller ſize: and of theſe there are ſome red, and others green with yellow tails; which laſt are commonly called gilt-tails: or, ſecondly, ſuch as are found in the bowels of animals, of which ſome are found in the inteſtines of men, as the lumbrici teretes. 2. The lumbrici lati, which are alſo called tæniæ. 3. Cucurbitini, which ſome take to be only fragments of the tæniæ. 4. Aſcarides, which are chiefly found in the rectum. Others are found in the inteſtines of beaſts, which are of two ſorts; the oblongi and pellucidi, of the thickneſs of a horſe-hair, and therefore called vermiculi ſetiformes: and the breves and craſſiores which are found in horſes, and called the botts.

To the genus of terreſtrial inſects many refer ſnails, whether with or without ſhells.

Aquatic inſects without feet, that do not change their form, are either, 1. Of the larger ſort, that, by fixing their heads to the ground, draw up their tails towards them, &c. Of theſe ſome are round and ſmooth, and are of three ſorts, as the medicinal hirundines or leeches, the common black horſe-leeches, and the aſh-coloured ſea-leeches; but there is alſo a ſmaller and flatter kind that ſtick to the ſtones in the bottom of ſmall brooks. Or of the leſſer ſort that move differently from the former; theſe are alſo either round or flat; of the round ſort there is one that is black with two ſmall horns on its head, found ſticking to wet ſtones on the tops of the hills; and another that is red, about a finger's length, with a forceps at the tail, found at the bottom of fiſh-ponds and ſtagnant waters. The flat ſort are very ſmall and thin, and called flukes, being ſometimes found in waters, and ſometimes in the branches of the porus biliarius in ſheep.

Inſects that do not change form, and have feet, are, 1. Thoſe with ſix feet. 2. Thoſe with eight feet. 3. Thoſe with fourteen feet; and, 4. Thoſe with many feet.

Thoſe of ſix feet are terreſtrial or aquatic: the terreſtrial are either of a larger kind, as 1. The yellowiſh inſect found in decaying oaks. 2. The black one on the ground, called vermivorous by Mouffet. 3. The black one living under ground, with a forceps at the tail. 4. A white ſort with ſquare black ſpots on its back. 5. The farinarium, that is bred in meal, of a whitiſh colour. Or, ſecondly, a ſmaller ſort, ſome of which are found about the bodies of animals, as 1. The cimex, bug, or wall-louſe, of a ſtinking ſmell. 2. Ricinus, the tick. 3. Pediculus, the common louſe. 4. Pediculus, the ferus ſeu inguinalis, the crab-louſe. 5. Pulex, the flea, of which there are various kinds. Others are not found on the bodies of animals; as, 1. One that reſembles a common louſe in bigneſs and figure, but is very nimble, and found in books and rotten paper. 2. Another with a very long body and a forcipital tail. 3. The black inſect found often in the flowers of the chelidonium. 4. A ſubterraneous ſort, a little whitiſh. 5. One that ſkips like a graſs-hopper, but much leſs.

The aquatic are, 1. The pediculus marinus grandis, which adheres to fiſhes. 2. The ſquilla fluviatilis, with a pyramidal tail, and two hairs or briſtles at the end.

Inſects that do not change form with eight feet, either have a tail, as the ſcorpion; or are without, as, 1. The ſpider; of which ſome ſpin no web, have but two eyes, and very long legs, as the opilio or ſhepherd: others ſpin a web; and of theſe they reckon three ſorts, 1. The aranea colceſtrenſis abdomine tumido, ſubrotundo, et elato. 2. The ſpider, with the thorax or middle part of the body as big as the abdomen. 3. The ſpider, with the long abdomen, found among reeds, ruſhes, graſs, &c. Secondly, the ticks with eight feet, of which ſome are more flat, as the rambling ticks that run over the bodies of animals, but do not faſten; and ſome more round and thick, which adhere to the ſkin. Thirdly, the ſyrones or mites. Inſects that do not change form, and with fourteen feet, are the aſelli; of which there are three ſorts, as, 1. The ſea aſellus, the longeſt and largeſt of all, living among the rocks, 2. Aſellus lividus, which rolls itſelf up into a ball. The common wood-lice, ſows, or cheſs-bugs. 3. Aſellus aſininus with a forked tail, not rolling itſelf up. To theſe ſpecies may likewiſe be added, 1. The aſellus marinus figuræ brevioris, rolling itſelf up. 2. Aſellus aquarum dulcium, with long legs and two briſtles on its tail. 3. Pulex aquaticus, both in freſh and ſalt water. 4. Pediculus aquaticus, which faſtens upon fiſh.

Inſects that do not change form, and with twenty-four feet, have the eight fore-feet leſſer, and the ſixteen hinder ones larger; there are two kinds of them, both with long bodies; the one larger, and of a dark colour, among the rocks by the ſea-ſide; the other of a ſilver colour, found in houſes.

There is a kind with thirty feet, of an oblong ſhape, cheſnut colour, and full flattiſh body, uſually lying under logs and trunks of trees; it is very agile.

Inſects that do not change form, and have many feet, are ſome on land, and either roundiſh in body, with all their legs riſing out of the middle of the belly nearly, as the julus; or more flat, with their legs not riſing as before from a point in the middle of their body, but growing along on the ſides, as the ſcolopendra. Others are aquatic, of which Mr. Ray makes three differences; 1. The Corniſh lugs, uſed as a bait for catching fiſh, with thirty-eight legs, and a ſmooth roundiſh body. 2. The ſcolopendra marina corpore plano. 3. The animalculum bicorpor, or rather bicaudatum, lying in the cleſts of ſtones under ſalt water.

Inſects which undergo a change, are improperly ſo denominated, as Swammerdam ſhews that there is only an explication of the parts of the animal, latent both in miniature, like the plant in the ſeed, and an increaſe of all the parts by proper degrees. The firſt ſpecies of tranſmutation is inſtantaneous. The inſects of this order do not loſe their motion at the time they ſhift their pellicles, at leaſt not to appearance. This is when the vermiculus, leaving the former ſhape of the nympha, with which it appeared in the egg, and ſubſiſted without food, now beginning to feed, has its parts viſibly ſtretched out, and takes the form of a new nympha, which is not without motion, and from thence becomes a flying inſect. Of this ſort are, 1. The libellæ or perlæ, which are produced from an inſect of ſix feet, and which Mouffet takes for the pulex marinus, or locuſta aquatica. Out of the cruſtaceous huſk of this inſect, the libella breaks by a fiſſure which begins between the eyes, and is continued to the roots of the wings, and is there joined to the lateral fiſſures. 2. The cimices ſilveſtres, whoſe characteriſtics, according to Willughby, are, 1. A long proboſcis, not ſpiral but ſtraight. 2. Their upper wings to the middle are thick and like leather, and thence to the extremities thin and membranous. 3. The figure of St. Andrew's croſs on the back. 4. The locuſta which Willughby refers to thoſe inſects that are not transformed. 5. The grylli campeſtres. 6. Grylli domeſtici or crickets. 7. Gryllo-talpa, the mole-cricket. 8. Cicada or graſshopper. 9. Blatta, according to Swammerdam. 10. Tipulæ aquaticæ, which run ſwiftly on the ſurface of the water, and have a ſting in their mouths, like the ticks or cimices. 11. Scorpius aquaticus, with a ſting in its mouth. 12. Muſcæ aquaticæ, which Aldrovandus calls apes amphibiæ. 13. Hemerobius or ephemera, or diaria of Swammerdam. 14. The forficula or auricularia.

The ſecond ſpecies of tranſmutation includes ſuch inſects as undergo a double metamorphoſis. 1. Into a chryſalis, or ſomething analogous thereto. 2. A flying inſect.

Theſe inſects, a while before they change, lie quite ſtill, and, with regard to their wings, are vaginipennes as the ſcarabæi or beetles. Secondly, thoſe whoſe wings are open, and theſe are either farinaceous, as the papiliones &c. or membranous, as the apes, muſcæ, &c. and they are either with two wings or with four. The ſcarabæ may be divided, 1. In reſpect of their horns, into the naſicornis, bucerota, and cervus volans or taurus. 2. In reſpect of their antennæ, which are of divers kinds, of which the moſt conſiderable are the capricorni. 3. With regard to their motion, as the ſaltatrices. 4. With reſpect to their colour, as the cantharides.

To the beetle kind may likewiſe be referred the cicindela or glow-worm; the ſtaphylinus; the proſcarabæus or oil-beetle, as, upon ſqueezing, a kind of oil is emitted from its joints: the anelytra with mealy wings, called papiliones, butterflies; and theſe are either diurnal or nocturnal: the characteriſtic of the diurnal is, that they always

always ſettle with their wings erect, are produced from an angular aurelia, and have their antennæ ſtudded; of theſe there are about fifty ſorts obſerved in England. The nocturnal butterflies or phalenæ are very numerous, and cannot be clearly methodized: but they may be divided into, 1. Geometrigenæ, which come from an eruca called geometra, from the manner of its walking, which is anſatinous, by curling up its back like the handle of a cup, with eight or ten feet. 2. Such as come from erucæ with fourteen feet: of this kind, which is very numerous, there hath been diſtinguiſhed the phalæna faſciata, whoſe wings are in areas of divers colours; phalæna lineata, whoſe wings are marked with tranſverſe lines; phalæna punctata, whoſe wings are marked with points; and, except theſe, all the others are diſtinguiſhed into greater, leſſer, and of a middling ſize. One of the larger kinds may be diſtinguiſhed likewiſe by their inner wings running out beyond the upper, when they reſt; and another by the appearance of eyes upon the wings; and a third by their long nails and narrow ſharp wings, which ſome call phalænæ prædatrices, or accipitrinæ.

The anelytra, with membranous wings, are bees, flies, waſps, bombylii, crabrones, &c. and to this kind Swammerdam refers the culex vulgaris or gnat, as alſo the formica or ant.

Hitherto alſo muſt be referred ſuch water inſects as are covered with a theca or caſe, according to Willughby. Theſe are, firſt, an immoveable caſe fixed to the ſtones; and this is either of a round figure, or one more compreſſed. Secondly, a moveable, portable caſe; and theſe are commonly called phryganæa; and their theca is, 1. Straight, and that either compoſed of ſtraws and little feſtucæ, lying parallel to one another; of which there are two kinds; a larger, where the feſtucæ are two inches long; and a leſſer, which are very common, and called ſtraw-worms. Or elſe the feſtucæ lie tranſverſely, and are ſhorter, having ſometimes pieces of ſhells or ſtones intermixed with them; others, whoſe caſes are ſtraight, have no feſtucæ, but always, either ſand or gravel; and of theſe ſome have the theca round, and called cod-baits; others are flat. 2. Crooked or horned, which run tapering; of theſe Mr. Ray reckons four kinds; a greater and leſs black ſort, and a greater and leſs aſh-coloured one. Theſe all produce flies with large wings, like butterflies.

The third ſpecies of tranſmutation is a ſimple change from a vermiculus to a flying inſect, but with a ſenſible ſtop between one form and the other of this kind are our fleſh flies, and all the nymphæ vermiformes, the veſpæ, ichneumones, &c.

As to the generation of inſects, the world is now generally convinced that they are not bred of corruption, but *ex ovo*, though the contrary was believed by the ancients.

Malpighi, Swammerdam, and Redi, have abundantly confuted the doctrine of equivocal generation, as well as the chimerical transformation of the caterpillar into the butterfly; and have ſhewn, that all the members of the butterfly were incloſed under the nympha or ſkin of the caterpillar, as the parts of a plant are in the ſeed.

Inſects take particular care to depoſit their eggs or ſemen in ſuch places where they may have a ſufficient incubation, and where the young, when hatched, may have proper food till they can ſhift for themſelves. Thoſe whoſe food is in the water, lay their eggs there: thoſe to whom fleſh is a proper food, in fleſh; and thoſe to whom the fruits or leaves of vegetables are food, are accordingly depoſited there, but conſtantly the ſame kind in the ſame tree. As for others that require a greater degree of warmth, they are provided by the parent with ſome place in or about the body of other animals, as the feathers of birds, hair of beaſts, ſcales of fiſh, in the noſe, in the fleſh, nay ſome in the bowels of man, and other creatures. And as for others, they make them neſts, by digging into the earth, wood, &c. carrying in and ſealing up proviſions that ſerve for the production of their young, and for their food, when produced.

There is obſerved in flies, butterflies, &c. a kind of glue, by which the female faſtens her eggs to the bearing buds of trees, &c. ſo as not to be hurt by rain or froſt.

Mr. Andry, in his Treatiſe *de la generation des vers dans le corps de l'homme*, takes notice that the ancients were miſtaken in denying that inſects breathed, on account of their wanting lungs; for modern obſervations convince us, that inſects have a greater number of lungs than other animals; they alſo thought that they had no blood, as many of them had no red liquor like ours; but it is not the colour, but the uſe of the liquor, that is to be regarded. They alſo believed that they had no hearts; whereas our microſcopes now diſcover that, when inſects have ſeveral lungs, they have alſo ſeveral hearts; and this in particular is obſervable in ſilk-worms, who have a continued chain of hearts from the head almoſt to the extremity of the tail; and, as is apparent from ſeveral inſects, who give ſigns of life, long after they are divided into ſeveral parts.

Inſects want no parts that are either neceſſary or convenient for their uſe, or to render them complete in their kind. Some affirm that earth worms, and thoſe round-tailed worms, which are found in the inteſtines of men, horſes, &c. as alſo ſnails and horſe-leeches, are hermaphrodites; but that ſuch worms as become flies, and that ſilk-worms, are not ſo, being of no ſex, but neſts full of real animals, which in time come out with wings.

INSIDIANT DISEASES, thoſe which ſhew no evident ſymptom, but lie concealed in the body, ready to break forth on the leaſt provocation, as it were by ſurpriſe.

INSITION, in gardening, the ſame with grafting. See GRAFTING.

INSOLATION, in chemiſtry, the ſuffering matters to ſtand and digeſt in the heat of the ſun, inſtead of that of a furnace. See FIRE and HEAT.

INSOLVENT, a term applied to perſons unable to pay their debts. See DEBT and DEBTOR.

INSPIRATION, *Inſpiratio*, the conveying certain ſupernatural notices to the ſoul. This is ſuch an overpowering impreſſion made of any propoſition upon the mind by God himſelf, as gives an indubitable evidence of the truth and divinity of it.

INSPIRATION, in phyſic, that part of reſpiration, whereby the air is drawn into the lungs, and ſtands contradiſtinguiſhed from exſpiration.

This admiſſion of the air depends immediately on its elaſticity, when the cavity of the breaſt is enlarged by the elevation of the thorax and abdomen, and particularly by the motion of the diaphragm downwards. This dilatation of the breaſt does not draw in the air, though it be a condition abſolutely neceſſary to inſpiration, but it is an actual intruſion of the air into the lungs.

INSPISSATING, INSPISSATION, or CONDENSATION, in pharmacy, the reducing a liquor to a thicker conſiſtence by evaporating the thinner parts. See INCRASSATING.

INSTALLMENT, the inſtating a perſon in any dignity.

The word is derived from the Latin *inſtallo*, which is compounded of *in*, and *ſtallum*, a ſeat in a church, bench in a court of juſtice, &c.

It chiefly denotes the induction of a dean, prebendary, or other eccleſiaſtic dignitary, into the poſſeſſion of his proper ſeat in a cathedral church. This is ſometimes called inſtallation.

INSTALLMENT likewiſe denotes the ceremony, whereby the knights of the garter are placed in their rank in the chapel of St. George at Windſor.

INSTANT, ſuch a part of duration wherein we perceive no ſucceſſion, or it is that which takes up the time of one idea in our minds.

The ſchoolmen diſtinguiſh three kinds of inſtants; a temporary, a natural, and a rational inſtant.

Temporary inſtant is a part of time immediately preceding another: thus the laſt inſtant of a day precedes, immediately and really, the firſt inſtant of the following day.

Natural inſtant is what we otherwiſe call a priority of nature, which obtains in things that are ſubordinated in acting, as firſt and ſecond cauſes, or cauſes and their effects: for the nature of things requires, that if there be a ſecond cauſe there muſt be a firſt; and that there muſt be a cauſe, if there be an effect. See CAUSE.

Rational inſtant is not any real inſtant, but a point which the underſtanding conceives to have been before ſome other inſtant, founded on the nature of the thing which occaſioned it to be conceived: for inſtance, if God made ſeveral things voluntarily, which he could otherwiſe have let alone, there is a reaſonable foundation to conceive God ſuch as he is in himſelf, before he had made any of theſe voluntary determinations: but as there was no real inſtant when God had not formed any determination, this inſtant is called a rational inſtant, by way of oppoſition to an inſtant of time.

INSTAURATION, the re-eſtabliſhment or reſtauration of a religion, a church, or the like, to its former ſtate.

INSTEP, in the manege, is that part of a horſe's hind leg which reaches from the ham to the paſtern-joint; and which, when the horſe is in his natural poſture of ſtanding, ſhould be large, flat, and in a perpendicular line with the ground: for when the inſteps do not ſtand perpendicularly, it is a certain ſign of weakneſs either in the reins or hinder quarters.

INSTINCT, an appellation given to the ſagacity and natural inclinations of brutes, which ſupplies the place of reaſon in mankind. See the articles REASON and BRUTE.

INSTITUTES, in literary hiſtory, a book containing the elements of the Roman law, and conſtitutes the laſt part of the civil law. See CIVIL LAW.

INSTITUTION, in general, ſignifies the eſtabliſhing or founding ſomething.

INSTRUMENT, in general, whatever is ſubſervient to a cauſe in producing any effect.

A common caſe of mathematical inſtruments contains ſeveral compaſſes, a ſector, ſcale, drawing-pen, and protractor. See the articles COMPASSES, SECTOR, SCALE, &c.

INSTRUMENT, in law, ſome public act, or authentic deed, by which any truth is made apparent, or any right or title eſtabliſhed in a court of juſtice. See the article DEED.

INSULATED, *Inſulatus*, in architecture, an appellation given to ſuch columns as ſtand alone, or free from any contiguous wall, &c. like an iſland in the ſea, whence its name.

INSULT, *Inſultus*, in medicine, ſignifies the acceſs of the paroxyſm of intermitting diſeaſes.

INSULT, in the art of war, the ſame with aſſault. See ASSAULT.

INSURANCE, or ASSURANCE, a contract or ſecurity, which is commonly called policy, given by one or more perſons, whereby they oblige themſelves, in conſideration of a ſum of money paid down, to make good ſhips, merchandizes, houſes, &c. to the value of that for which the premium is received, in caſe of loſs by ſtorm, pirates, fire, &c.

We have in London ſeveral offices of inſurance from fire, which are erected into corporations, as the Royal Exchange-aſſurance, the Sun-fire-office, the Hand in-Hand fire-office, the London-aſſurance, the Phœnix-office, &c. ſome for houſes, others for goods, and ſome for both.

There are alſo offices wherein private merchants grant inſurances for ſhips, and theſe are called inſurance-brokers.

We have alſo aſſurances for life, by virtue of which, when the perſon aſſured dies, a ſum of money, according as he inſured, becomes payable to the perſon in favour of whom the policy of aſſurance was granted. See POLICY *of Aſſurance*.

INTACTÆ, in conics, an appellation ſometimes given to the aſymptotes. See the article ASYMPTOTES.

INTAGLIOS, precious ſtones on which are engraved the heads of great men, inſcriptions, and the like; ſuch as we frequently ſee ſet in rings, ſeals, &c.

INTEGER, in arithmetic, a whole number, in contradiſtinction to a fraction. See NUMBER and FRACTION.

INTEGRAL, or INTEGRANT, in the ſchools, denotes thoſe parts which are neceſſary to the integrity of any whole, and ſo ſtand contradiſtinguiſhed from eſſential parts. The arms, &c. are integral parts of a man; body and ſoul are eſſential parts.

INTEGRAL *Calculus*, in the new analyſis, is the counter part to the differential calculus. The latter hath been fully explained by M. l'Hoſpital; but the former hath been but little cultivated.

The integral calculus of Leibnitz and others anſwers to the inverſe method of fluxions among the Engliſh. See FLUXIONS.

INTENDMENT, in law, is the intention, deſign, or true meaning of a perſon or thing, which frequently ſupplies what is not fully expreſſed: but though the intent of parties in deeds and contracts is much regarded by the law, yet it cannot take place againſt the rules of law.

INTENDMENT *of Crimes*; this in caſe of treaſon, where the intention is proved by circumſtances, is puniſhable in the ſame manner as if it was put in execution.

INTERCALARY DAY, in chronology, the odd day inſerted in a leap-year. See the article BISSEXTILE.

The word is Latin, *intercalaris*, and derived from *inter*, and *calo*, which anciently ſignified to call with a loud voice: an intercalary day among the Romans, ſignifying a day inſerted between two other days, which for that reaſon was proclaimed by the prieſts with a loud voice.

INTERCEPTED AXIS, in conic ſections, the ſame with abſciſs. See ABSCISS.

INTERCOLUMNIATION, in architecture, implies the ſpace between two columns, which is always to be proportioned to the height and bulk of the columns.

INTERCOMMONING, in law, is when the commons of two manors lie together, and the inhabitants of both have, time out of mind, cauſed their cattle to feed promiſcuouſly on them.

INTERCOSTAL, in anatomy, an appellation given to ſuch muſcles, nerves, arteries, and veins, as lie between the ribs. See RIB.

INTERDICT, an eccleſiaſtical cenſure, by which the church of Rome forbids the performance of divine ſervice in a kingdom, province, town, &c.

INTEREST, a ſum of money which is reckoned for the loan and forbearance of ſome other ſum lent for, or due at, a certain time, according to a certain rate in the hundred pounds. The ſum lent or forborne is called the principal, becauſe it produces the intereſt, or from which the intereſt is reckoned. Intereſt is either ſimple or compound.

Simple INTEREST is that which is paid for the loan of any principal or ſum of money lent out for ſome time at any rate, per cent. agreed on between the borrower and the lender; which, according to the laws of England, ought to be but 5 l. for the uſe of 100 l. for one year, and 10 l. for the uſe of 100 l. for two years; and ſo on for a greater or leſs ſum, proportionable to the time propoſed.

There are ſeveral ways of computing or anſwering queſtions about ſimple intereſt; as by the ſingle and double rule of three; others make uſe of tables compoſed of ſeveral rates per cent.

But we ſhall ſhew, that all computations, relating to ſimple intereſt, are grounded upon arithmetical progreſſion; and from thence raiſe ſuch general theorems as will ſuit with all caſes. In order to that,

Let $\begin{cases} P = \text{any principal or ſum put to intereſt.} \\ R = \text{the ratio of the rate per cent. per annum.} \\ t = \text{the time of the principal's continuing at intereſt.} \\ A = \text{the amount of the principal and its intereſt.} \end{cases}$

Note. The ratio of the rate is only the ſimple intereſt of 1 l. for one year, at any given rate; and it is found thus: viz.

100 : 5 : : 1 : 0.05 = the rate at 5 per cent. per annum.
100 : 6 : : 1 : 0.06 = the rate at 6 per cent. &c. Again,
100 : 6.5 : : 1 : 0.065 = the ratio 6 and $\frac{1}{2}$ per cent.

And if the given time be whole years, then t = the number of thoſe years: but if the time given be either pure parts of a year, or parts of a year mixed with years, thoſe parts muſt be turned into decimals; and then t = thoſe decimals, &c.

Now

Now the common parts of a year may be eaſily turned or converted into decimal parts, if it be conſidered,

That one { Day is the $\frac{1}{365}$ part of a year = 0.00274. / Month is the $\frac{1}{12}$ part of a year = 0.08333. / Quarter is the $\frac{1}{4}$ of a year = 0.25.

Half a year = 0.5, and three quarters = 0.75.

Theſe things being premiſed, we may proceed to raiſing the theorems:

Let R = the intereſt of 1 l. for one year, as before.

Then 2 R = the intereſt of 1 l. for two years.

And 3 R = the intereſt of 1 l. for three years.

4 R = the intereſt of 1 l. for four years; and ſo on for any number of years propoſed.

Hence it is plain that the ſimple intereſt of 1 l. is a ſeries of terms in arithmetical progreſſion increaſing, whoſe firſt term and common difference is R; and the number of all the terms is t: therefore the laſt term will always be tR = the intereſt of 1 l. for any given time ſignified by t.

Then { As 1 l. is to the intereſt of 1 l. ſo is any principal or given ſum to its intereſt.

That is, 1 l. : tR :: P : tR P = the intereſt of P. Then the principal being added to its intereſt, their ſum will be = A, the amount required: which gives this general theorem:

Theorem tR P + P = A.

From whence the three following theorems are eaſily deduced.

Theorem 2. $\frac{A}{tR+1} = P.$

Theorem 3. $\frac{A-P}{tP} = R.$

Theorem 4. $\frac{A-P}{RP} = t.$

Theſe four theorems reſolve all queſtions about ſimple intereſt. Thus if it were to be required to find what 256 l. 10 s. will amount to in three years, one quarter, two months, and eighteen days, at 6 per cent. per annum.

Here is given P = 256.5, R = 0.06, and t = 3.46599. Quere A, per theorem 1.

For three years = 3.
One quarter = 0.25
Two months = 0.16667 = 0.08333 × 2
Eighteeen days = 0.04932 = 0.00274 × 18

Hence t = 3.46599: × 0.06 = 0.2079594 = tR.
Then 0.207594 × 256.5 = 53.341586 = t R P.
And 53.341586 + 256.5 = 309.841586 = tR P + P = A.
That is, 309.841586 = 309 l. 16 s. 10 d. being the anſwer required.

And thus may all queſtions, relating to ſimple intereſt, be reſolved, due regard being had to the theorem relating to the queſtion.

Annuities, or penſions in arrears, may be computed by ſimple intereſt, as follows.

When annuities, payable yearly, half yearly, &c. are not paid as they become due, ſuch annuities are ſaid to be in arrears; and, therefore, to find the value of an annuity in arrears, we muſt calculate what all thoſe payments will amount to, allowing any rate of ſimple intereſt for their forbearance, from the time each particular payment became due. In order to this, put u = the annuity, t = the time it has continued unpaid, R = the ratio, or intereſt for 1 l. for one year, and A = the amount of the annuity and its intereſt.

Then if u = the firſt year's rent due with intereſt, Ru will = the intereſt, and 2 u = the rent due at the end of the ſecond year: and conſequently, 2Ru = the intereſt, and 3u = the rent due at the end of the third year; and 3Ru = the intereſt, and 4 u = the rent due at the end of the fourth year: and ſo on for any number of years.

Hence it is evident, that Ru + 2Ru + 3Ru + 4Ru + 5u = A, the ſum of all their rents and their intereſts being forborn five years: from whence it follows, that Ru + 2Ru + 3Ru + 4Ru = A − tu. Here t = 5. Divide the equation by u, and we have R + 2R + 3R + 4R = $\frac{A-tu}{u}$. In order to find the ſum of this progreſſion, put z = R + 2R + 3R + 4R, &c. Then 1 + 2 + 3 + 4, &c. = $\frac{z}{R}$. Here the ſum of the firſt and laſt terms is 4 + 1 = 5 = t. And the number of all the terms is 4 = t − 1: therefore $\frac{t-1}{2} \times t$ = the ſum of all the terms. That is, $\frac{tt-t}{2} = \frac{Z}{R}$. Hence $\frac{ttR-tR}{2} = z$. Conſequently $\frac{ttR-tR}{2} = \frac{A-tu}{u}$.

From this equation the three following theorems are eaſily and naturally deduced.

Theorem 1. $\frac{ttRu-tRu+2tu}{2} = A.$ Or, $\frac{ttu-tu}{2} \times R : + tu = A.$

Theorem 2. $\frac{2A}{ttR+tR+2t} = u.$ Theorem 3. $\frac{2A-2tu}{ttu-tu} = R.$ Let $\frac{2}{R} = x + 1.$ Then $t = \sqrt{\frac{2A}{Ru} + \frac{xx}{4}} - \frac{1}{2}x.$ Theorem 4.

By the help of theſe four theorems, all queſtions of this nature may be eaſily ſolved. Thus for example:

Suppoſe 250 l. yearly annuity, be forborn or unpaid ſeven years, what will it amount to in that time at ſix per cent. for each payment as it becomes due?

Here u = 250, t = 7, and R = 0,06, are given, to find A; which is eaſilyperformed by theorem 1. For, firſt 250 × 7 = 1750 = tu; and 1750 × 7 = 12250 = ttu. Again, 12250 − 1750 = 10500 = ttu − tu. And $\frac{10500}{2}$ × 0,06 = 315. Laſtly, 315 + 1750 = A = 2065 l. the anſwer required.

Having ſhewn the method of finding the value of annuities in arrears, we ſhall proceed to explain the manner of finding the preſent worth of annuities, computed at ſimple intereſt.

The whole buſineſs of purchaſing annuities, or taking of leaſes, &c. for any aſſigned time, depends upon the purchaſe, with the annuity or yearly rent, by allowing the ſame rate of intereſt to both parties, which may be eaſily performed by carefully attending to what has been already ſaid. For example, What is 75 l. yearly rent, to continue nine years, worth in ready money at 6 per cent. per ann. ſimple intereſt?

Firſt, by theorem 1, find what the propoſed yearly rent would amount to, if it were forborn nine years at 6 per cent. which by the ſaid theorem will amount to 837 = A.

Then find what principal being put out to intereſt, for the ſame time, and at the ſame rate, will amount to 837 l. = A.

Thus tR = 0.54 = 9 × 0.06, tR + 1 = 1.54, by which divide 837, and we have 543.5064 = 543 l. 10 s. 1 d. $\frac{1}{2}$, the preſent worth of the annuity required.

Compound INTEREST is that which ariſes from any principal and its intereſt put together, as the intereſt ſtill becomes due; ſo that at every payment, or at the time when the payments become due, there is created a new principal; and for that reaſon it is called intereſt upon intereſt, or compound intereſt.

As for inſtance, ſuppoſe 100 l. were lent out for two years at 6 per cent. per annum, compound intereſt; then at the end of the firſt year, it will only amount to 106 l. as in ſimple intereſt. But for the ſecond year this 106 l. becomes principal, which will amount to 112 l. 7 s. 2 d. $\frac{1}{2}$. at the ſecond year's end; whereas by ſimple intereſt it would have amounted to but 112 l. And although it be not lawful to let out money at compound intereſt, yet in purchaſing annuities or penſions, &c. and taking leaſes in reverſion, it is very uſual to allow compound intereſt to the purchaſer for his ready money, and therefore it is very requiſite to underſtand it.

Let R be the amount of one pound in one year, viz. principal and intereſt; P any ſum put out at intereſt for any number n of years, a its amount, A any annuity forborn n years, m its amount, and v its worth in preſent money, for the ſame time.

Therefore, ſince one pound put out at intereſt, in the firſt year is increaſed to R, it will be as 1 to R, ſo is R, the ſum forborn the ſecond year, to R^2, the amount of one pound in two years; and therefore as 1 to R, ſo is R^2, the ſum forborn the third year, to R^3, the amount in three years: whence it appears that R^n, or R, raiſed to the power whoſe exponent is the number of years, will be the amount of one pound in thoſe years: but as 1 l. to its amount R^n, ſo is P to a its amount in the ſame time; whence we have P × R^n = a. And becauſe the amount of one pound in n years is R^n, its increaſe in that

time will be R^n-1; but its intereſt for one ſingle year, or the annuity anſwering to that increaſe, is $R-1$; therefore as $R-1$ to R^n-1, ſo is A to m. Hence we get $\frac{A\times R^n-1}{R-1}=m$. But as it appears that one pound, ready money, is equivalent to R^n, to be received at the expiration of n years, we have as R^n to 1, ſo is $\frac{A\times R^n-1}{R-1}$ (the ſum in arrear) to v, its preſent worth in ready money; whence $\frac{A\times 1-R^{\frac{1}{n}}}{R-1}=v$. From theſe theorems the various queſtions relating to compound intereſt, annuities in arrears, and purchaſing of annuities, are reſpectively reſolved.

Several ingenious mathematicians, as Dr. Halley, De Moivre, Simpſon, &c. have explained the method of computing the expectation or eſtimate of life; we ſhall therefore here ſubjoin a curious and uſeful table, that ſhews the value of annuities for every fifth year of age to the 75th at 3, 4, and 5 per cent. as given by the laſt mentioned gentleman in his Doctrine of Annuities upon Lives.

Age	Year's purch. at 5 per cent.	Year's purch. at 4 per cent.	Year's purch. at 3 per cent.
6	14.1	16.2	18.8
10	14.3	16.4	19.0
15	13.9	15.8	18.3
20	13.0	14.8	17.2
25	12.3	14.0	16.1
30	11.6	13.1	15.0
35	10.9	12.3	14.1
40	10.3	11.5	13.2
45	9.8	10.8	12.3
50	9.2	10.1	11.4
55	8.5	9.3	10.3
60	7.9	8.4	9.2
65	7.1	7.5	8.0
70	6.2	6.5	6.9
75	5.2	5.4	5.6

INTEREST, in law, is generally taken for a chattel real, or a leaſe for years, &c. but more for a future term.

INTERJECTION, in grammar, an indeclinable part of ſpeech, ſignifying ſome paſſion or emotion of the mind.

As the greateſt part of the expreſſions uſed on theſe occaſions are taken from nature alone, the real interjections, in moſt languages, are monoſyllables; and as all nations agree in theſe natural paſſions, ſo do they agree in the ſigns and indications of them, as of love, mirth, &c.

The Greeks confound their interjections with adverbs, and the Hebrews confound them with their adverbs and prepoſitions, calling them all by the general name particle.

INTERIM, a name given to a formulary, or kind of confeſſion of the articles of faith, obtruded upon the proteſtants after Luther's death by the emperor Charles V. when he had defeated their forces; ſo called becauſe it was only to take place in the interim, mean time, till a general council ſhould have decided all points in diſpute between the proteſtants and the Romaniſts.

INTERLOCUTORY ORDER, in law, an order that does not decide the cauſe, but only ſome matter incident thereto, which happens between the beginning and end of a cauſe; as when in chancery or exchequer, the plaintiff obtains an order for an injunction until the hearing of the cauſe; which order, not being final, is called interlocutory.

INTERLUDE, an entertainment exhibited on the theatre between the acts of a play, to amuſe the ſpectators while the actors ſhift their dreſs, or to give time of changing the ſcenes and decorations.

INTERMITTENT or INTERMITTING FEVERS, ſuch fevers as go off and ſoon return again, in oppoſition to thoſe which are continual. See the article *Intermitting* FEVER.

INTERNAL, in general, denotes whatever is within a thing.

INTERNODIUM, among botaniſts, implies the ſpace between two knots or joints of the ſtalks of barley, oats, and the like plants.

INTEROSSEUS, in anatomy, an appellation given to the muſcles which move the fingers and toes, from their being ſituated between the bones of thoſe parts. See the articles MUSCLE, FLEXOR, &c.

INTERPRETATION, among critics, denotes a ſpurious paſſage, inſerted into the writings of ſome ancient author.

INTERPRETER, in general, denotes a perſon who explains the words or writings of another, ſo as to make them intelligible to thoſe who did not underſtand them before.

INTERREGNUM, the time during which the throne is vacant, in elective kingdoms; for in ſuch as are hereditary, like ours, there is no ſuch thing as an interregnum.

INTERREX, the magiſtrate who governs during an interregnum.

INTERROGATION, *or Point of* INTERROGATION, in grammar, a character of this form (?) ſerving to denote a queſtion.

INTERROGATION, in rhetoric, is a figure, whereby the orator propoſes ſomething by way of queſtion; which, it muſt be owned, greatly enlivens the diſcourſe.

INTERROGATORIES, in law, are queſtions wrote down, and demanded of the witneſſes examined in a cauſe, more eſpecially in the court of chancery.

INTERRUPTION denotes the ſame thing with diſjunction in proportion, and is noted thus (:·:) ſignifying the breaking of the ratio in the middle of four diſcrete proportionals, as A : B :· C : D; that is, as A to B, ſo is C to D.

INTERRUPTION, in rhetoric, when a perſon breaks off his diſcourſe ſuddenly to ſhew ſome paſſion.

INTERSECTION, in mathematics, the cutting of a line or plane by another, or the point or line wherein two lines, or two planes, cut each other.

The word is derived from the Latin *inter*, and *ſeco*, to cut.

The mutual interſection of two planes is a right line. The center of a circle is in the interſection of two diameters, &c. The equinoxes happen, when the ſun is in the interſections of the equator and ecliptic.

INTERSPINALES *Colli*, in anatomy, ſmall fleſhy muſcles of the neck, ariſing from the ſuperior parts of each double ſpinal proceſs of the neck, except of the ſecond vertebra; and inſerted into the inferior parts of all the double ſpines. When theſe muſcles act, they draw the ſpines of the vertebra of the neck nearer each other.

INTERSTELLAR, a word uſed by ſome authors to expreſs thoſe parts of the univerſe that are without and beyond our ſolar ſyſtem.

INTERTIES, in architecture, thoſe ſmall pieces of timber that lie horizontally between the ſommers, or between them and the ſell, or reſon.

INTERTRANSVERSALES *Colli*, in anatomy, certain muſcles ſituated among the tranſverſe apophyſes of the vertebræ: they ariſe from the lower vertebra, and are inſerted into that next above: they are of the ſame ſize and figure with the interſpinales.

INTERVAL, in muſic, the difference between two ſounds, in reſpect of acute and grave; or, that imaginary ſpace terminated by two ſounds, differing in acuteneſs or gravity.

Mr. Euler, in his *Nov. Theor. Muſ.* defines an interval, the meaſure of the difference of an acute and grave ſound: thus, ſuppoſe three ſounds a, b, c, of which c is the moſt acute, a the moſt grave, and b the intermediate ſound. It appears, that the interval between the ſound a and c, is the aggregate of the intervals between a and b, and between b and c. Therefore, if the interval between a and b, be equal to that between b and c, which happens when $a:b::c:d$; the interval between a to c, will be double the interval a to b, or b to c. This being conſidered, it will appear that intervals ought to be expreſſed by the meaſures of the ratios, conſtituting the ſounds forming thoſe intervals: but ratios are meaſured by the logarithms of fractions, the numerators of which denote the acute ſounds,

ſounds, and the denominators the grave. Hence the interval between the ſounds *a* and *b*, will be expreſſed by the logarithm of the fraction $\frac{b}{a}$, which is uſually denoted by L $\frac{b}{a}$; or, which comes to the ſame, by L *b* — L *a*. The interval therefore of equal ſounds, *a* to *a*, will be null, as L *a* — L *a* = *o*. The interval called an octave, or diapaſon, will be expreſſed by the logarithm of 2; and the interval of the fifth or diapente, will be L $\frac{3}{2}$ = L 3 — L 2. From whence it appears, that thoſe intervals are incommenſurable; ſo that no interval, however ſmall, can be an aliquot part, both of the octave and fifth. The like may be ſaid of the intervals L $\frac{4}{3}$ and L $\frac{5}{4}$, and others whoſe logarithms are diſſimilar. But intervals expounded by logarithms of numbers, which are powers of the ſame root, may be compared. Thus the interval of the ſounds 27 : 8, will be the interval of the ſounds 9 : 4, as 3 is to 2: for L $\frac{27}{8}$ = 3 L $\frac{3}{2}$, and L $\frac{9}{4}$ = 2 L $\frac{3}{2}$. Euler. *ibid.* p. 74. But though the logarithms of numbers, which are not powers of the ſame root, be incommenſurable, yet an approximating ratio of ſuch may be found. Thus, the meaſure of the octave is L 2 = 0.3010300, and the meaſure of the fifth is L 3 — L 2 = 0.1760913. Hence the interval of the octave will be to that of the fifth, nearly as 3010300 to 1760913; which ratio being reduced to ſmaller terms, will give us theſe ſimpler expreſſions for the ratio of the octave and fifth, 2 : 1, 3 : 2, 5 : 3, 7 : 4, 12 : 7, 17 : 10, 29 : 17, 41 : 24, 53 : 31, which laſt is very near the truth. Euler. *ibid.* p. 75.

In like manner intervals may be divided into any number of equal parts: for this purpoſe we need only divide the logarithm of the propoſed interval into the ſame number of parts, and then find its correſponding number by the tables. The ratio of the number ſo found, to unity, will give the required ratio of the dividend interval to its propoſed part. Thus let the third part of an octave be required; its logarithm will be = 0.1003433 = $\frac{1}{3}$ L 2: the ratio correſponding nearly to this, will be 63 : 50, or leſs accurately, 29 : 23, or 5 : 4, which laſt expreſſes the third major; and this is by the leſs knowing taken for the third part of an octave, and ſeems to be ſuch on our harpſichord and organs, where from C to E is a third, from E to G♯ another, and from G♯ or A♭ to *c*, another third. But the more intelligent know that G♯ and A♭ ought not to be reputed the ſame ſound, ſince they differ by a dieſis enharmonica, which is nearly equal to two commas.

INTERVALS, in gardening and huſbandry, the ſpaces left between the ſeveral rows of plants ſown or ſet in gardens or fields. See HUSBANDRY.

INTESTATE, in law, a perſon that dies without making a will; in which caſe, a diſtribution of his perſonal eſtate, after his debts and funeral charges are paid, is to be made among the wife and children of the deceaſed, or for want of ſuch, among the next of kin.

INTESTINES, in anatomy, long, cylindrical, hollow, and membranaceous bodies; or rather, one ſuch continued body, or tube, reaching from the ſtomach to the anus.

The ſtructure and ſubſtance of the inteſtines are membranaceous; being formed, in every part, of five coats or tunics. The firſt is the common coat, from the peritonæum, and is membranaceous. The ſecond is cellular, and is called by late writers, tunica celluloſa Ruyſchii: it is continuous with the meſentery, and is to be diſcovered by inflating it: this coat, in flat animals, frequently contains abundance of fat. The third is muſcular; it is compoſed of a double ſeries of fibres, in part longitudinal, and in part annular; and theſe aſſiſt the motion of the guts. The fourth coat is nervous: it is furniſhed with abundance of cellules, vaſcules, and glands, and is thicker than the others: from this ariſe the rugæ, and the valves of the inteſtines. The fifth is the villoſe coat, which ſuſtains the terminations of the excretory veſſels, and the beginnings of the lacteals: hence, when nicely examined, it has the appearance of a ſieve: it is the organ of percolation of the chyle.

The inteſtines have veſſels in great abundance, running over every part of their ſubſtance. Their arteries are from the meſeraic ones; the upper meſeraic ſerving for the ſmaller inteſtines, the lower for the larger; and theſe make a multitude of very ſingular and ſuprizing anaſtomoſes. The veins are meſeraics, and go off to the vena portæ and the liver. The nerves are ſent from the intercoſtals, and the par vagum. And beſide theſe we are to obſerve the lacteal veſſels. See the article LACTEAL.

The rectum, it is to be obſerved, receives blood-veſſels alſo from the hypogaſtrics. There are alſo, beſides the Brunnerian glands of the duodenum, other glands in the inteſtines, called from the name of the perſon who diſcovered them, glandulæ Peyeri. Theſe, in the ſmall guts, are uſually little, congregrate, and miliary; but ſometimes they are ſingle. They are larger as they are nearer to the duodenum, and ſmaller as they approach towards the great guts. Their office is to diſcharge into the inteſtines a liquor, which ſerves for the attenuation of the chyle, and for the lubricating of the inteſtines. In the larger guts, and in the vermiform appendage, they are ſingle and large, of a lenticular figure; and they are largeſt of all in the rectum. They have mouths, out of which there is ſecreted a fluid, which ſerves to lubricate the ſides of the inteſtines, and to ſoften the fæces, that they may be evacuated without pain.

The uſe of the ſmaller guts is to promote the formation of the chyle, to perfect its ſecretions, and to propel the remaining fæces to the larger. The office of the larger guts is to receive and collect the matter of the fæces, and at a proper time to expel it. See CHYLE.

INTESTINAL, ſomething belonging to, or ſeated in the inteſtines.

INTRADA, ENTRY, in the Italian muſic, is much the ſame with prelude or overture.

INTRENCHMENT, or RETRENCHMENT, in the art of war. See the article RETRENCHMENT.

INTRIGUE, or INTREAGUE, an aſſemblage of events or circumſtances, occurring in an affair, and perplexing the perſons concerned in it.

In this ſenſe, it is uſed to ſignify the nodus or plot of a play or romance; or that point wherein the principal characters are moſt embarraſſed, through the artifice and oppoſition of certain perſons, or the unfortunate falling out of certain accidents and circumſtances.

In tragedy, or an epic poem, there are always two deſigns; the firſt and principal is that of the hero of the piece. The ſecond contains the deſigns of all thoſe who oppoſe him: theſe oppoſite cauſes produce oppoſite effects; to wit, the efforts of the hero for the execution of his deſign, and the efforts of thoſe who thwart it. As thoſe cauſes and deſigns are the beginning of the action, ſo theſe efforts are the middle, and there form a knot or difficulty which we call the intrigue, that makes the greateſt part of the poem. It laſts as long as the mind of the reader or hearer is ſuſpended about the event of thoſe oppoſite efforts: the ſolution or cataſtrophe commences when the knot begins to unravel, and the difficulties and doubts begin to clear up.

INTRINSIC, a term applied to the inner, real, and genuine values, properties, &c. of any thing, in oppoſition to their extrinſic or apparent values, &c.

INTRUSION, in law, obtains where an anceſtor dies ſeiſed of an eſtate, or inheritance, which is expectant upon an eſtate for life, and the tenant for life dies; after which a ſtranger enters before the heir, in which caſe he is ſaid to intrude.

INTUITION, among logicians, the act whereby the mind perceives the agreement or diſagreement of two ideas, immediately by themſelves, without the intervention of any other; in which caſe, the mind perceives the truth as the eye doth the light, only by being directed towards it. Thus the mind perceives that white is not black, that three are more than two, and equal to one and two. See IDEA.

This part of knowledge, ſays Mr. Locke, is irreſiſtible, and, like the ſun-ſhine, forces itſelf immediately to be perceived as ſoon as ever the mind turns its view that way. It is on this intuition that all the certainty and evidence of our other knowledge depends; this certainty every one finds to be ſo great, that he cannot imagine, and therefore cannot require, a greater. See the articles

ticles JUDGMENT, KNOWLEDGE, DEMONSTRATION, &c.

INVALID, a perſon wounded, maimed, or diſabled for action by age, &c.

INVECTED, in heraldry, denotes a thing fluted or furrowed.

INVECTIVE, in rhetoric, differs from reproof, as the latter proceeds from a friend, and is intended for the good of the perſon reproved; whereas the invective is the work of an enemy, and entirely deſigned to vex and give uneaſineſs to the perſon againſt whom it is directed.

INVENTION denotes the act of finding any thing new, or even the thing thus found.

INVENTION, in rhetoric, being one of the ſecond diviſions of invention, according to Bacon, ſignifies the finding out and chooſing of arguments which the orator is to uſe for proving his point, or moving his hearers paſſions.

INVENTION, in poetry, is applied to whatever the poet adds to the hiſtory of the ſubject he has choſen, as well as to the new turn he gives it.

INVENTION, in painting, is the choice which the painter makes of the objects that are to enter the compoſition of his piece.

INVENTORY, in law, &c. is a ſchedule containing all the goods and chattels of a deceaſed perſon that belonged to him at the time of his death, together with the value of the ſame, as appraiſed by two or more indifferent perſons.

INVERSE is applied to a manner of working the rule of three, or proportion, which ſeems to go backward, or contrary to the order of the common or direct rule. See the articles RULE *of Three* and PROPORTION.

INVERSE *Method of Fluxions*. See FLUXIONS.

INVERSION, in grammar, is where the words of a phraſe are ranged in a manner not ſo natural as they might be.

It is a conſiderable beauty either in verſe or proſe, when we have it from an able hand; it gives vigour and variety to a ſentence, and keeps the mind in an agreeable ſuſpence and expectation of a marvellous turn and concluſion.

INVESTIGATION properly denotes the finding any thing out by the prints of the feet.

Mathematicians, &c. have hence applied the word to the reſpective reſearches in which they are employed.

INVESTIGATION *of a Theme*, in grammar, the finding out the primitive ſenſe, mood, and perſon of any verb that is remote from its ſource.

It is abſolutely neceſſary to be acquainted with this method of inveſtigation, in order to underſtand a Greek author.

Clenard was the firſt who introduced the term into grammar.

INVESTITURE, in law, a giving livery of ſeiſin or poſſeſſion.

INVOCATION, in theology, the act of adoring God, and eſpecially of addreſſing him in prayer for his aſſiſtance and protection.

INVOCATION, in poetry, an addreſs at the beginning of a poem, wherein the poet calls for the aſſiſtance of ſome divinity, particularly of his muſe, or the deity of poetry.

INVOICE, an account in writing of the particulars of merchandize, with their value, cuſtom, charges, &c. tranſmitted by one merchant to another in a diſtant country.

One copy of every invoice is to be inſerted verbatim in the invoice-book, for the merchant's private uſe; and another copy muſt, immediately upon ſhipping off the goods, be diſpatched by poſt, or otherwiſe, to the correſpondent. This copy is commonly drawn out upon a ſheet of large poſt paper, to the end of which is ſubjoined a letter of advice.

INVOICE-BOOK. This book is paged, and contains copies of the invoices of goods ſent to ſea: for as a merchant is obliged to ſend his correſpondent an invoice of all the goods he conſigns to him, ſo it is reaſonable that he ſhould keep a copy of it for himſelf.

INVOLUCRUM, among botaniſts, that ſort of calyx, or cup, which ſurrounds a number of flowers together, every one of which has, beſides this general cup, its own particular perianthium.

The involucrum conſiſts of a number of little leaves, diſpoſed in a radiated manner.

INVOLUTION, in algebra, the raiſing any quantity from its root to any height or power aſſigned.

The quantity a^m expreſſes any power of a in general; the exponent (m) being undetermined; and a^{-m} expreſſes $\frac{1}{a^m}$, or a negative power of a of an equal exponent: and $a^m \times a^{-m} = a^{m-m} = a^0 = 1$ is their product, a^0 expreſſes any other power of a; $a^m \times a^n = a^{m \times n}$ is the product of the powers a^m and a^n, and a^{m-n} is their quotient.

To raiſe any ſimple quantity to its 2d, 3d, or 4th power, is to add its exponent twice or four times to itſelf; therefore, the 2d power of any quantity is had by doubling its exponent, and the 3d by trebling its exponent; and in general the power expreſſed by m of any quantity is had by multiplying the exponent by m, as is obvious from the multiplication of powers.

Thus, the 2d power or ſquare of a is $a^{2 \times 1} = a^2$; its third power or cube is $a^{3 \times 1} = a^3$; and the m^{th} power of a is $a^{m \times 1} = a^m$. Alſo the ſquare of a^4 is $a^{2 \times 4} = a^8$; the cube of a^4 is $a^{3 \times 4} = a^{12}$; and the m^{th} power of a^4 is $a^{4 \times m}$. The ſquare of abc is $a^2 b^2 c^2$, the cube is $a^3 b^3 c^3$, the m^{th} power $a^m b^m c^m$.

The co-efficient muſt alſo be raiſed to the ſame power by a continual multiplication of itſelf, as often as an unit by itſelf, is contained in the exponent of the power required. Thus the cube of $3ab$ is $3 \times 3 \times 3 \times a^3 b^3 = 27 a^3 b^3$.

As to the ſigns when the quantity to be involved is poſitive, it is obvious that all its powers muſt be poſitive. And, when the quantity to be involved is negative, yet all its powers whoſe exponents are even numbers muſt be poſitive; for any number of multiplications of a negative, if the number is even, gives a poſitive.

The power then only can be negative, when its exponent is an odd number, though the quantity to be involved be negative.

The powers of $-a$ are $-a$, $+a^2$, $-a^3$, $+a^4$, $-a^5$, &c.

Thoſe whoſe exponents are 2, 4, 6, &c. are poſitive; but thoſe whoſe exponents are 1, 3, 5, &c. are negative.

The involution of compound quantities is a more difficult operation. The powers of any binomial $a+b$ are found by a continual multiplication of it by itſelf; as follows:

$a + b =$ the root.

$\times\ a + b$

$a^2 + ab$

$+ ab + b^2$

$a^2 + 2ab + b^2 =$ the ſquare or 2d power.

$\times\ a + b$

$a^3 + 2a^2 b + ab^2$

$+ a^2 b + 2ab^2 + b^3$

$a^3 + 3a^2 b + 3ab^2 + b^3$

$\times\ a + b$

$a^4 + 3a^3 b + 3a^2 b^2 + ab^3$

$+ a^3 b + 3a^2 b^2 + 3ab^3 + b^4$

$a^4 + 4a^3 b + 6a^2 b^2 + 4ab^3 + b^4 =$ the biquadrate or 4th power.

If the powers of $a-b$ are required, they will be found the ſame as the preceding, only the terms in which the exponent of b is an odd number will be found negative; becauſe an odd number of multiplications of a negative produces a negative. Thus the cube of $a-b$ will be found to be $a^3 - 3a^2 b + 3ab^2 - b^3$; where the 2d and 4th terms are negative, the exponent of b being an odd number in theſe terms. In general, the terms of any power of $a-b$ are poſitive and negative by turns.

If it be obſerved, that, in the firſt term of any power of $a \mp b$, the quantity a has the exponent of the power required; that, in the following terms, the exponents of a decreaſe gradually by the ſame difference (viz. an unit) and that in the laſt terms it is never found; the powers of b are in the contrary order: it is not found in the firſt term, but its exponent in the 2d term is an unit, in the

3d term its exponent is 2; and thus its exponent increaſes, till in the laſt term it becomes equal to the exponent of the power required.

As the exponents of a thus decreaſe, and at the ſame time thoſe of b increaſe, the ſum of their exponents is always the ſame, and is equal to the exponent of the power required.

To find the co-efficient of any term, the co-efficient of the preceding term being known, you are to divide the co-efficient of the preceding term by the exponent of b in the given term, and to multiply the quotient by the exponent of a in the ſame term, increaſed by an unit.

In general, if $a + b$ is to be raiſed to any power m, the terms, without their co-efficients, will be a^m, $a^{m-1}b$, $a^{m-2}b^2$, $a^{-3}b^3$, $a^{m-4}b^4$, $a^{m-5}b^5$, &c. continued till the exponent of b becomes equal to m.

The co-efficients of the reſpective terms, according to the laſt rules, will be $1, m, m \times \frac{m-1}{2}, m \times \frac{m-1}{2} \times \frac{m-2}{3}, m \times \frac{m-1}{2} \times \frac{m-2}{3} \times \frac{m-3}{4}, m \times \frac{m-1}{2} \times \frac{m-2}{3} \times \frac{m-3}{4} \times \frac{m-4}{5}$, &c. continued until you have one co-efficient more than there are units in m.

JOACHIMITES, in church hiſtory, the diſciples of Joachim, a Ciſtercian monk, who was an abbot of Flora in Calabria, and a great pretender to inſpiration.

The Joachimites were particularly fond of certain ternaries: the Father, they ſaid, operated from the beginning till the coming of the Son; the Son, from that time to theirs, which was the year 1260; and from that time the Holy Spirit was to operate in his turn. They alſo divided every thing relating to men, to doctrine, and the manner of living, into three claſſes, according to the three perſons in the Trinity: the firſt ternary was that of men; of whom the firſt claſs was that of married men, which had laſted during the whole period of the Father; the ſecond was that of clerks, which had laſted during the time of the Son; and the laſt was that of the monks, in which there was to be an uncommon effuſion of grace by the Holy Spirit: the ſecond ternary was that of doctrine, viz. the Old Teſtament, the New, and the everlaſting Goſpel; the firſt they aſcribed to the Father, the ſecond to the Son, and the third to the Holy Spirit: a third ternary conſiſted in the manner of living, viz. under the Father, men lived according to the fleſh; under the Son, they lived according to the fleſh and the ſpirit; and under the Holy Ghoſt, they were to live according to the ſpirit only.

JOB, or *Book of* JOB, a canonical book of the Old Teſtament, containing a narrative of a ſeries of misfortunes which happened to a man whoſe name was Job, as a trial of his virtue and patience; together with the conferences he had with his cruel friends, on the ſubject of his misfortunes, and the manner in which he was reſtored to eaſe and happineſs. This book is filled with thoſe noble, bold, and figurative expreſſions, which conſtitute the very ſoul of poetry.

Many of the Jewiſh rabbins pretend that this relation is altogether a fiction: others think it a ſimple narrative of a matter of fact, juſt as it happened: while a third ſort of critics acknowledge that the ground-work of the ſtory is true, but that it is wrote in a poetical ſtrain, and decorated with peculiar circumſtances, to render the narration more profitable and entertaining.

The time is not ſet down, in which Job lived. Some have thought that he was much ancienter than Moſes, becauſe the law is never cited by Job or his friends, and becauſe it is related that Job himſelf offered ſacrifices. Some imagine that this book was wrote by himſelf; others ſay, that Job wrote it originally in Syriac or Arabic, and that Moſes tranſlated it into Hebrew: but the rabbins generally pronounce Moſes to be the author of it, and many Chriſtian writers are of the ſame opinion.

JOBBER, in law, a perſon that buys and ſells cattle for others. Hence ſtock-jobbers are perſons who buy and ſell ſtocks for other perſons.

IOGUIS, among the Eaſt-Indians, a kind of hermits, who generally ſtand under trees, or near their pagods. Some of them go ſtark naked, holding their arms acroſs over their heads, and continue in that poſture all their lives: others lie on the ground, with one leg higher than the other, and their arms raiſed above their head; and theſe wretched penitents inſenſibly loſe the uſe of their arms and legs: ſome confine themſelves in cages, ſet on the top of a thick ſtake, fixed in the ground, and theſe cages are ſo ſmall, that they put the penitent to prodigious torture: ſome holding a ſabre in one hand, and a kind of ſhield in the other, go up a kind of crane, where hooking themſelves to an iron, which runs a conſiderable way into their backs, they ſpring forward into the air, flouriſhing their ſabres, and launching out into extravagant praiſes of their idols: and others plunge into the Ganges, in hopes of being devoured by a crocodile, fancying that by this means they ſhall obtain the happineſs of the next life.

Theſe miſerable wretches are conſidered by the Indians as perfect models of piety and holineſs: they are followed by perſons of both ſexes, who make a vow of devoting themſelves to their ſervice, and are wholly employed in ſoothing their voluntary ſufferings by offering them alms and refreſhments. They call the pious to their devotions by ringing a little bell; and when they hold their ſpiritual converſations, they ſit cloſe in a ring, and ſet up a banner, made of ſeveral pieces of ſtuff, faſtened at the end of a ſtick.

JOHN, or *Goſpel of St.* JOHN, a canonical book of the New Teſtament, containing a recital of the life, actions, doctrine, and death of our Saviour Jeſus Chriſt, written by St. John the apoſtle and evangeliſt. See the article GOSPEL.

St. John wrote his goſpel at Epheſus, after his return from the Iſle of Patmos, at the deſire of the Chriſtians of Aſia. St. Jerom ſays, he would not undertake it, but on condition they ſhould appoint a public faſt, to implore the aſſiſtance of God; and that the faſt being ended, St. John, filled with the Holy Ghoſt, broke out into theſe words, "In the beginning was the word, &c." The ancients aſſign two reaſons for this undertaking: the firſt is, becauſe, in the other three goſpels, there was wanting the hiſtory of the beginning of Jeſus Chriſt's preaching, till the impriſonment of John the Baptiſt; which, therefore, he applied himſelf particularly to relate. The ſecond reaſon was, in order to remove the errors of the Corinthians, Ebionites, and other ſects.

St. JOHN'S DAY, the name of two Chriſtian feſtivals, one obſerved on the twenty-fourth of June, kept in commemoration of the wonderful circumſtances attending the birth of St. John the Baptiſt; and the other on the twenty-ſeventh of December, in honour of St. John the Evangeliſt.

St. JOHN'S WORT, a plant called by authors hypericum. See HYPERICUM.

JOINDER, or JOYNDER, in law, ſignifies the joining of two perſons in one ſuit againſt another; as for inſtance, if there are two joint-poſſeſſors of goods, and theſe are taken from one of them, they may both join in an action to recover them.

JOINERY, the art of working in wood, or of fitting various pieces of timber together.

JOINT, in general, denotes the juncture of two or more things.

The joints of the human body are called by anatomiſts articulations. See ARTICULATION.

The term joint is alſo applied to the ſeparation between the ſtones or bricks of a building, uſually filled with mortar, plaſter, or cement: alſo by carpenters, to the ſeveral manners of aſſembling or fitting pieces of wood together; as a dove-tail joint, &c.

Stiffneſs of the JOINTS, in ſurgery and medicine, ſometimes proceeds from the bones being broken, bruiſed, or wounded, eſpecially about the extreme parts, which being kept in one poſture, in order for cure, the ſynovia of the joints becomes thick, and depraves or quite aboliſhes its motion; or it may proceed from the bony juice proceeding from broken bones, and inſinuating itſelf into the joint. Hoffman ſays, diſeaſes of the joints ſometimes proceed from ſpaſms of the ligament.

JOINT-EXECUTORS, in law, are when two or more perſons are appointed ſuch by will; in which caſe they are accounted but as one ſingle perſon; ſo that the actions done by one of them are taken to be the acts of all, becauſe they all repreſent the perſon of the teſtator.

JOINT LIVES, in law, is where any thing is granted or given to two or more during their lives.

JOINT-TENANTS are ſuch as hold lands or tenements jointly by one title; as where a man grants lands, &c. to perſons and their heirs; ſuch perſons, during their joint tenancy, muſt jointly plead, as well as be jointly ſued, which is common to them with coparceners of lands.

JOINTURE, in law, generally implies a ſettlement of lands and tenements made on a woman in conſideration of marriage.

It alſo ſignifies a covenant, by which the huſband, or ſome friends of his, aſſures lands, &c. to his wife, for the term of her life.

JOINTURESS, or JOINTRESS, the perſon on whom a jointure is ſettled.

JOISTS, or JOYSTS, in architecture, thoſe pieces of timber framed into the girders and ſommers, on which the boards of the floor are laid.

Joiſts are from ſix to eight inches ſquare, and ought ſeldom to lie at a greater diſtance from each other than ten, or at moſt twelve inches, nor ought they ever to bear a greater length than ten feet, or to be leſs into the wall than eight inches. All joiſts on the back of a chimney ought to be laid with a trimmer, at ſix inches diſtance from the back.

Some carpenters furr their joiſts, as they call it; that is, they lay two rows of joiſts, one over another, the undermoſt of which are framed level with the under ſide of the girder; and the uppermoſt, which lie croſs the lower ones, lie level with the upper ſide of the girder.

JONAH, or *Prophecy of* JONAH, a canonical book of the Old Teſtament, in which is related, that Jonah was ordered to go and propheſy the deſtruction of the Ninevites; but that diſobediently attempting a voyage another way, he was diſcovered by the riſing of a ſudden tempeſt, and caſt into the ſea, where he was ſwallowed up by a whale, which having lodged him three days and three nights in his belly, diſgorged him upon the ſhore; whereupon being ſenſible of his paſt danger and ſurpriſing deliverance, he betook himſelf to the journey and embaſſy to which he was appointed; and arriving at Nineveh, the metropolis of Aſſyria, he, according to his commiſſion, boldly laid open to the inhabitants, their ſins and miſcarriages, and proclaimed their ſudden overthrow; upon which the whole city, by prayer and faſting, and a ſpeedy repentance, happily averted the divine vengeance, and eſcaped the threatened ruin.

IONIC ORDER, the third of the five orders of architecture, being a kind of mean between the robuſt and delicate orders. See plate XLIII. *fig.* 3.

The firſt idea of this order was given by the people of Ionia, who, according to Vitruvius, formed it on the model of a young woman of an elegant ſhape, dreſſed in her hair; whereas the Doric had been formed on the model of a ſtrong robuſt man. The Ionic order is diſtinguiſhed from the Compoſite, in that it has none of the acanthus-leaves in its capital; and from the Tuſcan and Doric, by the channels and flutings in its ſhaft.

The capital of this order is adorned with volutes, and its corniche with dentiles. The proportions of the Ionic pillar, as they are taken from the famous one in the temple of Fortuna Virilis at Rome, now the church of St. Mary the Egyptian, are theſe: 1. The entire order from the ſuperficies of the area to the corniche, are twenty-two modules, or eleven diameters. 2. The column with its baſe contains eighteen modules. 3. The entablature contains four modules. 4. The volute of the capital is of an oval form. 5. The columns in this order are often hollowed, and furrowed with twenty-four gutters or channels, called flutings: theſe flutings are not always concave from the top of the ſhaft to the bottom, but for that third of it next the baſe, they are filled up with a kind of rods or canes; and in the other two thirds they are left hollow, or ſtriated, in imitation of the folds or plaits of a garment.

When this order was firſt invented, its height was but ſixteen modules; but the ancients, to render it ſtill more beautiful than the Doric, augmented its height, by adding a baſe to it.

Mr. Le Clerc makes its entablement four modules and ten minutes, and its pedeſtal ſix entire modules; ſo that the whole order makes twenty-eight modules ten minutes.

This order is at preſent uſed properly in churches and religious houſes, courts of juſtice, and other places of tranquility and devotion.

This order has one advantage above any of the reſt, which conſiſts in this, that the fore and hind parts of its capital are different from its ſides; but this is attended with an inconvenience, when the ordonnance is to turn from the front of the building to the ſide; to obviate which, the capital may be made angular, as is done in the temple of Fortuna Virilis.

Scamozzi, and ſome other modern architects, have introduced the upper part of the Compoſite capital, in lieu of the Ionic, imitating that of the temple of Concord, whoſe four ſides are alike. To render it a little more beautiful, the volute may be made a little oval and inclining.

For the baſe, corniche, freeze, and pedeſtal of this order, ſee the articles BASE, CORNICHE, &c.

IONIC DIALECT, in grammar, a manner of ſpeaking peculiar to the people of Ionia.

IONIC SECT was the firſt of the ancient ſects of philoſophers; the others were the Italic and Ileatic. The founder of this ſect was Thales, who being a native of Miletus in Ionia, occaſioned his followers to aſſume the appellation of Ionic: Thales was ſucceeded by Anaximander, and he by Anaximenes, both of Miletus; Anaxagoras Clazomenius ſucceeded them, and removed his ſchool from Aſia to Athens, where Socrates was his ſcholar. It was the diſtinguiſhing tenet of this ſect that water was the principle of all natural things.

IONIC TRANSMIGRATION was anciently a very celebrated epocha; it took its riſe from the retreat of the Athenian colonies, who upon the death of Codrus, put themſelves under the command of his ſon Neleus, and eſtabliſhed the twelve cities of Ionia in Aſia. Theſe colonies, according to Eratoſthenes, were eſtabliſhed fifty years after the return of the Heraclidæ; and, according to Marſham, ſeventy-ſeven years after the taking of Troy.

JOSHUA, a canonical book of the Old Teſtament, containing a hiſtory of the wars and tranſactions of the perſon whoſe name it bears. This book may be divided into three parts; the firſt of which is a hiſtory of the conqueſt of the land of Canaan; the ſecond, which begins at the twelfth chapter, is a deſcription of that country, and the diviſion of it among the tribes; and the third, compriſed in the two laſt chapters, contains the renewal of the covenant he cauſed the Iſraelites to make, and the death of their victorious leader and governor. The whole comprehends a term of ſeventeen, or, according to others, of twenty-ſeven years.

JOURNAL, a day-book, regiſter, or account of what paſſes daily.

JOURNAL, or DAY-BOOK, among merchants, is that wherein the tranſactions recorded in the waſte-book, are prepared to be carried to the ledger, by having their proper debtors and creditors aſcertained and pointed out; for a more diſtinct account of which ſee the article BOOK-KEEPING.

JOURNAL, among ſeamen, a certain diary, or daily compact, of the occurrences that happen from noon to noon in the courſe of the voyage, as winds, weather, ſetting and ſhifting of ſails, and remarking the various courſes and diſtances run, which are reduced into one, and corrected by a ſolar obſervation. Every thing material that happens to the ſhip or her crew is alſo obſerved particularly in this journal.

IPECACUANHA, in pharmacy, a ſlender root, brought from the Spaniſh Weſt-Indies, in ſhort pieces, variouſly bent and contorted, full of wrinkles and deep circular fiſſures, which reach quite down to a ſmall whitiſh woody fibre, that runs in the middle of each piece: the cortical part is compact, brittle, and looks ſmooth and reſinous on breaking. Two ſorts of this root are met with in the ſhops, one brought from Peru, the other from Braſil; uſually denominated from their external colour, the firſt whitiſh, grey, or aſh-coloured, the other brown. The firſt is generally preferred, being found to operate with the greateſt certainty and mildneſs.

A root has been brought over under the name of white ipecacuanha, which has little or nothing of the virtues of the two foregoing: this is eaſily diſtinguiſhed by its yellowiſh

yellowiſh white colour, woody texture, and having no fiſſures or wrinkles. More dangerous abuſes have ſometimes been committed, by the ſubſtitution or mixture of the roots of an American apocynum, which have been found to operate with great violence, both upwards and downwards, and in ſome inſtances, as is ſaid, to prove fatal: theſe may be known by their being larger than the true ipecacuanha, the fiſſures more diſtant, the intermediate ſpaces ſmoother, and more particularly by the colour of the medullary fibre, which in the poiſonous roots is a deep reddiſh yellow, in the true ipecacuanha, a whitiſh or pale greyiſh.

Ipecacuanha has ſcarcely any ſmell, unleſs during its pulverization or infuſion in liquors, in which circumſtances it emits a faint nauſeous one: in chewing, the wrinkled cortical part proves bitteriſh and ſubacrid, and covers the tongue as it were with a kind of mucilage; the medullary woody fibre is nearly inſipid. Geoffroy obſerves, that in pulverizing conſiderable quantities, the finer powder that flies off, unleſs great care be taken to avoid it, is apt to affect the operator with a difficulty of breathing, a ſpitting of blood, a bleeding at the noſe, or a ſwelling and inflammation of the eyes and face, and ſometimes of the throat; and that theſe ſymptoms go off in a few days, either ſpontaneouſly, or by the aſſiſtance of venæſection.

This root is the mildeſt and ſafeſt emetic that has yet been diſcovered; and may be ventured on almoſt in the loweſt circumſtances, where the ſtomach requires to be unloaded. The common doſe is from ten grains to a ſcruple, and upwards. In the Medical Obſervations and Enquiries, publiſhed by a ſociety of phyſicians in London, a great number of caſes is mentioned, in which two grains operated ſufficiently: in conſtitutions which bore vomiting ill, and which were greatly ruffled by the uſual doſes, two or three grains operated with great eaſe. Where it fails of operating upwards, it commonly purges, and ſometimes conſiderably; in this intention it may be employed, in ſeveral caſes, to advantage, in conjunction with other purgatives, to determine its action downwards: fifteen grains of jalap with two or three of ipecacuanha have been found to purge more than twice the quantity of jalap by itſelf.

The ipecacuanha was firſt introduced, about the middle of the laſt century, as a ſpecific in dyſenteries; and repeated experience has confirmed its efficacy in this diſtemper, not only when uſed as an emetic, but likewiſe when given in ſuch ſmall doſes as ſcarcely to affect the groſſer emunctories. In common dyſenteric fluxes, it frequently performs a cure in a very ſhort ſpace of time; not by its exerting an aſtringent power, as ſome have ſuppoſed, for it does not appear to have any real aſtringency; nor by its mucilaginous ſubſtance covering the inteſtines, and incraſſating thin humours, as others, with more plauſibility, have inferred both from its mucilaginous taſte, and from the ropineſs and ſlimineſs which it manifeſtly communicates to the contents of the ſtomach; but apparently by promoting perſpiration, the freedom of which is in theſe caſes of the utmoſt importance; and an increaſe of which, even in a ſtate of health, is generally obſerved to diminiſh the evacuation by ſtool. In common dyſenteries, the ſkin is for the moſt part dry and tenſe, and perſpiration obſtructed; and indeed this obſtruction, and the converſion of the perſpirable matter upon the inteſtines, is very frequently the immediate cauſe of the diſeaſe. Moſt of the common diaphoretics paſs off, in theſe caſes, without effect: but ipecacuanha, if the patient after a puke or two be covered up warm in bed, brings on a free diaphoreſis, or a plentiful ſweat, by which means the diſtemper has often terminated at once. In putrid or malignant dyſenteries, or where the patient breathes a tainted air, it has not been found equally ſucceſsful: it requires here to be continued for ſeveral days, or repeated as an evacuant, with the further aſſiſtance of rhubarb, cordial antiſeptics, and mild opiates or aſtringents. Where plentiful evacuation is neceſſary, or the offending matter lodged deep, and the operation can be borne without inconvenience, the ipecacuanha is moſt advantageouſly given in ſmall quantities at a time, and repeated at proper intervals, till a vomiting or purging comes on.

The emetic virtue of ipecacuanha reſides in its reſinous parts. By digeſting the root in freſh quantities of rectified ſpirit, and inſpiſſating the filtered tinctures, a reſinous extract is obtained, to the quantity of about three ounces from ſixteen, which, by itſelf, vomits ſtrongly, and with great irritation; the reſiduum yields to water nearly four ounces of a ſoft tenacious mucilage, which has ſcarcely any ſenſible operation. If only a part of the reſin be extracted by ſlight digeſtion in a little highly rectified ſpirit, the remaining root proves more gentle, and rather purgative than emetic: in this ſtate it is recommended by ſome in dyſenteries accompanied with a conſiderable fever, where the root with its natural quantity of reſin might irritate too much; but as ſmall doſes of the root itſelf operate with all the eaſe and gentleneſs that can be wiſhed for, this precarious method of weakening it does not appear adviſeable.

By boiling in water, a part of the reſin is taken up with the mucilage; the extract amounting to about ſix ounces from ſixteen, and proving mildly emetic. The beſt menſtruum for extracting the entire virtue of the root appears to be a mixture of one part of pure ſpirit, with two or rather three parts of water: after ſufficient digeſtion in this menſtruum, neither water nor ſpirit took up any thing conſiderable from the remainder. In the ſhops, wine is employed: an ounce of the root is macerated or digeſted in a pint of canary or mountain; to which ſome add a quarter of an ounce of dried orange peel, to cover the unpleaſant flavour of the ipecacuanha. Theſe tinctures, in doſes of from half an ounce or leſs to an ounce and upwards, prove mildly emetic. *Lewis's Materia Medica.*

IPOMÆA, American jaſmine, in botany, a genus of plants, the corolla of which conſiſts of a ſingle infundibuliform petal; the tube is nearly cylindric, and very long; the limb is patent, and divided into five ſemi-lanceolated plane ſegments; the fruit is a roundiſh capſule, containing three cells; the ſeeds, of which there are ſeveral in each cell, are of an oval figure. This plant is by ſome reckoned a ſpecies of the convolvulus.

IRELAND, an iſland of the Atlantic ocean, ſubject to Great Britain, ſituated between 5° and 10° weſt longit. and between 51° and 56° north latitude; being bounded by the Northern ocean on the north, by St. George's channel, which divides it from Great Britain, on the eaſt, and by the Atlantic and Weſtern ocean on the ſouth and weſt. This country is two hundred and fifty miles long, and one hundred and fifty broad; diſtant from Holyhead, in North Wales, fifty miles, and from Galloway, in Scotland, fifteen miles. It is divided into four large provinces, viz. Ulſter on the north, Leinſter on the eaſt, Munſter on the ſouth, and Connaught on the weſt.

IRIS, the RAINBOW, in phyſiology. See the article RAINBOW.

IRIS, in anatomy, the anterior coloured part of the uvea of the eye. See EYE.

IRIS, in botany, a perennial plant with long narrow leaves, ſtanding edgewiſe to the ſtalk; and large naked flowers, divided deeply into ſix ſegments, of which, alternately, one is erect and another arched downwards, with three ſmaller productions in the middle, incloſing the ſtamina and piſtil: the roots are tuberous, irregular, and full of joints.

IRIS, the flower-de-luce, common iris, or orrice, in botany, a plant with blue flowers, whoſe arched ſegments are bearded with a yellowiſh matter, ſtanding ſeveral on one ſtalk higher than the leaves. It is a native of the mountainous parts of Germany, common in our gardens, and flowers in June.

The roots of this plant have, when freſh, a diſagreeable ſmell, and an acrid nauſeous taſte. They are a ſtrong irritating cathartic; in which intention, their expreſſed juice has been given in hydropic caſes, from one or two drams to three or four ounces, diluted largely with watery or vinous liquors to prevent its inflaming the throat.

The bluiſh expreſſed juice of the flowers changes on being inſpiſſated, eſpecially if a little lime water is added, to a fine green; and in this form is directed, in foreign pharmacopœias, for tinging ſome of the unctuous compoſitions called odoriferous or apoplectic balſams.

IRIS,

IRIS, Florence orrice, ſuppoſed to be only a variety of the foregoing, occaſioned by difference of climate; diſtinguiſhable from it in our gardens, by the flowers being white, and the leaves inclining more to bluiſh. The ſhops are ſupplied from Italy with dried roots ſuperior to thoſe of our own growth, in oblong flattiſh pieces freed from the fibres and browniſh bark, externally of a whitiſh colour, with browniſh ſpecks, internally inclining to yellowiſh, eaſily reducible into farinaceous yellowiſh white powder.

This root, in its recent ſtate, does not ſeem to differ much from the preceding; being, like it, nauſeous, acrimonious, and purgative, though not quite in ſo great a degree, and loſing theſe qualities on being dried. The dry root, as met with in the ſhops, has an unctuous, biterish, pungent taſte, not very ſtrong, but very durable in the mouth: and a light agreeable ſmell, approaching to that of violets. It is uſed in perfumes; in ſternutatory powders, for communicating a grateful flavour, ſomewhat like raſpberries, to wines and to ſpirits; and medicinally in diſorders of the breaſt, for attenuating viſcid phlegm, and promoting expectoration.

IRON, *Mars*, in natural hiſtory, a greyiſh metal, ſoon tarniſhing in the air to a duſky blackiſh hue, and in no long time contracting a yellowiſh or reddiſh ruſt. It is the moſt ſonorous of the metals except copper; the hardeſt and moſt elaſtic of them all; hence its excellence for mechanic inſtruments: it is made into tools, by which all the others are filed, drilled, and cut; and is the only one that ſtrikes ſparks with flint. It ſpreads difficultly under the hammer, but may be extended to a great degree, drawn into wire, as ſlender as the fineſt hairs: it is more eaſily malleable when ignited than when cold; whilſt ſome of the other metals, though ductile when cold, become quite brittle by heat. It is lighter, conſiderably, than copper; and a little heavier than tin. It is the only metallic body which attracts, or is attracted by, the magnet, one of its own ores.

Iron grows red-hot much ſooner than any other metal, and this not only from the application of actual fire, but likewiſe from ſtrong hammering, friction, or other mechanic violence. It nevertheleſs melts the moſt difficultly of all the metals; requiring, in its moſt fuſible ſtate, an intenſe bright white heat. When perfectly malleable, it is not fuſible at all, without additions, or the immediate contact of the burning fuel; and when melted, it loſes that quality, which deprive it at the ſame time of the other, as if fuſibility and malleability were in this metal incompatible.

Solutions of iron made in acids give a yellow ſtain to linen, &c. and ſtrike a black colour with galls and other vegetable aſtringents. Theſe are very valuable properties of iron to the calico-printer, the ſtainer of leather, wood, &c. and the dyer. For linen and leather, the metal is commonly diſſolved in ſour whey or ſmall beer; for dyeing, the vitriol is made uſe of. This metal affords alſo, in its calces, red and yellow pigments to the painter; and a fine blue in the preparation, called from the place where it was firſt diſcovered, Berlin or Pruſſian blue. A ſlight ſolution of vitriol has been employed by ſome as an aſſay liquor for diſtinguiſhing French brandies from common ſpirits prepared in imitation of them; French brandy having uſually an aſtringent impregnation from the oaken caſks in which it has been kept, and hence ſtriking a bluiſh or black colour with the chalybeate ſolution; whilſt ſpirits tinctured only with molaſſes, burnt ſugar, &c. give no ſuch colour. The principle on which the blue colour depends, ſhews that it is no certain teſt: all ſpirits will exhibit it if impregnated with aſtringents; and French brandies will not, without ſuch impregnation.

Iron is exceeding rarely, if ever, found native in the earth. Mr. Lewis ſays he never ſaw a ſpecimen of pure native iron; but the maſſes which have been ſhewn him for ſuch, were either not attracted by the magnet, or not diſſoluble in aqua-fortis. Its ores on the other hand are extremely plentiful in almoſt all parts of Europe: but South America, ſo rich in gold and ſilver, has little of this moſt uſeful metal. The richeſt ores of iron are compact and ponderous, of a browniſh, reddiſh brown, or red colour: they ſcarcely ever participate of perfect ſulphur, the pyritæ excepted, and contain but little foreign matter: ſuch are, the magnet, the hæmatites or blood-ſtone, the common iron-ſtone, and ruddle. The running down of the iron-ſtone requires no particular management, a ſtrong charcoal fire being the principal point.

Smelting of IRON *Ores.*—The ores of iron are commonly calcined previous to the fuſion; the harder ones, though they ſhould contain nothing ſulphureous or arſenical, requiring that proceſs to render them pulverable. In the large works, a quantity of the ore is placed on a bottom of wood or charcoal, intermingled with ſtrata of the ſame kind of fuel; the pile carried up to a conſiderable height, and ſet on fire.

The fuſion is performed in furnaces twenty or thirty feet high, and eight or ten feet wide in the middle, but narrower above and below. The furnace is charged at top with charcoal, and the fire excited by large bellows moved by water. When the whole internal ſurface appears of a ſtrong white heat, the ore is thrown in, by little at a time, with charcoal over it, and commonly a portion of limeſtone, the true uſe of which is probably, not as has been generally ſuppoſed, to abſorb ſulphur, but to promote the fuſion. The ore, gradually melting, drops down through the fuel into the receiver or bottom of the furnace, where a paſſage is open for taking off the ſcum or droſs. The metal, now in ſtrong fuſion, is let out, by a tap-hole, into furrows made in a bed of ſand: the large maſs, which ſets in the main furrow, is called by the workmen a ſow, and the leſſer ones pigs of iron. Chimney-backs, ſtoves, garden-rollers, &c. are formed of this rough metal taken out of the receivers with ladles, and caſt into moulds made of fine ſand. Two or three tons of iron are run off in twenty-four hours: before the force of water was called in aid to work the bellows, ſcarce an hundred weight could be obtained in a day, and a large quantity of the metal was left in the droſs: hence, in ſome places, the ſlags of the old works are now remelted to advantage along with freſh ore. From the richneſs of the ſlags of different ores left by former times, ſome have been miſled into an opinion, that the metal was regenerated in them.

From the great conſumption of wood in this buſineſs, and its ſcarcity in ſome places where there are rich mines of iron, attempts have been made to ſubſtitute other fuels. Peat has been found to anſwer tolerably well: in ſome parts of England, a quantity of this has for a conſiderable time been mixed with the charcoal; and a patent has been lately obtained for running down the ore with peat alone. Pit-coal renders the iron hard and brittle: this inconvenience is ſaid to be in a good meaſure prevented, by previouſly coaking the coal, as is cuſtomary to fit it for the drying of malt.

The impure iron, as run from the ore, is melted down in another furnace, intermixed with charcoal; a ſtrong blaſt of air being impelled on the ſurface of the metal, by which its fuſion is remarkably promoted. On diſcontinuing the action of the bellows, the iron thickens into a maſs called a loop, which is conveyed under a large hammer raiſed by the motion of a water-mill. The iron, beat into a thick ſquare, is heated till ready to melt, and forged again: by a few repetitions of this proceſs, it becomes completely malleable, and is at length formed into bars for ſale. A large quantity of vitreous ſcoria ſeparates both in the fuſion and the forging: the rough caſt iron, obtained from ſome ores, loſes more than half its weight in being made into bars.

Preparation of IRON, in medicine, are, 1. The crude filings, reduced to an impalpable powder, greatly recommended in female diſorders.

2. The crocus martis. See CROCUS.

3. The flores martiales, or flowers of iron, See the article FLOS.

4. The ſal martis, or ſalt of iron, which is prepared thus: mix together a quart of water, and eight ounces of the oil of vitriol; pour the oil of vitriol in by a little at a time: put the mixed liquor into a glaſs-veſſel, and add to it four ounces of the filings of iron: when the ebullition is over, evaporate the liquor to a pellicle, and ſet it to ſhoot, there will then be a green vitriol or ſalt found in fair cryſtals; dry them for uſe.

This ſalt is one of the moſt powerful preparations of this metal; it opens obſtructions of all kinds, ſtrengthens the viſcera, is an excellent medicine in cachexies, and deſtroys worms.

5. Tincture of iron, with ſpirit of ſalt, is made thus: take filings of iron, half a pound; Glauber's ſpirit of ſea ſalt, three pounds; rectified ſpirit of wine three pints: digeſt the ſpirit of ſalt and the filings together, without heat, as long as the ſpirit will work upon them; then after the fæces have ſubſided, pour off the clear liquor, evaporate it to one pound, and to this add the ſpirit of wine.

This has the ſame virtues as the crocus martis. See the article CROCUS.

6. Chalybeate, or ſteel-wine, is made in the following manner: take filings of iron, four ounces; cinnamon and mace, of each half an ounce; of rheniſh wine, two quarts; infuſe them a month, without heat, often ſhaking the veſſel, and then filter it off for uſe.

This wine is an excellent ſtomachic and aperient; a moderate glaſs may be drank once or twice a day, or it may be mixed in apozems of the aperient vegetables.

IRONY, in rhetoric, is when a perſon ſpeaks contrary to his thoughts, in order to add force to his diſcourſe; whence Quintilian calls it *diverſiloquium*.

Thus, when a notorious villain is ſcornfully complimented with the titles of a very honeſt and excellent perſon; the character of the perſon commended, the air of contempt that appears in the ſpeaker, and the exorbitancy of the commendations, ſufficiently diſcover the diſſimulation or irony.

IRRADIATION, the act of emitting ſubtile effluvia, like the rays of the ſun every way.

IRRATIONAL, an appellation given to ſurd numbers and quantities. See the article NUMBER, QUANTITY, and SURD.

IRREGULAR, ſomething that deviates from the common forms, or rules; thus we ſay an irregular fortification, an irregular figure, &c. See the article FORTIFICATION, &c.

IRREGULAR, in grammar, ſuch inflections of words as vary from the general rules; thus we ſay, irregular nouns, irregular verbs, &c.

IRREGULAR BODIES are ſolids not terminated by equal and ſimilar ſurfaces.

IRREGULAR COLUMN, in architecture, a column which does not only deviate from the proportions of any of the five orders, but whoſe ornaments, whether in the ſhaft or capital, are abſurd and ill choſen.

ISAIAH, or *Prophecy of* ISAIAH, a canonical book of the Old Teſtament. Iſaiah is the firſt of the four greater prophets, the other three being Jeremiah, Ezekiel, and Daniel. This prophet was of royal blood, his father Amos being brother to Azariah, king of Judah. The five firſt chapters of this prophecy relate to the reign of Uzziah; the viſion, in the ſixth chapter, happened in the time of Jotham: the next chapters to the fifteenth, include his prophecies under the reign of Ahaz; and thoſe that were made under the reigns of Hezekiah and Manaſſeh, are related in the next chapters to the end. The ſtile of this prophet is noble, ſublime, and florid. Grotius calls him the Demoſthenes of the Hebrews. He had the advantage, above the other prophets, of improving his diction by converſing with men of the greateſt parts and elocution, and this added a ſublimity, force, and majeſty to what he ſaid. He impartially reproved the vices of the age in which he lived, and openly diſplayed the judgments of God that were hanging over the Jewiſh nation; at the ſame time denouncing vengeance on the Aſſyrians, Egyptians, Ethiopians, Moabites, Edomites, Syrians, and Arabians, who were inſtrumental in inflicting thoſe judgments. He foretold the deliverance of the Jews from their captivity in Babylon, by the hand of Cyrus king of Perſia, an hundred years before it came to paſs; but the moſt remarkable of his predictions are thoſe concerning the Meſſiah, in which he not only foretold his coming in the fleſh, but all the great and memorable circumſtances of his life and death.

ISATIS, Woad. See the article WOAD.

ISCHIADIC, in anatomy, a name given to two crural veins, called the greater and leſſer iſchias. See the article VEIN.

ISCHIUM, in anatomy, the name of a bone deſcribed under the article innominata oſſa. See the article INNOMINATA.

ISCHURY, *Iſchuria*, in phyſic, a ſuppreſſion of urine.

The word is Greek, ἰσχυρία, and formed from ἰσχω, to retain, and ὑρον, urine.

Women with child are often troubled with an entire ſuppreſſion of urine; the moſt general cauſes of which are gravel and ſtone, an inflammation of the neck of the bladder, owing to the piles; or a ſtrangulation of the neck of the bladder betwixt the os pubis and head of the child, when it is ſunk down very low.

In the two firſt caſes, general remedies, as bleeding, emollient clyſters, and gentle purges with ſoftening decoctions, are of great uſe; but nothing gives ſo ſpeedy a relief as a catheter. But when the head of the child is ſunk very low, and preſſes ſtrongly againſt the os pubis, the catheter will not paſs; and then the remedy is to put back the child's head, which immediately gives liberty to the urine to come away without uſing the catheter.

La Motte makes a diſtinction betwixt a ſuppreſſion and retention of urine. In the latter caſe the patient has frequent motions to make water, without being able to do it. But in a total ſuppreſſion of urine the patient has ſeldom or never any inclination to make water, and if any happen, it is done in a moment: this laſt is the moſt dangerous.

To diſcharge the urine by a puncture of the bladder is never undertaken, when relief can be had from internal medicines, or the introduction of the catheter. Now the catheter cannot be introduced in the following caſes: 1. When the neck of the bladder is greatly inflamed, whereby the urethra is contracted. 2. A caruncle, cicatrix, or hard tubercle may obſtruct the paſſage. 3. The introduction of the catheter in old men is ſometimes impracticable from the ſtricture or wrinkles of the urethra. 4. From the diſtention of its ſpongy ſubſtance with blood. 5. From a ſcirrhoſity or preternatural tumor of the proſtate gland. Laſtly, from a ſtone lodged in the neck of the bladder. Upon ſuch occaſions recourſe muſt be had to this operation; and among the various methods made uſe of, Heiſter prefers the following, namely, to make an inciſion on the left ſide of the future of the peritonæum into the body of the bladder, ſo as not to injure its neck, with a trochar and cannula. After which the perforator is extracted, but the cannula remains there for the more ready diſcharge of the urine, by which means both the operation and cure are greatly facilitated. Nor is it improper to paſs one or two fingers into the anus for the better direction of the inſtrument into the bladder, and the preſervation of the rectum.

When the cauſe is removed, the tube may be extracted, and the wound healed by the application of balſam of capivi.

ISIA, feaſts and ſacrifices anciently ſolemnized in honour of the goddeſs Iſis.

ISINGLASS, *Ichthyocolla*, in the materia medica, &c. See ICHTHYOCOLLA.

ISLAND, a tract of dry land, encompaſſed with water, in which ſenſe it ſtands contradiſtinguiſhed from continent, or terra firma.

ISLE, in general, denotes the ſame with iſland, only frequently uſed in a diminutive ſenſe.

ISLES, in architecture, denote the ſides or wings of a building.

ISOCHRONAL, ISOCHRONE, or ISOCHRONOUS, is applied to ſuch vibrations of a pendulum, as are performed in the ſame ſpace of time, as all the vibrations or ſwings of the ſame pendulum are, whether the arches it deſcribes be longer or ſhorter: for when it deſcribes a ſhorter arch, it moves ſo much the ſlower, and when a long one proportionably faſter.

ISOCHRONAL LINE, that in which a heavy body is ſuppoſed to deſcend without any acceleration. See the article ACCELERATION.

ISOPERIMETICAL FIGURES. See MAXIMUM and MINIMUM.

ISOSCELES, TRIANGLE, in geometry, a triangle which hath two equal ſides, as A B C (plate LXXVII. *fig.* 1.) where the ſide A B is equal to A C.

ISPIDA, the king fiſher, in ornithology, a genus of the picæ-order of birds, with a bill of a trigonal figure, ſomewhat arcuated, compreſſed, and its two chaps equal: there are four toes on each foot, with only one of them placed behind.

This is a very numerous genus, the ſpecies of which are chiefly diſtinguiſhed by their ſize and different colours.

ISSUE, in law, has ſeveral ſignifications, it being ſometimes taken for the children begotten between a man and his wife; ſometimes, for profits ariſing from amercements and fines; and ſometimes, for the profits iſſuing out of lands or tenements: but this word generally implies the concluſion, or point of matter, that iſſues from the allegations and pleas of the plaintiff and defendant in a cauſe tried by a jury of twelve men.

ISSUES, in ſurgery, ſmall artificial apertures made in a fleſhy part of the body, to drain off ſuperfluous or noxious humours.

An iſſue ſhould be made in the middle of a muſcle, that the neceſſary motion of the part may not incommode or put the patient to pain. The beſt way of making iſſues in children is by applying a ſmall piece of bliſtering plaſter, as big as a pea, to the part; and letting it lie on for a few hours, it will cauſe a bliſter: upon raiſing the ſkin, apply a pea and compreſs it tight with a bandage, till by degrees it ſinks in and forms an iſſue.

ISTHMIA, or ISTHMIAN GAMES, ἰσθμια, one of the four ſolemn games which were celebrated every fifth year in Greece; ſo called from the Corinthian iſthmus, where they were kept.

Theſe games, according to ſome, were inſtituted in honour of Palæmon, or Melicertes, the ſon of Athamas king of Thebes, and Ino. Others report, that they were inſtituted by Theſeus, in honour of Neptune: others again are of opinion, that there were two diſtinct ſolemnities obſerved in the Iſthmus, one to Melicertes, and another to Neptune. Theſe games were held ſo ſacred and inviolable, that when they had been intermitted for ſome time, through the oppreſſion and tyranny of Cypſelus, king of Corinth, after the tyrant's death the Corinthians, to renew the memory of them, employed their utmoſt power and induſtry. The victors were rewarded with garlands of pine-leaves; afterwards parſley was given them; but at length, the pine was reſumed, and to this was added the reward of one hundred ſilver drachmæ. Theſe games were ſo celebrated, and the concourſe at them ſo great, that only the principals of the moſt remarkable cities could have place in them. The Athenians had only as much room allowed them as the ſail of a ſhip, which they ſent yearly to Delos, could cover.

ISTHMUS, in geography, a narrow neck of land that joins two continents, or joins a peninſula to the terra firma, and ſeparates two ſeas. The moſt celebrated iſthmuſes are thoſe of Panama, or Darien, which joins North and South America; and that of Suez, which connects Aſia and Africa; that of Corinth, of Crim Tartary, &c.

ITALIAN, the language ſpoken in Italy.

This tongue is derived principally from the Latin; and of all the languages formed from the Latin, there is none which carries with it more viſible marks of its original than the Italian. It is accounted one of the moſt perfect among the modern tongues, containing words and phraſes to repreſent all ideas, to expreſs all ſentiments, to deliver one's ſelf on all ſubjects, to name all the inſtruments and parts of arts, &c. It is however complained, that it has too many diminutives and ſuperlatives, or rather augmentatives, but without any great reaſon: for if theſe words convey nothing farther to the mind than the juſt ideas of things, they are no more faulty than our pleonaſms and hyperboles. The language correſponds to the genius of the people; they are ſlow and thoughtful, and accordingly their language runs heavily, though ſmoothly, and many of their words are lengthened out to a great degree. They have a great taſte for muſic, and to gratify their paſſion this way, have altered abundance of their primitive words, leaving out conſonants, taking in vowels, ſoftening and lengthening out their terminations for the ſake of the cadence. Hence the language is extremely muſical, and ſucceeds better than any other in operas, and ſome parts of poetry; but it fails in ſtrength and nerves: hence alſo, a great part of its words borrowed from the Latin, become ſo far diſguiſed, that they are not eaſily known again.

ITALIC CHARACTERS, in printing. See the article LETTER.

ITALIC or ITALIAN HOURS, the twenty-fours of the natural day, accounted from the ſun-ſetting of one day, to the ſame again the next day. See HOUR.

ITALIC SECT, a party of ancient philoſophers, founded by Pythagoras, ſo called, becauſe that philoſopher taught in Tarentum, Metapontus, Heraclea, Naples, &c. in Italy.

ITALY, a country, ſituated between ſeven and nineteen degrees eaſt long. and between thirty-eight and forty-ſeven degrees north latitude, bounded by Switzerland, and the Alps, which ſeparate it from Germany, on the north; by the gulph of Venice, on the eaſt; by the Mediterranean ſea, on the ſouth; and by the ſame ſea and the Alps, which ſeparate it from France, on the weſt; and if we include Savoy, which lies indeed on the weſt-ſide of the Alps, between Italy and France, we muſt extend it a degree farther weſt: this is uſually deſcribed however with Italy, as it is contiguous to Piedmont, and has the ſame ſovereign, being a province of the king of Sardinia's dominions. Italy is ſaid to reſemble a boot, and is in length from north-weſt to ſouth-eaſt 600 miles; the breadth is very unequal; in the north, which may be called the top of the boot, it is 400 miles broad from eaſt to weſt; in the calf of the leg, or middle, it is about 120 miles broad; and towards the ſouth, about the inſtep, eighty miles broad; and comprehends the following countries or ſubdiviſions. 1. In the north are the duchies of Savoy, Piedmont, and Montſerrat; the territories of Genoa; the duchies of Milan, Mantua, Parma, Modena, and the territories of Venice. 2. In the middle of Italy, are the duchy of Tuſcan, the pope's dominions, and the ſtate of Lucca. 3. And in the ſouth is the kingdom of Naples.

ITCH, a diſeaſe of the ſkin which is corrupted by the oozing out of certain ſharp humours, which gather into puſtules, and occaſion a prurigo or itching.

The itch is either moiſt or dry, which, appearing in the joints principally at firſt, gradually ſpreads through the reſt of the body, except the head.

This diſeaſe firſt appears in a reddiſh roughneſs of the ſkin; which is ſucceeded by pimples, that let out matter or a ſharp ichor; and the exulceration is attended with itching, and ſpreads by contagion. It may juſtly be called an animated diſeaſe, as owing its origin to ſmall animals. For there are certain inſects, ſo very ſmall as hardly to be ſeen, without the aſſiſtance of a microſcope, which depoſit their eggs in the furrows of the cuticle, as in proper neſts; where, by the warmth of the place, they are hatched in a ſhort time, and the young ones coming to full growth penetrate into the very cutis with their ſharp heads, and gnaw and tear the fibres. Their bitings cauſe an intolerable itching, which brings on a neceſſity of ſcratching; whereby the part is torn, and emits a thin humour, which concretes into hard ſcabs; whilſt the little worms conſtantly burrowing under the cuticle, and laying their eggs in different places, ſpread the diſeaſe.

Hence the reaſon manifeſtly appears why the diſeaſe is communicated by the linen, wearing apparel, gloves, &c. which were uſed by infected perſons: for the eggs which had ſtuck to ſoft ſubſtances of this kind, are rubbed into the furrows of the cuticle, and are there hatched and nouriſhed.

Now what is of greateſt moment in this theory is, that the knowledge of the true cauſe of the diſeaſe naturally points out the cure: for neither cathartics nor ſweeteners of the blood are of any ſervice here; the whole management conſiſts in external applications, in order to deſtroy theſe corroding worms, and this is eaſily effected: wherefore,

fore, firſt let the patient go into a warm bath, and then let the parts affected be anointed every day, either with the ointment of ſulphur, or the ointment with precipitate of mercury, which is leſs offenſive to the olfactory organs; inſtead of which a liniment may be made of orange flowers, or red roſes, the mercurial red corroſive, and hogs-lard, pounded together, which is of a very pleaſant ſmell, and of equal efficacy. *Mead.*

ITINERANT JUDGES, a name formerly given to thoſe judges who were ſent into ſeveral counties to hear cauſes.

JUBILEE, among the Jews, denoted every fiftieth year, being that which followed the revolution of ſeven weeks of years; at which time all ſlaves were made free, all debts annihilated, and all lands, &c. reverted to their ancient poſſeſſors; all agriculture was forbid, and the poor intitled to all the productions of the earth that year. The privilege extended only to original Iſraelites.

According to Maſius, the word is derived from Jubal, the inventor of muſical inſtruments; whence the words Jobel, and Jubilee, ſignified the year of deliverance and remiſſion, becauſe proclaimed with the ſound of one of thoſe inſtruments, which at firſt was no more than the horn of a ram.

The Chriſtians, in imitation of the Jews, have likewiſe eſtabliſhed jubilees, which began in the time of pope Boniface VIII. in the year 1300, and are now practiſed every twenty-five years; but theſe relate only to the pretended forgiveneſs of ſins, and the indulgences granted by the church of Rome: together with the privilege of performing a thouſand frolics in maſquerade. The ceremony of the jubilee obſerved at Rome, begins in the following manner: the pope goes to St. Peter's church, to open the holy gate, which is walled up, and opened only on this occaſion; and, holding a golden hammer in his hand, he knocks at the gate three times, repeating theſe words, *aperite mihi portas juſtitiæ*, &c. *Open to me the gates of righteouſneſs; I will go into them, and I will praiſe the Lord*, Pſal. cxviii. 19. upon which the maſons fall to work, and break down the wall that ſtops up the gate: which done, the pope kneels down before it, and the penitentiaries ſprinkle him with holy water. Then, taking up the croſs, he begins to ſing te deum, and enters the church, followed by the clergy. In the mean time, three cardinal-legates are ſent to open the three other holy gates which are in the churches of St. John of Lateran, St. Paul, and St. Mary the Greater. When the holy year is expired, the holy gates are ſhut in this manner: the pope, after he has bleſſed the ſtones and mortar, lays the firſt ſtone, and leaves there twelve boxes of gold and ſilver medals; after which the holy gates are walled up as before, and continue ſo till the next jubilee.

JUDAISM, the religious doctrines and rites of the Jews. See JEWS.

JUDE, *or the general Epiſtle of* JUDE, a canonical book of the New Teſtament, written againſt the heretics, who by their diſorderly lives and impious doctrines, corrupted the faith and good morals of the Chriſtians. St. Jude draws them in lively colours, as men given up to their paſſions, full of vanity, conducting themſelves by worldly wiſdom, and not by the ſpirit of God.

In the early ages of Chriſtianity, ſeveral rejected this Epiſtle becauſe the apocryphal books of Enoch and the aſcenſion of Moſes are quoted in it. Nevertheleſs, it is to be found in all the ancient catalogues of the ſacred writings; and Clement of Alexandria, Tertullian and Origen, quote it as written by Jude, and reckon it among the books of ſacred Scripture.

St. JUDE'S DAY, the ſame with that of St. Simon. See the article SIMON.

JUDGE, an officer appointed by the ſovereign powers of any country to diſtribute juſtice to their ſubjects which they themſelves cannot do in perſon.

Book of JUDGES, a canonical book of the Old Teſtament, ſo called from its relating the ſtate of the Iſraelites under the adminiſtration of many illuſtrious perſons who were called judges, from their being both the civil and military governors of the people, and who were raiſed up by God upon ſpecial occaſions, after the death of Joſhua, till the time of their making a king. In the time of this peculiar polity, there were ſeveral remarkable occurrences, which are recorded in this book. It acquaints us with the groſs impiety of a new generation which ſprung up after the death of Joſhua, and gives us a ſhort view of the diſpenſations of heaven towards this people, ſometimes relieving and delivering them, and at others, ſeverely chaſtiſing them by the hands of their enemies.

The book of Judges is uſually divided into two parts; the one containing the hiſtory of the judges from Othniel to Sampſon; which ends with the ſixteenth chapter: the other containing ſeveral memorable actions, which were performed in or about the time of the judges, from the ſeventeenth chapter to the end of the book. The author of this book is wholly unknown; ſome aſcribe it to Samuel, others to Hezekiah, and others to Ezra.

JUDGMENT, among logicians, a faculty or rather act of the human ſoul, whereby it compares its ideas, and perceives their agreement or diſagreement. See the article KNOWLEDGE.

JUDGMENT, in law, the ſentence of the judges upon a ſuit, &c.

JUDGMENTS *for crimes*, in caſe of treaſon or felony, muſt be by an expreſs ſentence, an out-lawry, or abjuration: and no judgment can be inflicted contrary to law, or that is not appointed by act of parliament.

JUDGMENTS *for debts*, are acknowledged by a perſon's giving a general warrant of attorney to any attorney of the court in which it is to be acknowledged, to appear for him at the ſuit of the party to whom the ſame is to be done, and to file common bail, receive a declaration, and then to plead, *non ſum informatus*, I am not informed; or to let it paſs *nihil dicit*, he ſays nothing; upon which judgment is entered for want of a plea.

JUGALE, in anatomy the cheek bone. See the article MALA.

JUGERUM, in Roman antiquity, a ſquare of one hundred and twenty Roman feet; its proportion to the Engliſh acre being as ten thouſand to ſixteen thouſand and ninety-ſeven. See MEASURE.

JUGULAR, in anatomy, an appellation given to two veins of the neck, which ariſe from the ſubclavians. 1. The external jugular, diſtributed over the external parts of the head; and which, in its ſeveral parts, receives different denominations from them, as the frontal, temporal, occipital, &c. vein. 2. The internal jugular, which gives ramifications to the larynx, the pharynx, the muſcles of the os hyoides, and to the tongue; thoſe which are under its vertex being called raninæ. But beſides theſe branches, its trunk terminates in a diverticulum, called the jugular ſack, and brings back the blood from the ſinuſes of the dura mater, and from the brain. See the article VEIN.

There are alſo certain glands in the anterior part of the neck, called jugular. See GLAND.

JUICE denotes the ſap of vegetables when expreſſed. See SAP.

JUICE is alſo uſed to denote the liquors of animals, as the nervous juice, the pancreatic juice, &c.

JUJUBES, *Jujubæ*, in pharmacy, a fruit of the plum kind, about the ſize and ſhape of an olive, conſiſting of a pretty thick reddiſh yellow ſkin, a whitiſh fungous pulp, and a wrinkled ſtone of an oblong figure. It is the produce of a prickly tree, with three-ribbed leaves, and herbaceous or yellowiſh flowers, ſometimes found wild, and commonly cultivated in the ſouthern parts of Europe.

This fruit has an agreeable ſweet taſte; and in thoſe countries where it is common, makes an article of food in its recent ſtate, and of medicine when half dried; decoctions of it being uſed, like other glutinous ſweets, as incraſſants, and demulcents in defluxions on the breaſt.

The jujubes have been made a general ingredient in pectoral decoctions; but they are now become a ſtranger to the ſhops, the tree not producing fruit in this climate; and that which we received from abroad being commonly mouldy or carious.

JULEP, in pharmacy, an alterative medicine, unknown to the ancient Greeks, and invented by the Arabians, compoſed chiefly of diſtilled waters, &c. and ſweetened with ſugar or proper ſyrups.

It was ſo called becauſe uſually prepared of ſweet ingredients, julep ſignifying, in the Perſian language, a ſweet potion.

JULIAN PERIOD, in chronology, a period ſo called as being adapted to the Julian year.

It is made to commence before the creation of the world. Its principal advantage lies here, that the ſame years of the cycles of the ſun, moon, and indiction, of which three cycles it was made to conſiſt by Joſeph Scaliger in 1580, belonging to any year of this period, will never fall together again till after the expiration of ſeven thouſand nine hundred and eighty years. There is taken for the firſt year of this period, that which hath the firſt of the cycle of the ſun, the firſt of the cycle of the moon, and the firſt of the indiction cycle, and ſo reckoning on.

The firſt year of the Chriſtian æra is always, in our ſyſtems of chronology, the 4714th of the Julian period.

To find what year of the Julian period any given year of Chriſt anſwers to: to the given year of Chriſt add 4713, becauſe ſo many years of the Julian period were expired A. D. 1; and the ſum gives the year of the Julian period ſought.

On the contrary, having the year of the Julian period given, to find what year of Chriſt anſwers thereto: from the year of the Julian period given ſubſtract 4713, and the remainder will be the year ſought.

JULUS, in botany, the ſame with what is otherwiſe called catkins or amentaceous flowers.

JULUS is alſo the name of an inſect very common among rubbiſh, and called in Engliſh the gally-worm: it is furniſhed with a great number of feet, has the power of rolling itſelf up like a ball when touched, and is eſteemed a very valuable medicine in the jaundice and ſuppreſſion of urine.

JULY, the ſeventh month of the year, during which the ſun enters Leo.

It was called Julius, by Marc Anthony, from the ſurname of the dictator C. Cæſar, who was born in this month. It was before called Quintilis, as being the fifth month of the year in Romulus's calendar, which began in March.

JUMENTA, in zoology, the name by which Linnæus calls the fifth order of quadrupeds, the characteriſtic of which is, that the teeth of all the animals belonging to it are placed in a different manner from the other five orders. See the article QUADRUPED.

To this order belong the elephant, rhinoceros, hippopotamus, horſe, and hog. See ELEPHANT, RHINOCEROS, &c.

JUNCUS, the ruſh, in botany, a genus of plants which has no corolla; but the perianthium, when freſh and coloured, greatly imitates one: the fruit is a coloured capſule, of a triquetrous figure, and formed of three valves, containing a few roundiſh ſeeds.

Authors have divided the ſeveral ſpecies of juncus into what they call ruſhes, and ruſh-graſſes, from their having or wanting leaves; but the fructifications in both are the ſame.

JUNCUS ODORATUS, a name ſometimes given to ſchoenanth. See SCHOENANTH.

JUNIPER, in botany, an ever-green tree or buſh, clothed with ſlender, narrow, ſtiff, ſharp leaves, like prickles, which ſtand generally three together: the flowers are a kind of ſmall ſcaly catkins, growing on one plant; the fruit, round berries, growing on a different one, containing each three oblong irregular ſeeds. It is common on heaths in different parts of Europe; and is found, at all ſeaſons of the year, both with unripe green or red berries, and with ripe bluiſh black ones.

The berries are brought chiefly from Holland and Italy: they ſhould be choſen freſh, not much ſhrivelled, and free from mouldineſs, which they are very ſubject to contract in keeping. They have a moderately ſtrong, not diſagreeable, ſmell, and a warm pungent ſweetiſh taſte, which, if they are long chewed or previouſly well bruiſed, is followed by a conſiderable bitterneſs. Diſtilled with water, they yield a yellowiſh eſſential oil, very ſubtile and pungent, in ſmell greatly reſembling the berries; in quantity, if they have been ſufficiently bruiſed, about one ounce from forty: the remaining decoction, inſpiſſated to the conſiſtence of a rob or extract, has a pleaſant, balſamic, ſweet taſte, with a greater or leſs degree of bitterneſs. A part of the flavour of the berries ariſes alſo in diſtillation with rectified ſpirit: the inſpiſſated tincture conſiſts of two diſtinct ſubſtances; one oily and ſweet; the other tenacious, reſinous, and aromatic.

Theſe berries are uſeful carminatives, detergents, and diuretics. The diſtilled oil is a very ſtimulating diuretic, approaching in quality to that of turpentine, like which, it impregnates the urine with a violet ſmell: the ſpirituous extract gives the ſame kind of ſmell; as does likewiſe the berry in ſubſtance, in a lower degree; but the watery extract or rob, as being diveſted of the oil, has no ſuch effect. This laſt may be uſed with advantage in caſes where the more ſtimulating preparations would be improper; as in catarrhs, debilities of the ſtomach and inteſtines, and difficulties of the urinary excretions, in perſons of an advanced age. Among the aromatics that have been tried in conjunction with juniper berries, ſweet fennel ſeeds and carraway ſeeds ſeem the beſt adapted to improve their flavour: a cordial water is prepared in the ſhops by drawing off a gallon of proof ſpirit from a pound of the berries, and an ounce and a half of each of the ſeeds. The water is ſtrongly impregnated with the volatile virtue of the berry; to which the more fixed ones may in many caſes be uſefully ſuperadded, by mixing with it a proper quantity of rob.

We uſed to keep a diſtilled ſpirituous water of juniper in the ſhops; but the vulgar got an opinion of its being a pleaſant dram, and conſequently the making it became the buſineſs, not of the apothecary, but the diſtiller, who ſold it under the name of geneva; but at preſent it is only a better kind that is made with the juniper-berry; what they commonly ſell is made with no better ingredient than oil of turpentine, put into the ſtill with a little common ſalt, and with the coarſeſt ſpirit they have, which is drawn off much below proof ſtrength, and is conſequently a liquor that one would wonder any people could accuſtom themſelves to drink for pleaſure.

JUNK, among ſailors, certain pieces of old cable cut into different lengths.

JUNO, in aſtronomy, the name by which ſome call the ſecond of Jupiter's ſatellites. See the article JUPITER.

JUNTA, JUNTO, or JUNCTO, in matters of government, denotes a ſelect council for taking cognizance of affairs of great conſequence, which require ſecrecy.

IVORY, *Ebur*, the tuſk, or dens exertus of an elephant, growing on each ſide of his trunk, in form of a horn. Each tuſk is ſix or ſeven feet in length, and as thick as a man's thigh at the baſe, and almoſt ſolid; and both together ſometimes weigh about three hundred and thirty pounds.

It is much eſteemed for its colour, poliſh, and the fineneſs of its grain when wrought.

The ivory of the iſles of Ceylon and Achem never becomes yellow, as that of the terra firma and the Eaſt-Indies does; on which account the former is dearer.

We have alſo fine ivory brought from Angola, Sumatra, &c. Large quantities of it are not taken in the Eaſt-Indies immediately from the head of the animal, but found buried in the earth.

The preparations of ivory have all the ſame virtues with thoſe of harts-horn, and its raſpings, in the ſame manner as ſhavings of harts-horn boiled into a jelly with water, and have the ſame reſtorative qualities.

Staining and marbling of IVORY *yellow.* —Boil it firſt in a ſolution of alum, in the proportion of one pound to two quarts of water: and then prepare a tincture of the French berries, by boiling half a pound of the berries, pounded, in a gallon of water with a quarter of a pound of pearl aſhes. After this tincture has boiled about an hour, put the ivory, previouſly boiled in the alum water into it; and let it remain there half an hour.

If turmeric root be uſed inſtead of the French berries, a brighter yellow may be obtained; but the ivory muſt in that caſe be again dipped in alum water after it is taken out of the tincture; otherwiſe an orange-colour, not a yellow, will be produced from the effect of the pearl-aſhes on the tumeric.

Staining IVORY *green.* —It muſt be boiled in a ſolution of

5 JA 59

Fig. 1. Isosceles.

Fig. 2. JUPITER ♃

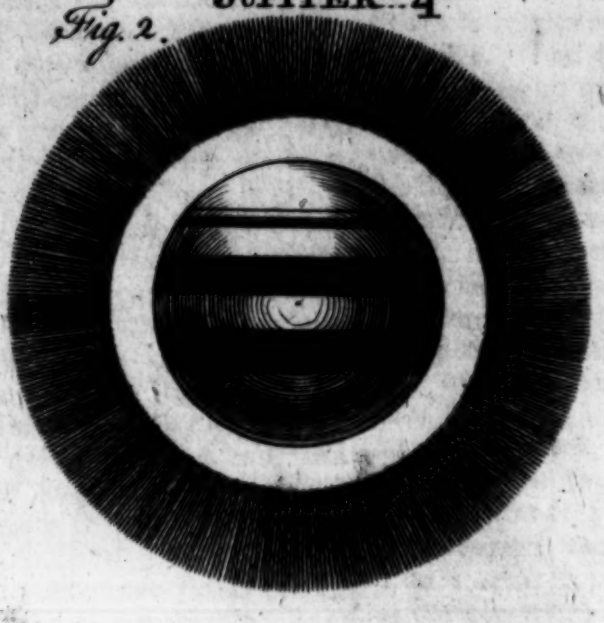


Fig. 3. Jupiter's Moons.

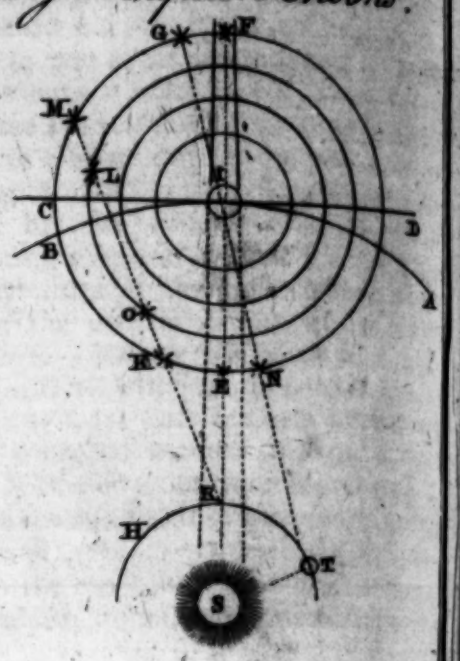
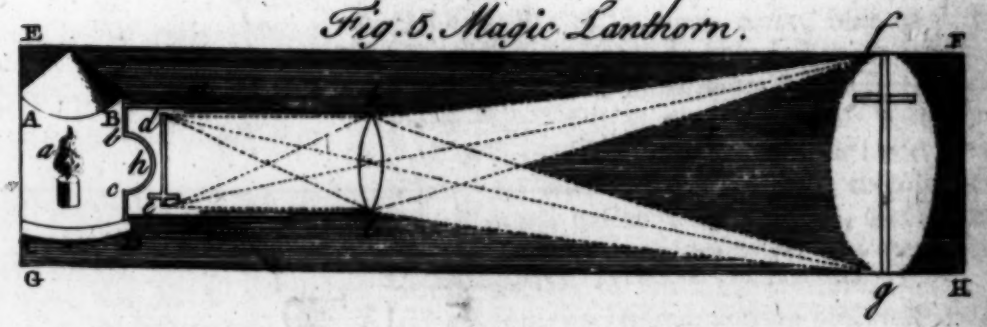


Fig. 4. Key.

Fig. 5. Magic Lanthorn.



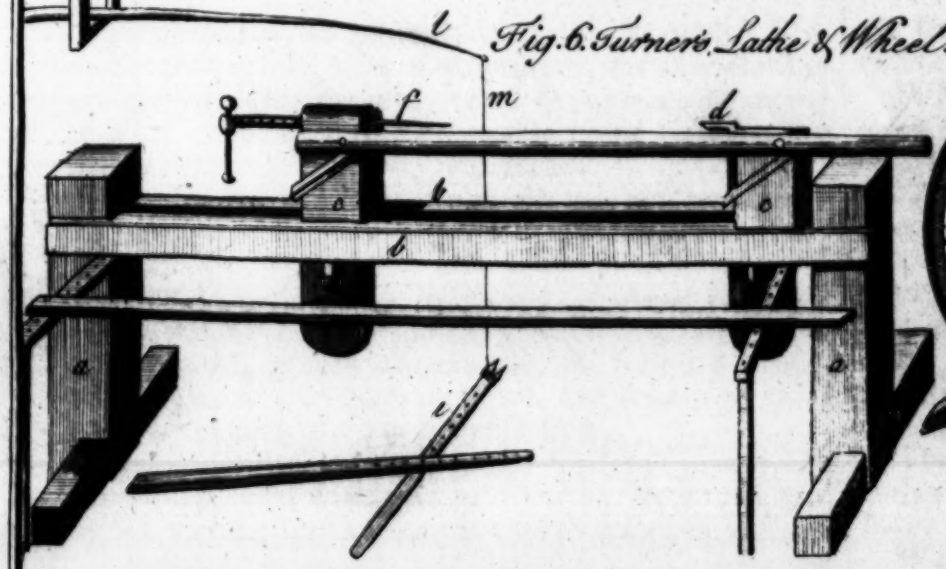


Fig. 6. Turner's Lathe & Wheel.

Fig. 7. Lathe.

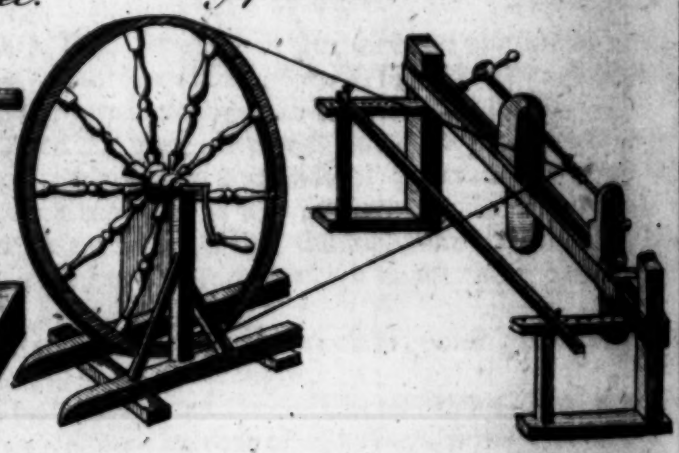


Fig. 10. Lathe for turning Oval and Rose Work

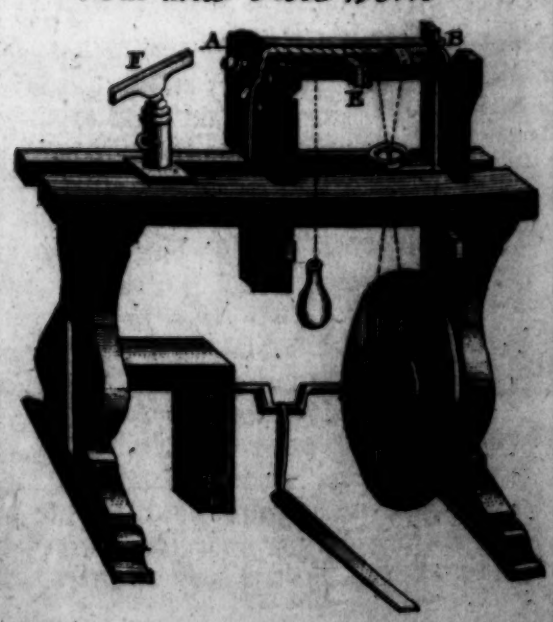


Fig. 8. Brasier's Lathe.

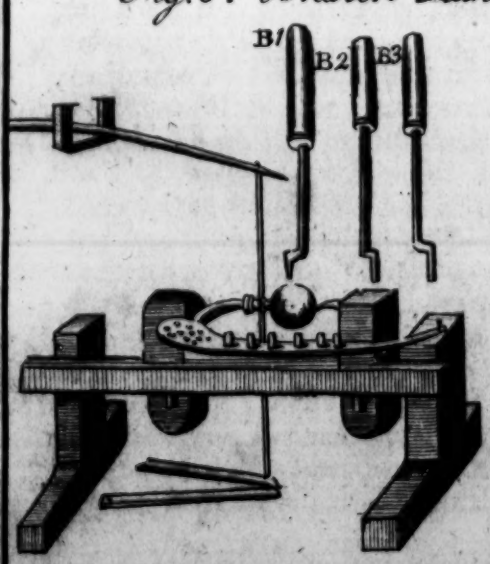
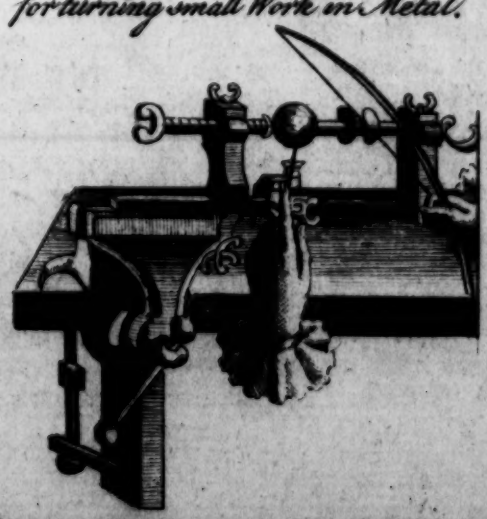


Fig. 9. An Iron Lathe for turning small Work in Metal.



of verdigriſe in vinegar; or of copper in aqua-fortis, prepared as above directed, a veſſel of glaſs or earthen ware being employed for this purpoſe, till it be of the colour deſired.

Staining IVORY *red.* — Take ſtrong lime-water, prepared as for other purpoſes; and the raſpings of Braſil-wood, in the proportion of half a pound to a gallon. Let them boil for an hour; and then put in the ivory, prepared by boiling in alum-water in the manner beforementioned for the yellow; and continue it there till it be ſufficiently coloured. If it be too crimſon, or verge toward the purple, it may be rendered more ſcarlet, by dipping again in the alum-water.

Staining IVORY *blue.* — Stain the ivory firſt green, according to the manner above deſcribed; and then dip it in a ſolution of pearl-aſhes, made ſtrong and boiling hot: but it muſt not be continued longer, nor dipped oftner, than is neceſſary to convert the green to blue.

The ivory may otherwiſe be boiled in the tincture of indigo, prepared as by the dyers; and afterwards in the ſolution of tartar.

Staining IVORY *purple.* — This colour is to be treated in the ſame manner as was directed for the red, except that log-wood muſt be ſubſtituted in the place of Braſil-wood; and the uſe of the alum-water muſt be omitted wholly.

If a redder purple be wanted, a mixture of the log-wood and Braſil muſt be employed, inſtead of the log-wood alone. The proportion may be equal parts; or any leſs proportion of the Brazil, according to the colour deſired.

By this method you may alſo imitate tortoiſe-ſhell and ſeveral other ſubſtances in ivory.

JUPITER, ♃, in aſtronomy, one of the ſuperior planets, remarkable for his brightneſs.

This planet is ſituated between Saturn and Mars, and revolves about his own axis in 9 hours 56 minutes. His periodical revolution round the ſun is performed in 4332 days, 12 hours, 20 minutes, or almoſt 12 years, in an orbit whoſe radius or ſemi-diameter is equal to 424 millions of miles. The inclination of the orbit to the plane of the ecliptic is 1°. 20′. The place of the node ☋ 7° 39′ 54″; and of the aphelion ♎ 9° 9′ 54″.

Jupiter is the largeſt of all the planets, his diameter being 81155 Engliſh miles. See PLANET.

Jupiter has had his ſpots obſervable, ever ſince the invention and uſe of large teleſcopes; and from repeated obſervations they ſhew Jupiter's revolution about his axis is in 9 hours and 56 minutes. Beſides theſe ſpots, Jupiter has the appearance of three zones or belts encompaſſing his body. (See plate LXXVII. *fig.* 2.) Sometimes more, ſo that his diſk ſeems clouded with them: what they are, no body yet can tell. The axis of this planet is alſo nearly perpendicular to the plane of his orbit.

Conſidering the large magnitude of Jupiter, and his ſhort diurnal rotation, the equatorial parts of his ſurface muſt have a prodigious velocity, which of conſequence muſt cauſe him to be of a ſpheroidical figure (as was ſhewn of the earth.) Accordingly Caſſini found the axis of the equator to be to that of the poles as 14 to 15; but Mr. Pound afterwards more exactly determined them to be as 12 to 13, agreeable to Sir Iſaac Newton's computation.

Jupiter is obſerved with a teleſcope to have four ſatellites, which move about him in the times and diſtances following, viz. The firſt in 1 day, 18 hours, 27 minutes, at the diſtance of 5.6 ſemi-diameters of Jupiter's body from his center, as meaſured by a micrometer. The ſecond in 3 days, 13 hours, 13 minutes, at the diſtance of 9 ſemi-diameters. The third in 7 days, 3 hours, 42 minutes, at the diſtance of 14.3 ſemi-diameters. The fourth in 16 days, 16 hours, 32 minutes, at the diſtance of 25.3 ſemi-diameters.

Galileo firſt diſcovered the ſatellites or moons of Jupiter, in the year 1610; and called them Medicea ſidera, or Medicean ſtars, in honour of the family of the Medici, his patrons. The famous piece called Sidereus Nuncius, in which he particularly deſcribes the diſcovery of theſe ſtars, he dedicated to Coſmus Medicis II. the fourth great duke of Hetruria.

The orbits of Jupiter's moons lie nearly in the plane of the ecliptic, which is the reaſon why their motion is apparently in a right line, and not circular, as it really is. To underſtand this, let S (plate LXXVII. *fig.* 3.) be the ſun, T the earth in its orbit T H, I the planet Jupiter in his orbit A I B, and in the center of the 4 orbits of his moons. Then, becauſe the plane of thoſe orbits does nearly paſs through the eye, the real motion of the ſatellite in the periphery will be apparently in the diameter of the orbit, which is at right angles to the line joining the center of the earth and Jupiter.

Thus ſuppoſing the earth at R, if D C be drawn through the center of Jupiter perpendicular to R I, the motion of each moon and their places will appear to be in that line. Thus, if the exterior moon be at E or F, it will appear to be at I either upon or behind the center of Jupiter; if the moon moves from E to K, it will appear to have moved from I to L; and when it moves from K to C, it will appear to move from L to C. Again, while the ſatellite moves from C to M, it will appear to move from C to L; and as it goes from thence to F, it apparently moves from L to I. Thus alſo on the other ſide the orbit, while the ſatellite deſcribes the quadrant F D, its apparent motion will be from I to D; and then from D to I again, as it comes from D to E.

Whence, ſince this is the caſe of each ſatellite, it appears that while each ſatellite deſcribes the remote half of its orbit C F D, its apparent motion will be direct, or from weſt to eaſt along the line C D; and while it deſcribes the other half D E C, its apparent motion is retrograde, or from eaſt to weſt back again along the ſame line from D to C; ſo that each ſatellite traverſes the diameter of its orbit twice in each revolution.

The moons of Jupiter ſeverally ſhew the ſame phaſes to him as ours does to us. They diſappear from our ſight ſometimes, ſo that it is very rare to have all the four in view at once; nor is it poſſible to know which ſatellite in order you ſee, but from the knowledge of the theory and calculation; becauſe the remoteſt ſatellite may appear neareſt to Jupiter, and the contrary, as is evident from a view of the figure.

Theſe moons, like our own, ſuffer an eclipſe every time they come into the ſhadow of Jupiter, as at F. Alſo ſuppoſing the earth at T, the ſatellite at G will undergo an occultation behind the body of Jupiter, as is evident from the ſcheme. Again a ſatellite will ſometimes loſe its luſtre, as it paſſes over the enlightened diſk of its primary; as when it is at E and N, and the earth in R and T. Laſtly, one ſatellite at O may diſappear behind another at K, or cauſe another to diſappear behind it at M.

The obſervations by teleſcopes have been carried ſo far as to make it very probable, that all the ſatellites do really revolve about their own axis, by means of ſpots which they have diſcovered to belong to them, and which by their motion cauſe a great variety in the brightneſs of the ſatellites, and ſometimes do almoſt obſcure them: For which ſee Mr. Pound's obſervations on Jones's Abridgment of the *Philoſophical Tranſactions*, vol. IV. p. 307.

By means of Jupiter's ſatellites ſeveral noble problems in natural philoſophy have an eaſy and elegant ſolution; the firſt of which is to determine the ratio of the velocity of light: for the manner how this is done, ſee the article LIGHT. The ſecond is to determine the longitude of a place from any propoſed meridian; which is eaſily done by the following method: Let the moment of time in which the ſatellite enters the ſhadow of Jupiter be calculated for the given meridian from tables of its motion: then let the moment of time be well obſerved, when this immerſion happens at the propoſed place; the difference of theſe two moments turned into motion will give the longitude of the place, allowing 15 degrees for every hour, 1 degree for every 4 minutes of time, or 15 minutes of a degree for every minute of time. See LONGITUDE.

The third problem is to find the diſtance of Jupiter from the ſun. This is done as follows: Let the middle moment of the occulation of a ſatellite, as at G, be obſerved; and again the middle moment of the following at F; this will give the time in which the arch G F is deſcribed. Then ſay, as the time of the whole revolution is to the time now found, ſo is the whole circle of 360 degrees to the degrees and minutes contained in the arch

TIS; which is therefore the measure of the angle FIG, or its equal TIS, which is the parallactic angle at Jupiter; which being known at this distance of Jupiter from the sun, IS is easily found.

JURISDICTION, in law, signifies the power and authority with which any person is invested in administering justice in cases of complaint laid before him.

Jurisdictions are either ecclesiastical or secular; ecclesiastical belongs to bishops and their deputies.

Secular jurisdiction belongs to the king and his judges. The courts and judges at Westminster are not restrained to any county or place, they having jurisdiction all over England; but other courts are confined to their particular jurisdictions, which if they go beyond, all their proceedings become erroneous: as to inferior jurisdictions, they are of several sorts; one of which is to hold pleas, and the plaintiff may either sue there or in the king's courts. Another is the conusance of pleas; where a right is invested in the lord of the franchise to hold pleas. A third kind is an exempt jurisdiction, as where the king grants to the inhabitants of a particular city or corporation, the privilege of being sued only within their own city, &c.

JURISPRUDENCE, the science of what is just or unjust; or the knowledge of laws, rights, customs, statutes, &c. necessary for the administration of justice.

JURIS UTRUM, in law, is a writ in behalf of a clergyman, whose predecessor has alienated the lands belonging to his church.

JUROR, in law, signifies any person sworn on a jury.

JURY, a certain number of men sworn to enquire into and try a matter of fact, and to declare the truth upon such evidence as shall appear before them.

Juries are, in these kingdoms, the supreme judges in all courts and in all causes in which either the life, property, or reputation of any man is concerned: this is the distinguishing privilege of every Briton, and one of the most glorious advantages of our constitution; for as every one is tried by his peers, the meanest subject is as safe and as free as the greatest.

All criminal causes must first be tried by a grand jury, which commonly consists of twenty-four men of greater note than the petit jury, who are chosen indifferently out of the whole country, and no man can suffer the disgrace of being tried in any ignominious cause, without their first finding him guilty; if they find him innocent, he is immediately discharged; but if otherwise, they only find an indictment, on which he is tried, and finally acquitted or convicted by the verdict of the petit-jury, who are not only to be returned from the county, where the fact was done, but near neighbours, such as are most sufficient and least suspicious; to prevent partiality, the names of the persons impannelled are wrote on several pieces of paper of equal size, and delivered by the under-sheriff to the judge's marshal, who causes them to be rolled up, all in the same manner, and put together in a box, and when any cause is brought to trial, some indifferent person is to draw out twelve of these papers, and the persons whose names are drawn, if not challenged, are to be the jury to try the cause; and in case any are challenged, and set aside, or do not appear, then a further number is to be drawn till there is a full jury. See CHALLENGE.

When a juryman is sworn, he must not depart from the bar on any account whatsoever, till the evidence is given, without leave of the court; and if that be obtained, he must have a keeper with him. As soon as the whole evidence is summed up, the jury are to be kept together till they are all of one mind, and unanimous in bringing in their verdict, without being admitted to the speech of any person, and without meat, drink, fire, or candle. They are fineable if they agree to cast lots for their verdict, and also for being tampered with in relation to it: but as they are the sole judges of the fact, they are not fineable for giving a verdict contrary to what may appear plain evidence, because the law presumes that they may have some other evidence besides what is given in court; but where any corruption appears, a jury may be attainted for going contrary to evidence; and if a juror takes any thing either of the plaintiff or defendant for giving a verdict, he is to pay ten times as much as he has taken, or suffer a year's imprisonment; yet in trying causes, juries are to have their charges allowed them by the court. In all cases of difficulty it is safest for the jury to find the essential matter, and to leave it to the judge to determine how the law stands upon the fact.

Infants, persons of seventy years of age, and upwards, clergymen, apothecaries, &c. are exempted from serving upon juries; and barons, and all above them, are not to serve in any ordinary jury. Jurors, in London, must not only be housekeepers, but must have land or goods with one hundred pounds; and they may be examined on oath as to that point. 3 Geo. II. c. 25.

The qualifications of a jury-man for a county, is ten pounds per annum, either in freehold or copyhold-estate within the same county; but cities, boroughs, and corporate towns, are excepted by the statutes: however, no jury is obliged to appear upon a trial at Westminster, where the offence was committed thirty miles off, except it be required by the king's attorney-general. According to usage, the sheriff should return twenty-four jurors, in order to speed the trial in case of challenge, sickness, &c. and should he only return twelve, pursuant to the writ, he is liable to be amerced. By 4 and 5 W. and M. no sheriff, bailiff, &c. under the penalty of ten pounds, shall return any person to serve on a jury, who has not been duly summoned six days before his appearance, nor under the like penalty shall he accept of money or other reward for excusing the appearance of a juryman: jurymen neglecting to appear, shall be fined in a sum not exceeding five pounds, nor less than forty shillings, except they can give a reasonable excuse for their non-appearance; and in case a juryman does appear, but refuses to be sworn, or to give a verdict, an attachment may be issued against him.

Lists of jurors, according to the statutes of 4 and 5 W. and M. and 7 and 8 W. III. are now to be made from the rates of each parish, and fixed on the doors of churches, &c. twenty days before Michaelmas, that public notice may be given of persons omitted who are qualified, or of persons inserted who are not so; after which, the lists being settled by the justices of the peace at the quarter-sessions, duplicates are to be delivered to the sheriffs by the clerks of the peace; and the names contained in these lists must be entered alphabetically by the sheriffs in a book to be kept for that purpose, together with their additions and places of abode. The sheriffs are liable to be fined for returning other persons; and also if they return jurors that have served two years before. Sheriffs, on the return of writs of *venire facias*, are to annex a pannel of the names of a competent number of jurors, mentioned in the lists, and not less than forty-eight in any county, nor more than seventy-two, unless they are otherwise directed by the judges, which jurors shall be summoned to serve at the assizes, &c.

When it is conceived that an indifferent and impartial jury will not be returned by the sheriff, a special jury is allowed; in which case the court, upon a motion made, will order the sheriff to attend the secondary of the king's bench with his book of freeholders of the county, and the secondary is to mark a jury, in the presence of the attornies on both sides: also, if a cause of consequence is to be tried, the court of king's bench, on a motion upon an affidavit made, will make a rule for the secondary to name forty-eight freeholders, out of which each party is to strike out twelve, one at a time, the plaintiff's attorney beginning first, and the remainder of the jurors will be the jury for the trial: though the nomination of a special jury ought to be in the presence of the attornies on each side; yet in case either of them neglects, or refuses to attend, the secondary may proceed, and strike out twelve for the attorney that makes default. By 3 G. II. c. 25. on the motion of the prosecutor, plaintiff or defendant, on trials of issues on indictments, and in all actions whatsoever, the courts of Westminster are authorised to order a special jury to be struck in the same manner as upon trials at bar. Where a special jury is ordered by a rule of court, in any cause arising in a city, corporation, &c. this jury is to be taken out of the lists or books of the persons qualified, which are to be produced by the sheriffs, &c. before the proper officer. The same indulgence is granted both to merchants and foreigners; for where

where two merchants are plaintiff and defendant, the court may be moved for a jury of merchants to try the iſſue between them; and if either of the parties in the ſuit be an alien, the jury, at the deſire of the party, is to be compoſed of half foreigners and half Engliſh. See the articles PEERS and VERDICT.

JURY-MASTS, in the marine, certain ſpare maſts which are erected in a ſhip, when the others are carried away by the violence of a ſtorm, or otherwiſe.

JUST, a ſportive combat on horſeback, man againſt man, armed with lances.

JUSTICE, *Juſtitia*, in a moral ſenſe, is one of the four cardinal virtues, which gives every perſon his due.

JUSTICE, *Juſticiarius*, in a legal ſenſe, a perſon deputed by the king to adminiſter juſtice to his ſubjects, whoſe authority ariſes from his deputation, and not by right of magiſtracy.

JUSTICES *of the Peace* are perſons appointed by the king's commiſſion to keep the peace of the county in which they reſide; and ſome of theſe, who are of ſuperior rank or quality, are called juſtices of the quorum, and without the preſence or aſſent of theſe, or at leaſt one of them, no buſineſs of importance can be diſpatched.

JUSTICES *within Liberties*, are juſtices of the peace who have the ſame authority in cities or other corporate towns, as the others have in counties, and their power is the ſame, only theſe laſt have the aſſize of ale and beer, wood, and victuals, &c.

JUSTICE-SEAT is the higheſt foreſt court, always held before the lord chief juſtice in eyre of the foreſt; in which court fines are ſet for offences, and judgments given.

JUSTICIARY, or *Court of* JUSTICIARY, in Scotland, a court of ſupreme juriſdiction in all criminal caſes.

JUSTIFICATION, in law, ſignifies a maintaining, or ſhewing a ſufficient reaſon in court, why the defendant did what he is called to anſwer.

IVY, *hedera*, in botany, an evergreen plant, climbing and ſpreading on trees and old walls; with numerous ſlender twigs, and angular leaves. When grown old, the angles of the leaves diſappear, the plant becomes erect, produces flowers, ſmall and herbaceous, in autumn; and cluſters of black berries in winter.

The leaves of ivy have a very nauſeous taſte, and little or no ſmell. Haller ſays, they are commended in Germany againſt the atrophy of children. Among us, they are ſometimes applied externally by the common people, for drawing and healing running ſores, and keeping iſſues open.

The berries were ſuppoſed by the ancients to have a purgative and emetic quality; and later writers have recommended them, in ſmall doſes, as alexipharmic and ſudorific. It is ſaid, that in the London plague, the powder of them was given in vinegar or white wine with good ſucceſs. It is probable, however, that the virtue of this compound was rather owing to the vehicle than to the ivy-berries.

JYNX, the wry-neck, in ornithology, a genus of birds of the pye-kind, the beak of which is ſmooth, and the noſtrils hollowed: the tongue is very long, and of a rounded form, reſembling a worm: the toes are four in number, two before and two behind.

Of this genus there is only one known ſpecies, called, from its ſingular manner of twiſting its head about, the wry-neck. It is about the ſize of a lark, and is called by authors jynx, torquilla, turbo, &c.

K.

KAL — KAO

K, A double conſonant, and the tenth letter of the alphabet. It is borrowed from the Greek K, Kappa, which was made from the old Hebrew Caph, when reverted. It was but little uſed among the Latins; and Priſcian looked on it as ſuperfluous, and ſays it was never uſed except in words borrowed from the Greek; we ſeldom, it is true, meet with it in Latin authors, except in *kalendæ*.

This letter is formed in the voice by a guttural expreſſion of the breath through the mouth, together with a depreſſion of the lower jaw, and opening of the lips and teeth. It has much the ſame ſound as the hard ſound of C, and is generally uſed only before *i*, *e*, and *n*, in the beginning of words, where the hard ſound of *c* is formed, as in *kill*, *ken*, *knave*, &c.

K is alſo a numeral letter, denoting 250, according to this following verſe.

K quoque ducentos & quinquaginta tenebit.

When it had a ſtroke at top $\overline{K}$, it ſtood for 250,000.

KAABA, or CAABA. See CAABA.

KABBALA, or CABBALA. See CABBALA.

KÆMPFERIA, in botany, a genus of plants, the flower of which conſiſts of a ſingle petal, with a long ſlender tube, and the limb is divided into ſix ſegments: the fruit is a roundiſh and ſomewhat trigonal capſule, with three cells, each containing a conſiderable number of ſeeds.

The roots of this plant are the galangals of the ſhops. See GALANGALS.

KALI, glaſſwort, in botany, a plant with ſpreading, reddiſh, pretty thick branches; oblong, narrow, pointed, fleſhy leaves, like thoſe of the houſe-leeks; and imperfect flowers in the boſoms of the leaves, followed each by one ſeed ſpirally curled and incloſed in the cup. It is annual, and grows wild on the ſea-coaſts in the ſouthern parts of Europe, particularly of the Mediterranean.

This herb is very juicy, in taſte bitteriſh and remarkably ſaline. The expreſſed juice, and infuſions or decoctions of the leaves, are ſaid to be powerfully aperient and diuretic; and in this intention have by ſome been greatly recommended in hydropic caſes: half a dram of the juice is reckoned a ſufficient doſe. But the kali is principally regarded, on account of its yielding copiouſly, when burnt, the fixed alkaline ſalt called ſoda, or ſouda: an impure ſoda is prepared from it about Montpelier, where the plant is ſaid to be cultivated for this uſe in the ſalt marſhes; and a purer kind at Alicant in Spain, from a ſomewhat different ſpecies of kali. The ſalt called kelp, prepared among ourſelves from different marine plants, contains an alkali of the ſame kind, but more impure.

The ſoda is much milder in taſte than the common vegetable alkalies, and is in ſeveral other reſpects alſo very conſiderably different from them, being of the ſame nature with the mineral alkali or baſis of ſea-ſalt. It promiſes to be an uſeful article of the materia medica, and now begins to be introduced into practice in this country, as it has long been among the French.

Of the aſhes of kali is made ſope, glaſs, alkali-ſalt, potaſh, &c. See SOPE, GLASS, &c.

The method of preparing it is this: when dry, they burn it in certain pits, dug in the ground, which are cloſe covered up with earth, ſo that no air can come at the fire: by this means the matter is not only reduced to aſhes, but made into a very hard ſtone, like rock ſalt, which they are forced to break with hammers to get it out. The beſt ſort is in little dry ſtones, of a bluiſh grey colour, and full of little eyes or holes. See the article ALCALI.

KAOLIN, the name of one of the two ſubſtances, which are the ingredients of China-ware. The other, which is called petuntſe, is eaſily vitrifiable, and this kaolin is ſcarce at all ſo. Whence the fire compoſes, from a mixture of them both, a ſemivitrification, which is China-ware.

Mr. Reaumur had an opportunity of examining this ſubſtance, not in its native ſtate, but only in form of ſmall bricks, made out of a paſte of the powder of the native kaolin and water. He found it of a white colour, and ſprinkled all over with fine glittering particles; but theſe he did not judge to be fragments of a different ſubſtance mixed among the maſs, as are the ſmall flakes of talc in our clays and ſands; but that the whole maſs was compoſed of ſome ſtone reduced to powder and made into a paſte with water, and that theſe larger ſpangles were only coarſer particles of the powder; the examination of which he promiſed himſelf would diſcover what the ſtone was of which they were formed. And this was the more worthy a diligent enquiry, ſince the pentuntſe might eaſily be ſupplied by many of our own earths and ſands; nothing being required of that but a ſubſtance eaſily running into a white glaſs. But the difficulty of vitrifying this other ingredient renders it a thing much more difficult to be ſupplied by one of the ſame nature among ourſelves. The compariſon of theſe with other mineral ſubſtances ſoon proved that they were of the nature of talc; or, in other words, that kaolin was talc powdered, and made up into a paſte with water. And, to be aſſured whether the whole maſs was talc powdered, or any thing elſe with a mixture of talc, he ſeparated the particles of the kaolin by water, and found the ſmall ones wholly the ſame with the larger, and that the larger, when reduced to powder alone, made with water a paſte wholly the ſame with the kaolin.

It is well known that the fragments of talc have a great reſemblance to the pearly part of ſome ſhell-fiſhes; and hence unqueſtionably has ariſen the opinion of porcelain being made of ſea-ſhells; ignorant perſons having ſeen the talc or kaolin, and taken it for ſhelly matter. Talc has not yet been ſucceſsfully uſed in any of our European manufactures of porcelain; but it is eaſy to ſee, from many unanſwerable reaſons, that ſince China porcelain is made of a mixture of vitrifiable and an unvitrifiable matter, nothing is ſo likely to ſucceed with us, in the place of the laſt of theſe, as talc.

1. We know no ſubſtance in the foſſil world ſo difficult to reduce to glaſs as talc, which, if put into the ſtrongeſt

ſtrongeſt of our fires, in a crucible, is not to be vitrified, nor even calcined. 2. We know no ſubſtance which keeps ſo much brightneſs after having paſſed the fire as talc, or is of ſo pure a white; whence we may alſo learn that it is not to the petuntſe alone, that the China ware owes its whiteneſs, but that the kaolin is inſtrumental to the giving it that colour. 3. Talc is tranſparent, nay, and in ſome degree keeps its tranſparence after the action of the moſt violent fire. If we are to make porcelain of a vitrifiable and an unvitrifiable matter, mixed together, yet it is neceſſary that the unvitrifiable matter ſhould retain its tranſparence, otherwiſe it would obſcure the maſs; and talc is therefore the only known ſubſtance qualified for this purpoſe. Perſons who have been at the China works, ſay, that the porcelain is made of equal quantities of petuntſe and kaolin, and it is therefore a juſt and exact ſemi-vitrification. 4. Talc is well known to have a great flexibility and toughneſs, and, as it is found to preſerve this even after it has paſſed the fire, it is very probable, that it is owing to this property of the kaolin, that the China-ware is ſo much leſs brittle than glaſs. *Mem. Acad. Par.*

KEBLA, an appellation given by the Mahometans to that part of the world where the temple of Mecca is ſituated, towards which they are obliged to turn themſelves when they pray.

KECKLING, among ſailors, certain pieces of rope wound about the cable, to prevent it from being fretted or chafed by the ſhip's ſtem or bow.

KEDGE-ANCHOR, among ſailors, a ſmall anchor uſed in harbours and rivers, either to remove the ſhip from one place to another, by the help of certain tranſporting ropes, called warps, or to keep her ſteady as ſhe rides at anchor, eſpecially at the turn of the tide, when ſhe may come ſo nigh it as to entangle the flooks of it with her cable, if not kept from it by the kedge. See the article ANCHOR.

KEEL, in naval architecture, the principal piece of timber firſt laid upon the blocks, which ſupports the whole fabric of a ſhip in the ſame manner as the backbone ſuſtains the human body. When this cannot be had of a ſufficient depth in one piece, there is a ſtrong thick plank faſtened to the bottom, called the falſe-keel, which alſo ſerves to ſave the bottom of the main keel.

The keel of a ſhip of war is generally compoſed of four pieces bolted together lengthwiſe, and clinched. See the article SHIP-BUILDING.

The keels of the ſhips of war of the ancients were defended by pieces of wood nailed on the bilges, on either ſide, to prevent the keel from receiving damage when the ſhip was firſt launched into the water, or afterward ſtruck againſt any rock or ſand: theſe were called χελευσμάτα, in Latin *cunei*; according to Ovid,

Jamque labant cunei, ſpoliataque tegminæ ceræ
Rima patet.

The wedges break, and loſing all its wax,
A hole lets in the water.

KEEL is alſo a veſſel employed in divers parts of Northumberland to bring coals down the rivers to the ſhips into which they diſcharge them for tranſportation: theſe veſſels reſemble the coal barges on the river Thames, but are generally much ſtronger.

KEELSON, or KELSON, is the upper part of the keel, or that part of it which is within the ſhip. It is layed over the floor timbers, and bolted through them to the keel; this is alſo made like the keel of three or four pieces of timber ſcarfed together. See the article SHIP-BUILDING.

KEEPER *of the Foreſt*, an officer that has the chief management of every thing belonging to a royal foreſt, as well as the government of all the other officers. See FOREST.

KEEPER *of the Great Seal* is a lord by his office, is ſtiled lord-keeper of the great ſeal of Great Britain, and is always one of the privy council. All grants, charters and commiſſions of the king under the great ſeal, paſs through the hands of the lord-keeper, for without that ſeal, many of thoſe grants, &c. would be of no force; the king being, in the interpretation of the law, a corporation, and therefore paſſes nothing but by the great ſeal, which is alſo ſaid to be the public faith of the kingdom, being in the higheſt eſteem and reputation.

Whenever there is a lord-keeper, he is inveſted with the ſame place, authority, prehemmence, juriſdiction, or execution of laws, as the lord chancellor of Great Britain is veſted with.

KEEPER *of the Privy Seal* is alſo a lord by his office, through whoſe hands all grants, pardons, &c. paſs before they come to the great ſeal, and even ſome things paſs this officer's hands which do not paſs the great ſeal at all. This officer is likewiſe one of the privy-council, yet was anciently called clerk of the privy ſeal. His duty is to put the ſeal to no grant, &c. without a proper warrant, nor with warrant where it is againſt law, or inconvenient, but ſhall firſt acquaint the king therewith.

KELP, a fixed ſalt, or particular ſpecies of pot-aſh, procured by burning the weed kali. See the article KALI.

KERMES, round reddiſh-brown grains, about the ſize of peas; found in Spain, Italy, and the ſouthern parts of France, adhering to the branches of the ſcarlet oak. Theſe grains appear, when freſh, full of minute reddiſh ova or animalcules, of which they are the nidus, and which in long keeping change to a browniſh red powdery ſubſtance. They are cured by ſprinkling with vinegar before exſiccation: this prevents the exclution of the ova, and kills ſuch of the animals as are already hatched; which would otherwiſe become winged inſects, and leave the grain an empty huſk.

Freſh kermes yields upon expreſſion a red juice, of a light pleaſant ſmell, and a bitteriſh, ſubaſtringent, ſomewhat pungent taſte: this juice or ſyrup made from it, are brought from the ſouth of France, and ſometimes made uſe of as mild reſtringents and corroborants. An elegant cordial confection, for theſe intentions, is prepared in the ſhops, by diſſolving in the heat of a water bath, ſix ounces of fine ſugar in ſix ounces by meaſure of damaſk roſe water, then adding three pounds of the juice of kermes warmed and ſtrained, and after the whole has grown cold, mixing in half a ſcruple of oil of cinnamon: this confection is taken from a ſcruple to a dram or more; either by itſelf, or in juleps, with which it mingles uniformly without injuring their tranſparency. The dried grains, if they have not been too long kept, give out, both to water and to rectified ſpirit, the ſame deep red colour, and nearly the ſame kind of ſmell and taſte, with thoſe of the expreſſed juice.

KERMES-MINERAL.—The kermes mineral was a preparation of Glauber, which the king of France bought of Mr. de la Ligerie, and made public in 1720. That receipt was in the following form: take a pound of Hungarian antimony, broken into thin pieces, according to the direction of its ſpicula; four ounces of nitre, fixed by charcoal; and a pint of rain water: boil them two hours: then filtre the warm liquor, and, when it cools, the kermes precipitates. The ſame antimony undergoes the ſame operations with the remaining liquor, to which three ounces of fixed nitre, and a pint of water, are added. In a third boiling, two ounces of nitre, and a pint of water, are to be added to the former lixivium. The kermes thus obtained is about a drachm, which after being well edulcorated by waſhing it in water, and burning ſpirit of wine on it, is dried for uſe.

Mr. Geoffroy ſhews, by many experiments, that the kermes is the reguline part of the antimony, joined to a ſort of hepar ſulphuris. He teaches us a much eaſier way of preparing this medicine, thus: mix intimately the fine powder of two parts of antimony, and one of any fixed alkaline ſalt; melt thoſe materials in a crucible; then, having powdered them while hot, boil them two hours in a large quantity of water: after this, paſs the hot liquor through paper, receiving it into a veſſel, in which there is hot water; the kermes ſeparates, when it cools. The groſſer parts, which do not paſs through the paper, are to be boiled again, and filtrated again; and the operation is to be repeated a third time, by which ſix or ſeven drachms of kermes may be got out of every ounce of antimony. He ſays, he has ſeen effects, like to thoſe of mild kermes from antimony, reduced to ſuch a fine powder, that none of the ſhining ſpicula are to be ſeen; and

that the magiſtery of antimony, made by pouring ſpirit of nitre, or aqua regia, on the powder of antimony, and then edulcorating the maſs with water, has the ſame effects as kermes. *Mem. de la Acad. des Sciences.*

Half a grain, or a grain, of this powder, given every three or four hours, produces no violent effects; but, by increaſing the doſe, it may be made to vomit, purge, and ſweat. Some commend this medicine as the moſt univerſal reſolvent and deobſtruent; aſſuring us, that it almoſt infallibly cures pleuriſies, peripneumonies, aſthmas, catarrhs, anginæ, ſmall-pox, and many other diſeaſes. Others are as poſitive, that it heats and thickens the blood, thereby increaſing obſtructions, and is particularly hurtful in all inflammatory diſeaſes.

This preparation was famous in France, and known by the name of poudre des Chartereux, becauſe a Carthuſian monk, who got it from Mr. de la Ligerie, firſt brought it into vogue. See *Hiſt. de l' Acad. des Sciences* 1720, and the Memoirs for the ſame year, where it is ſaid that Glauber was looked upon as the firſt inventor of this remedy.

Its effect, like that of many other antimonial preparations, is very various, which is frequently owing, as Mr. Geoffroy obſerves, to the different manner and care of making it. He adds, that the more the kermes contains of a regulus eaſily revivified, the more it proves emetic. He alſo ſhews how to make a cinnabar with kermes and mercury, and to diſengage the vitriolic acid from the kermes. *See Mem. de l' Acad. des Sciences* 1734.

KERNING, among ſalt makers, the cryſtallizing of ſalt. See SALT.

KESTRIL, or KASTRIL, in ornithology, the yellow legged falcon, with a brown back, a ſpotted breaſt, and a rounded tail, with a broad black faſcia towards the end. It is a very beautiful bird, about the ſize of a pigeon, and very bold. It is known, among authors, by the names of tinnunculus and cenchris; and is alſo called in Engliſh, the ſtannel or windhover.

KETCH, in the marine, a veſſel with two maſts, viz. a main and mizen maſt.

The principal uſe of this ſort of ſhips is to bombard a place, being properly furniſhed with mortars, bombs, carcaſes, &c. for this employment, and built remarkably ſtrong to encounter the ſhock of firing ſhells for a continuance.

KETTLE-DRUMS, in the art of war. See the article DRUM.

KEVELS, in ſhip-building, a ſort of frame compoſed of two pieces of wood thruſt into a third, which is bolted to the inſide of the ſhip: the uſe of which is to faſten ſome rope to, but more particularly the main and fore ſheets. See the article SHEET.

KEY, *Clavis*, a well known inſtrument for opening and ſhutting the locks of doors, cheſts, bureaus, and the like. See LOCK.

The names of the ſeveral parts of a key are theſe: A (plate LXXVII. *fig.*5.) is the pin-hole, drilled into the end of the ſhank H; B is the ſtep, or dap-ward; C, the hook-ward; D, the middle-ward; E E, the croſs-ward; F, the main-ward; G G, croſs-ward; I, the pot; K, the bow-ward; L, the bow, or handle; and B F E D, &c. the piece of ſteel, containing the wards, is called the bit of the key. Keys are prohibited to be imported.

KEY, in muſic, a certain fundamental note, or tone, to which the whole piece, be it in concerto, ſonata, cantata, &c. is accommodated, and with which it uſually begins, but always ends. See CLEF.

To give a diſtinct notion of the key, we muſt obſerve, that the octave contains in it the whole principles of muſic, both with reſpect to conſonance and melody; and that if the ſcale be continued to a double octave, there will in that caſe be ſeven different orders of the degrees of an octave, proceeding from the ſeven different letters, with which the terms of the ſcale are marked. Any given ſound therefore, i. e. a ſound of any determinate pitch of tune, may be made the key of the piece, by applying it to the ſeven natural notes ariſing from the diviſion of an octave, and repeating the octave above and below at pleaſure: the given note is applied as the principal note or key to the piece, by making frequent cloſes or cadences upon it; and in the progreſs of the melody, no other than theſe ſeven natural ſounds can be admitted, while the piece continues in that key.

Here too it muſt be added with reſpect to the two different diviſions of the octave, that a ſound may belong to the ſame key, that is, have a juſt muſical relation to the ſame fundamental in the one kind of diviſion, and be out of the key in reſpect of the other. Now a piece of muſic may be carried through ſeveral keys, that is, it may begin in one key, and be led out of that into another, by introducing ſome ſound foreign to the firſt, and ſo on to another: but a regular piece of muſic muſt not only return to the firſt key, but thoſe keys too muſt have a particular connection with the firſt. It may be added, that thoſe other keys muſt be ſome of the natural ſounds of the principal key, though not any of them at pleaſure.

From the diſtinctions already obſerved, it is evident, that there are but two different ſpecies of keys, which ariſe according as we join the greater or leſſer third, theſe being always accompanied with the ſixth and ſeventh of the ſame ſpecies; the third greater, for inſtance, with the ſixth and ſeventh greater, and the third leſſer with the ſixth and ſeventh leſſer.

And this diſtinction is expreſſed under the name of a ſharp key, which is that with the third greater, &c. and the flat key with the third leſſer, &c. whence it is plain, that how many different caſes ſoever there be in a piece, there can be but two keys, if we conſider the eſſential difference of keys: every key being either flat or ſharp, and every ſharp key being the ſame as to melody, as well as a flat one.

KEY is alſo uſed for an index, or explanation of a cipher. See CIPHER.

KEYS likewiſe denote thoſe little pieces in the forepart of an organ, ſpinnet, or harpſicord, whereby the jacks are played, ſo as to ſtrike the ſtrings of the inſtrument, and wind is given to the pipes by raiſing and ſinking the ſucker of the ſound-board.

KEY-STONE *of an Arch, or Vault*, that placed at the top or vertex of an arch, to bind the two ſweeps together.

KIDNIES, *Renes*, in anatomy, two pretty ſolid, glandular bodies, ſituated in the poſterior part of the cavity of the abdomen, on each ſide of the lumbar vertebræ, between the laſt falſe ribs and oſſa ilium.

The right kidney lies under the great lobe of the liver, and is conſequently lower than the left, which lies under the ſpleen. The figure of the kidney reſembles that of a large bean; being convex on one ſide, and concave on the other; the concave ſide is turned to the vertebræ, and the convex the oppoſite way. Their length anſwers to the diſtance between the laſt falſe rib and os ilium; they are about half as broad as long, and half as thick as broad.

The deſcending aorta and inferior vena cava lie between the kidnies, pretty cloſe to the bodies of the vertebræ and to each other; the artery being on the left hand, and the vein on the right. Each of theſe large veſſels ſends out, tranſverſely, towards each ſide, commonly one capital branch, which enters the ſinus and depreſſion of the kidney by ſeveral ramifications. Theſe veſſels were by the ancients called emulgent arteries and veins, but are rather renal veins and arteries. There are more than one of each kind, particularly in the arteries; ſometimes on one ſide only, and ſometimes on both.

The left renal artery is ſhorter than the right, becauſe the aorta lies neareſt the left kidney; and the left renal vein is longer than the right, becauſe the vena cava lies fartheſt from the left kidney. The veins lie more anteriorly than the arteries.

Each renal artery is ſurrounded by a nervous net work called plexus renalis, furniſhing a great number of filaments to the kidnies, that come partly from the ſemilunar ganglions of two great ſympathetic nerves, and partly from the plexus hepaticus and ſplenicus. This renal plexus alſo ſends filaments round the renal veins.

The kidnies are ſurrounded by a very looſe, membranous, and cellular covering called membrana adipoſa, which is not a duplicature of the peritonæum, the true membranous lamina of which covers only the foreſide of the kidnies. The only coat they have is the cellular ſubſtance,

ſubſtance, which likewiſe inveſts the renal arteries and veins like a vagina.

The proper membrane of the kidnies conſiſts of two laminæ, between which there is alſo a very fine cellular ſubſtance, as appears upon blowing.

The external lamina is very thin, adhering cloſely to the internal by means of the cellular ſubſtance. The internal lamina penetrates every where into the ſubſtance of the kidney.

In children the convex ſurface is divided into ſeveral lobes, almoſt as in oxen and calves; and in grown perſons we ſometimes obſerve the ſame inequalities.

The blood-veſſels entering the kidnies are ramified every way; and theſe ramifications ſend out the capillary branches all the way to the ſurface thereof: ſometimes theſe two ramifications penetrate to the membrana adipoſa, communicating there with the adipoſe veins and arteries.

The proper membrane having ſurrounded the kidney all the way to the ſinus, joins the veſſels there, and accompanies all their ramifications through the body of the kidney, like a capſula, and contributes in part to form the pelvis and calices or infundibula.

Sometimes, but rarely, a conſiderable veſſel goes in or comes out from the convex ſurface of the kidney, and then there is a depreſſion by which the proper membrane enters, and communicates with that portion which goes in by the ſinus.

The tunica adipoſa terminates at the ſinus in the interſtices between the ramifications.

There are three kinds of ſubſtances in the kidney, that may be ſeen when it is cut through the great curvature: 1. An exterior, which is thick, granulated, and in a manner cortical. 2. A middle ſubſtance, which is medullary and radiated, called ſtriata, ſulcata, or tubularis; and 3. An inner ſubſtance, which is only a continuation of the ſecond, and terminates on the inſide by papillæ; and for that reaſon is called papillaris.

By the microſcope the cortical ſubſtance is obſerved to be of a ſpongy, granulated, and waving texture, of a bright whitiſh grey-colour; and likewiſe great numbers of ſmall red corpuſcles, more or leſs round, are to be ſeen, and diſpoſed almoſt like bunches of currants.

The other two ſubſtances are but one and the ſame maſs, of a more reddiſh colour; the convex ſide of which riſes into narrow tubercles, lodged in the ſame number of cavities. The radiated ſtriæ are afterwards continued to the papillary portion, and the papillæ form ſo many centers of theſe radii, oppoſite to the tubercles. The medullary ſubſtance has arterial and venal arches that ſend capillaries on all hands, and its colour is more or leſs red.

The papillæ are often a little paler than the medullary ſubſtance. They are ten or twelve in number, reſembling the ſame number of cones, with very broad baſes and obtuſe apices. At the point of each papilla may be ſeen ſeveral very ſmall holes, through which little drops run, when the papillæ are compreſſed; being little drops of urine that are filtered and diſcharged at theſe orifices.

Each papilla lies in a kind of calyx or infundibulum, which opens into a common cavity, called the pelvis. This cavity in men is not uniform, but diſtinguiſhed into three portions, each of which contains a certain number of infundibula, together with the papillæ that lie therein.

At the place where theſe infundibula ſurround the baſes of the papillæ, they ſend productions into the medullary ſubſtance of the kidney, which accompany the blood-veſſels, and ſerve for vaginæ to all the vaſcular arches, and their different ramifications, quite as far as the ſurface of the kidney.

KILDERKIN, a liquid meaſure, containing two firkins. See FIRKIN.

KINDRED, in law, perſons related to another, whereof the law of England reckons three degrees or lines, viz. the deſcending, aſcending, and collateral line.

On there being no kindred in the deſcending line, the inheritance paſſes to the collateral one. See INHERITANCE.

KING, in the general acceptation of the word, is a perſon who has a ſupreme authority, with the power of levying taxes, making laws, and enforcing an obedience to them: but in England, which is a limited monarchy, the power of the king is greatly reſtrained; which is ſo far from diminiſhing his honour, that it adds a glory to his crown; for while other kings are abſolute monarchs over innumerable multitudes of ſlaves, the king of England has the diſtinguiſhed glory of governing a free people, the leaſt of whom is protected by the laws: he has great prerogatives, and a boundleſs power in doing good; and is at the ſame time only reſtrained from acting inconſiſtently with his own happineſs, and that of his people. He has all the enſigns of royalty, and all the marks of ſovereignty: but while he has the power of making treaties, of ſending and receiving ambaſſadors, of conferring titles of honour, creating privy counſellors, officers of ſtate, and judges, and may raiſe men and arms both for ſea and land, he cannot force his ſubjects to maintain them, or raiſe one tax by his ſole authority: he has the privilege of coining money, but he cannot force the meaneſt ſubject to part with his property; he can pardon a criminal, but he cannot put a ſubject to death, till he is condemned by his peers: he may at his pleaſure call, continue, prorogue, and diſſolve parliaments, and without his royal aſſent no bill in parliament can paſs into a law; yet he can neither act contrary to law, nor make new laws by his ſole authority; on the contrary, he may even be ſued and caſt in his own courts.

KING'S-BENCH, in law, a court held in Weſtminſter-Hall, ſo called, in regard the king is ſuppoſed to ſit in perſon as judge of the court, and may do ſo whenever he pleaſes; wherefore all writs, &c. in this court are made returnable *coram nobis*, and not *coram juſticiariis noſtris*, as in the Common-Pleas.

The judges are the lord chief juſtice, and three other puny juſtices. Here are principally determined matters relating to the crown and the peace. When any are aggrieved by an order of juſtices or quarter ſeſſions, they have recourſe hither: the rights of election of mayors, bailiffs, conſtables, &c. are, upon mandamus's, ſettled here, and prohibitions iſſued to ſtay proceedings in the eccleſiaſtical, admiralty, or other inferior court. Here any debt or contract may be ſued for, as well as in any other court, and may as expeditiouſly proceed.

Books of KINGS, two canonical books of the Old Teſtament, ſo called becauſe they contain the hiſtory of the kings of Iſrael and Judah, from the beginning of the reign of Solomon, down to the Babyloniſh captivity, for the ſpace of near ſix hundred years. The firſt book of Kings contains the latter part of the life of David, and his death; the flouriſhing ſtate of the Iſraelites under Solomon, his building and dedicating the temple of Jeruſalem, his ſhameful defection from the true religion, and the ſudden decay of the Jewiſh nation after his death, when it was divided into two kingdoms: the reſt of the book is taken up in relating the acts of four kings of Judah, and eight of Iſrael.

The ſecond book, which is a continuation of the ſame hiſtory, is a relation of the memorable acts of ſixteen kings of Judah, and twelve of Iſrael, and the end of both kingdoms, by the carrying of the ten tribes captive into Aſſyria by Salmanaſer, and the other two into Babylon by Nebuchadnezzar.

It is probable that theſe books were compoſed by Ezra, who extracted them out of the public records which were kept of what paſſed in that nation.

KING'S-FISHER, *Iſpida*, in ornithology. See the article ISPIDA.

KINK, a ſort of twiſt or turn in the cable, owing to its being very ſtiff, or not well cleared at the time of its running out of the ſhip when the anchor is let fall from the bow.

KIRK, a Saxon term, ſignifying the ſame with church. See the article CHURCH.

KIRK-SESSIONS, an inferior church-judicatory, in Scotland, conſiſting of the miniſters, elders, and deacons of a pariſh.

KITCHEN GARDEN, a piece of ground laid out for the cultivation of fruit, herbs, pulſe, and other vegetables uſed in the kitchen.

A kitchen garden ought to be ſituated on one ſide of the

houſe, near the ſtables, from whence the dung may be eaſily conveyed into it; and after having built the wall, borders ſhould be made under them, which according to Miller, ought to be eight or ten feet broad: upon thoſe borders expoſed to the ſouth, many ſorts of early plants may be ſown; and upon thoſe expoſed to the north, you may have ſome late crops, taking care not to plant any ſort of deep-rooting plants, eſpecially beans and peas, too near the fruit-trees. You ſhould next proceed to divide the ground into quarters; the beſt figures for theſe is a ſquare, or an oblong, if the ground will admit of it; otherwiſe they may be of that ſhape which will be moſt advantageous to the ground; the ſize of theſe quarters ſhould be proportioned to that of the garden; if they are too ſmall, your ground will be loſt in walks, and the quarters being encloſed by eſpaliers of fruit-trees, the plants will draw up ſlender, for want of a more open expoſure. The walks ſhould alſo be proportioned to the ſize of the ground; theſe in a ſmall garden ſhonld be ſix feet broad, but in a larger one ten; and on each ſide of the walk there ſhould be allowed a border three or four feet wide, between it and the eſpalier, and in theſe borders may be ſown ſome ſmall ſallads, or any other herbs that do not take deep root, or continue long: but theſe quarters ſhould not be ſown or planted with the ſame crop two years together. In one of theſe quarters, ſituated neareſt to the ſtables, and beſt defended from the cold winds, ſhould be the hot-beds, for early cucumbers, melons, &c. and to theſe there ſhould be a paſſage from the ſtables, and a gate through which a ſmall cart may enter. The moſt important points of general culture conſiſt in well digging and manuring the ſoil, giving a proper diſtance to each plant, according to their different growths, as alſo in keeping them clear from weeds; for this purpoſe you ſhould always obſerve to keep your dung-hills clear from them; if this is not done, their ſeeds will be conſtantly brought in, and ſpread with the dung.

KITE, *Milvus*. See MILVUS.

KNAVE, in old law books, an appellation given to a man ſervant, or even to a male child.

KNEE, *Genu*, in anatomy, the articulation of the thigh and leg-bones. See the articles FEMUR, TIBIA, PATELLA, &c.

The two principal motions of this joint are flexion and extenſion: in the former of theſe the leg may be brought to a very acute angle with the thigh, by the condyles of the thigh bone being round and ſmoothed ſo far backwards; and in performing this, the patella is pulled down by the tibia. When the leg is to be extended, the patella is drawn upwards, and the tibia forwards, by the extenſor-muſcles, which, by means of the protuberant joint, and this thick bone with its ligament, have the chord with which they act, at a conſiderable angle, and therefore act with advantage; but, in order that the body may be ſupported by a firm perpendicular column, they are reſtrained by the poſterior croſs-ligament, from pulling the leg farther than to a ſtraight line with the thigh; and when this is done, the thigh and leg are almoſt as immoveable as if they were one continued bone: but when the joint is a little bent, the poſterior ligament is relaxed, and the patella not tightly braced; therefore the ſuperficial cavities of the tibia will allow this bone to be moved a little to either ſide, or with a ſmall rotation; which is done by the motion of the external cavity backwards and forwards on the internal, which ſerves as a kind of axis. The rotation of the leg outwards is of great advantage to us in croſſing our legs on ſeveral neceſſary occaſions; though it is wiſely ordered by Providence, that this motion ſhould not be very great, ſince this would have occaſioned frequent luxations. While all theſe motions are performing, the only part of the tibia that moves immediately on the condyles, is only ſo much as is within the cartilaginous rings, which by the thickneſs of their outſides, make the cavities of the tibia more horizontal, by raiſing their external ſide, where the ſurface of the tibia ſlants downwards; by which means the motions of this joint are more equal and ſteady than they would otherwiſe have been. The cartilages are fitted to do this good office in the different motions and poſtures of the member, by being capable of changing a little their ſituation; and this alſo contributes to make the motions larger and quicker.

KNEE *of the Head*, in ſhip-building, a large piece of timber fayed and bolted to the ſtem, on which the figure or image of the head reſts: by reaſon of its great breadth at the upper part, it is compoſed of ſeveral pieces: it is let into the head, and faſtened to the ſhips bows on each ſide by knees, which are called the cheeks of the head: it is alſo ſcarfed to the head of the fore-foot, and faſtened to the ſtem by a knee, called a ſtandard, in the form of a K. This is commonly called cut-water by ſeamen. See the article CUT-WATER.

KNEES, in ſhip-building, certain crooked pieces of timber, one leg or arm of which is bolted to the beams, and the other to the ſhip's ſide. They are either lodging or hanging: the hanging knees are fayed up and down; and the others fore and aft on the inſide of the ſhip, reſting upon clamps.

KNIGHT, *Eques*, among the Romans, a perſon of the ſecond degree of nobility, following immediately that of the ſenators.

KNIGHT, a perſon who, on account of ſome martial feat, or notable action, is by the king raiſed to a rank above a gentleman.

The original High Dutch word *knecht*, ſignifies a ſervant, as we find it ſtill meant by knight of the ſhire; and afterwards it denoted a military man, or horſeman, as being uſually employed on horſeback. In our common law, they are called *milites*, as commonly holding lands in knight-ſervice to ſerve the king in his wars.

Knights were originally ſaid to be adopted, now we call it dubbed, as being ſuppoſed, in ſome meaſure, the ſons of him who knighted them.

The principal ceremonies at the creation of a knight, were a box on the ear, a ſtroke with a ſword on the ſhoulder, putting on a ſhoulder-belt, gilt ſword, ſpurs, &c. after which, being properly armed, he was ſolemnly led to the church.

Camden deſcribes the manner of making knights batchelors, which is the loweſt, though the moſt ancient order of knighthood in England; the perſon kneeling was gently ſtruck on the ſhoulder, and accoſted by the prince in theſe words, "Riſe, and be a knight in "the name of God." See the articles BATCHELOR, BANNERET, BARONET, BATH, GARTER, &c.

KNIGHT alſo denotes a perſon admitted into any order, with certain marks of diſtinction, as the knights of the garter, of the elephant, of the thiſtle; of the Holy Ghoſt, Malta, &c.

KNIGHTS-ERRANT, a pretended order of chivalry, much talked of in old romances, being a kind of heroes that travelled the world in ſeach of adventures, redreſſing wrongs, reſcuing damſels, and taking all occaſions of ſignalizing their proweſs. Of this kind of knights was Don Quixote, the hero of a celebrated romance, known by that name. This romantic bravery of the old knights was heretofore the chimera of the Spaniards.

KNIGHTS *of the Shire*, or KNIGHTS *of Parliament*, in the Britiſh polity, are two knights or gentlemen of eſtate, who are elected, on the king's writ, by the freeholders of every county, to repreſent them in parliament.

The qualifications of a knight of the ſhire, is to be poſſeſſed of 600 l. per ann. in a freehold eſtate. Their expences during their ſitting, were, by a ſtatute of Henry VIII. to be defrayed by the county; but this is now ſcarce ever required.

KNIGHT-MARSHAL, an officer in the king's houſehold, who has juriſdiction and cognizance of any tranſgreſſion within the king's houſhould and verge; as alſo of contracts made there, whereof one of the houſe is party.

KNIGHT-HEADS, in ſhip-building, two ſtrong pieces of timber placed on each ſide of the deck of a merchant-ſhip. They are uſed to ſupport the windlaſs, or roller, by which the cable is wound into the ſhip; and as each of them is formed of two pieces, they can be occaſionally taken down and ſeparated, to remove the cable from off the windlaſs, which reſts upon, and turns round in the knight-heads: they are otherwiſe called bits, and in this ſenſe the upper-part only is called the knight-head.

KNOTTING, among ſailors, untwiſting the ends of a rope, and interweaving them curiouſly amongſt each other, ſo as to form knots of various ſhapes; among which

which they number the diamond-knot, the wall-knot, or walnut, the roſe-knot, bowline-knot, double diamond-knot, &c.

KNOWLEDGE, according to Mr. Locke, conſiſts in the perception of the connection and agreement, or diſagreement and repugnancy of our ideas: and ſo it ſtands contradiſtinguiſhed from ignorance.

The whole ſtock of our knowledge conſiſts of four heads, namely, identity or diverſity, relation, co-exiſtence, and real exiſtence.

As to the identity or diverſity of our ideas, it is the firſt act of the mind to perceive its own ideas, and, ſo far as it perceives them, to know what each is, and thereby find out their difference.

The next kind of agreement or diſagreement in our ideas is co-exiſtence or non-co-exiſtence in the ſame ſubject, and this belongs particularly to ſubſtances.

The fourth ſort is that of actual exiſtence, agreeing to any idea. The mind becomes poſſeſſed of truth ſeveral ways, which conſtitute ſo many different ſpecies of knowledge. Thus, when the mind has a preſent view of the agreement or diſagreement of any of its ideas, or relation they bear to one another, this is called actual knowledge.

Secondly, a man is ſaid to know a propoſition, when having once evidently perceived the agreement or diſagreement of the ideas of which it conſiſts, and ſo lodged it in his memory, the mind aſſents to it without any heſitation, whenever it comes to be reflected on again; and this may be called habitual knowledge. Of this there are two ſorts; the one conſiſts of ſuch truths laid up in the memory, as, whenever they occur to the mind, it actually perceives their relation by an immediate view: the other is of ſuch truths of which the mind having been convinced, it retains the memory of the conviction, without the proofs.

Degrees and Extent of KNOWLEDGE. The clearneſs of our knowlege ſeems to lie in the different ways the mind has of perceiving the agreement or diſagreement of its ideas. When the mind perceives it immediately, it is intuitive knowledge. On this intuition depends all the certainty and evidence of our other knowledge.

The next degree of knowledge is by the intervention of other ideas, to diſcover the agreement or diſagreement. Thoſe intervening ideas are called proofs, and, where the agreement and diſagreement is plainly perceived, it is called demonſtration; and a quickneſs in the mind to find theſe proofs is called ſagacity.

This knowledge, though it be certain, is not ſo evident as intuitive knowledge. Before demonſtration there was a doubt, which in intuitive knowledge cannot happen to the mind. Now in every ſtep that reaſon makes in demonſtrative knowledge, there is an intuitive knowledge of that agreement or diſagreement it ſeeks with the next intermediate idea, which it uſes as a proof. This intuitive perception of the agreement or diſagreement of the intermediate ideas in each ſtep muſt alſo be exactly carried in the mind.

It has been generally taken for granted, that mathematics alone are capable of demonſtration; but to have ſuch an agreement or diſagreement as may be intuitively perceived, being not the privilege of the ideas of number, extenſion, figure, and modes alone, it may poſſibly be the want of due method and application in us, and not of ſufficient evidence in things, that demonſtration has been thought to have ſo little to do in other parts of knowledge. The reaſon why it has been generally ſuppoſed to belong to theſe only, is, becauſe, in comparing the equality or exceſs, the modes of numbers have every the leaſt difference clearly perceivable: and in extenſion, though every the leaſt exceſs is not ſo perceivable, yet the mind has found out ways to diſcover the juſt equality of two angles, &c. Add to this, that both numbers and figures can be ſet down by viſible marks. But in other ſimple ideas, whoſe modes and differences are counted by degrees, and not quantity, we have not ſo accurate a diſtinction of their differences, as to perceive their juſt equality or leaſt differences.

Thus not knowing what number of particles nor what motion of them is fit to produce any preciſe degree of whiteneſs, becauſe we have no certain ſtandard to meaſure them by, nor means to diſtinguiſh every the leaſt difference, the only help we have is from our ſenſes, which here fail us. But where the difference is ſo great, as to produce ideas clearly diſtinct, theſe ideas, as we ſee in colours of different kinds, are as capable of demonſtration, as ideas of number and extenſion. And this holds in all ſecondary qualities.

Whatever comes ſhort of intuition and demonſtration, is but faith or opinion, not knowledge, at leaſt in all general truths. As we are invincibly conſcious to ourſelves of a different perception, when we look on the ſun in the day, and think on it by night, we may add to the two former ſorts of knowledge this alſo of the exiſtence of particular external objects by that conſciouſneſs we have of the actual entrance of ideas from them; ſo that there is a third degree of knowledge, which may be called ſenſitive.

But ſince our knowledge is founded on our ideas only, will it follow, that it muſt be conformable to our ideas? We anſwer no; for our knowledge conſiſting in the perception of the agreement or diſagreement of any two ideas, clearneſs or obſcurity conſiſts in the clearneſs or obſcurity of that perception, and not in the clearneſs or obſcurity of the ideas themſelves: but obſcure and confuſed ideas can never produce any clear or diſtinct knowledge; becauſe, as far as they are ſo, the mind can never perceive whether they agree or diſagree.

Extent and Limits of Human KNOWLEDGE. 1. It is evident that we can have no knowledge farther than we have perception of the agreement or diſagreement of our ideas, whether by intuition, demonſtration, or ſenſation. 2. We cannot have an intuitive knowledge that ſhall extend itſelf to all our ideas and all that we know about them, becauſe we cannot examine and perceive all the relations they have to each other; thus we cannot intuitively perceive the equality of two extenſions, the difference of whoſe figures makes their parts incapable of an exact immediate application. 3. Demonſtrative knowledge cannot reach to the whole extent of our ideas, becauſe we cannot always find ſuch proofs as will connect them together, with an intuitive knowledge in all the parts of the deduction. Thus, though we have the ideas of a ſquare, a circle, and equality, yet we, perhaps, ſhall never be able to find a ſquare exactly to a circle. The affirmations, or negations we make concerning the ideas we have, being reduced by Mr. Locke to theſe four, viz. identity, co-exiſtence, relation, and real exiſtence, he examines how far our knowledge extends to each of theſe.

1. As to identity and diverſity, our intuitive knowledge is ſo far extended as our ideas themſelves, and there can be no idea in the mind which it does not preſently, by an intuitive knowledge, perceive to be what it is, and to be different from any other.

2. As to the agreement or diſagreement of our ideas of co-exiſtence, our knowledge herein is very defective, though the greateſt and moſt material part of our knowledge concerning ſubſtances conſiſts in it.

As to the powers of ſubſtances, which makes a great part of our enquiries about them, our knowledge reaches little further than experience, becauſe they conſiſt in a texture and motion of parts which we cannot by any means come to diſcover.

3. As to the third ſort, the agreement or diſagreement of our ideas in any other relation; this is the largeſt field of knowledge, and it is hard to determine how far it may extend. This part depending on our ſagacity in finding intermediate ideas, that may ſhew the habitudes and relations of ideas, it is difficult to tell when we are at an end in ſuch diſcoveries.

4. As to the fourth part of knowledge, viz. of the real actual exiſtence of things, we have an intuitive knowledge of our own exiſtence, a demonſtrative knowledge of the exiſtence of God, and a ſenſitive knowledge of the objects that preſent themſelves to our ſenſes. See the article EXISTENCE.

Reality of Human KNOWLEDGE. It is evident, ſays Mr. Locke, that the mind knows not things immediately, but by the intervention of the ideas it has of them. Our knowledge therefore is real only ſo far as there is a conformity between our ideas and the reality of things.

But how ſhall we know when our ideas agree with things themſelves? It is anſwered, there are two ſorts of ideas that we may be aſſured agree with things: theſe are,

1. Simple ideas; which, ſince the mind can by no means make to itſelf, muſt be the effect of things operating upon the mind in a natural way, and producing therein thoſe perceptions which, by the will of our Maker, they are ordained and adapted to. Hence it follows, that ſimple ideas are not fictions of our fancies, but the natural and regular productions of things without us really operating upon us, which carry with them all the conformity our ſtate requires, which is to repreſent things under thoſe appearances they are fitted to produce in us. Thus the idea of whiteneſs, as it is in the mind, exactly anſwers to that power which is in any body to produce it there. And this conformity between our ſimple ideas and the exiſtence of things, is ſufficient for real knowledge. See IDEA.

2. All our complex ideas, except only thoſe of ſubſtances, being archetypes of the mind's own making, and not referred to the exiſtence of things as to their originals, cannot want any conformity neceſſary to real knowledge.

3. But the complex ideas which we refer to archetypes without us, may differ from them, and ſo our knowledge about them may come ſhort of being real, and ſuch are our ideas of ſubſtances. Theſe muſt be taken from ſomething that does or has exiſted, and not be made up of ideas arbitrarily put together, without any real pattern. Herein, therefore, is founded the reality of our knowledge concerning ſubſtances, that all our complex ideas of them muſt be ſuch, and ſuch only, as are made up of ſingle ones, as have been diſcovered to co exiſt in nature; and our ideas being thus true, though not perhaps very exact copies, are the ſubjects of real knowledge of them. Whatever ideas we have, the agreement we find they have with others, will be knowledge: if thoſe ideas be abſtract, it will be general knowledge; but to make it real concerning ſubſtances, it muſt be taken from the real exiſtence of things: wherever therefore, we perceive the agreement or diſagreement of our ideas, there is certain knowledge, and wherever we are ſure theſe ideas agree with the reality of things, there is certain real knowledge.

Improvement of Human KNOWLEDGE. The ſentiments of the ſame author upon the improvements of our knowledge are as follow: It being the received opinion among men of letters, that maxims are the foundations of all knowledge, and that ſciences are each of them built upon certain præcognita, from whence the underſtanding was to take its riſe, and by which it was to conduct itſelf in its enquiries in the matters belonging to that ſcience, the beaten road of the ſchools was to lay down, in the beginning, one or more general propoſitions called principles or foundations, whereon to build the knowledge that was to be had of that ſubject.

That which gave occaſion to this way of proceeding, he ſuppoſes to have been the good ſucceſs it ſeemed to have in the mathematics, which of all other ſciences have the greateſt clearneſs, certainty, and evidence in them; but if we conſider it, we ſhall find that the great advancement and certainty of real knowledge men arrive at, in theſe ſciences, was not owing to the influence of theſe principles, but to the clear, diſtinct, and complete ideas their thoughts were employed about, and the relation of equality and exceſs ſo clear between ſome of them, that they had an intuitive knowledge, and by that way to diſcover it in others, and this without the help of thoſe maxims. See AXIOM.

The way to improve in knowledge, is not to ſwallow principles with an implicit faith, and without examination, which would be apt to miſlead men, inſtead of guiding them into truth; but to get and fix in our minds clear and complete ideas, as far as they are to be had, and annex to them proper and conſtant names, and thus barely by conſidering our ideas, and comparing them together, and obſerving their agreement or diſagreement, their habitudes and relations, we ſhall get more true and clear knowledge by the conduct of this one rule, than by taking up principles, and thereby putting the mind into the diſpoſal of others.

We muſt therefore, if we proceed as reaſon adviſes, adapt our methods of enquiry to the nature of the ideas we examine, and the truth we ſearch after. General and certain truths are only founded in the habitudes and relations of abſtract ideas; therefore a ſagacious methodical application of our thoughts, for the finding out theſe relations, is the only way to diſcover all that can with truth and certainty be put into general propoſitions. By what ſteps we are to proceed in theſe, is to be learned in the ſchools of the mathematicians, who from very plain and eaſy beginnings, by gentle degrees, and a continued chain of reaſonings, proceed to the diſcovery and demonſtration of truths, that appear at firſt ſight above human capacity. This may reaſonably be ſaid, that if other ideas, that are real as well as nominal eſſences of their ſpecies, were purſued in the way familiar to mathematicians, they would carry our thoughts farther, and with greater evidence and clearneſs, than probably we are apt to imagine.

In our knowledge of ſubſtances, we are to proceed in quite a different method; the bare contemplation of their abſtract ideas, which are but nominal eſſences, will carry us but a very little way in the ſearch of truth and certainty: here experience muſt teach us what reaſon cannot; and it is by trying alone that we can certainly know what other qualities co-exiſt with thoſe of our complex idea; for inſtance, whether that yellow, heavy, fuſible body we call gold, be malleable or not, which experience, however it prove in that particular body we examine, makes us not certain that it is ſo in all or any other yellow, heavy, fuſible bodies, but that which we have tried; becauſe it is no conſequence, one way or other, from our complex idea. As far as our experience reaches, we may have certain knowledge, and no farther. It is not denied, but that a man, accuſtomed to rational and regular experiments, ſhall be able to ſee farther into the nature of bodies, and their unknown properties, than one that is a ſtranger to them; but this is only judgment and opinion, not knowledge and certainty. This makes our author ſuſpect that natural philoſophy is not capable of being made a ſcience from experiments and hiſtorical obſervations: we may draw advantages of eaſe and health, and thereby increaſe our ſtock of conveniencies for this life; but beyond this, he fears, our talents do not reach, and gueſſes that our faculties are not able to advance farther. See EXPERIMENTAL PHILOSOPHY.

The ways to enlarge our knowledge, as far as we are capable, ſeem to be theſe two: the firſt is, to get and ſettle in our minds, as far as we can, clear, diſtinct, and conſtant ideas of thoſe things we would conſider and know: for it being evident, that our knowledge cannot exceed our ideas; where they are either imperfect, confuſed, or obſcure, we cannot expect to have certain, perfect, or clear knowledge. The other is the act of finding out the intermediate ideas, which may ſhew us the agreement, or diſagreement, or repugnancy, of other ideas, which cannot be immediately compared. That theſe two, and not the relying on maxims, and drawing conſequences from ſome general propoſitions, are the right method of improving our knowledge in the ideas of other modes, beſides thoſe of quantity, the conſideration of mathematical knowledge will eaſily inform us; where we ſhall find, that he who has not clear and perfect ideas of thoſe angles or figures, of which he deſires to know any thing, is thereby utterly incapable of any knowledge about them.

Our knowledge, as in other things, ſo in this alſo, has ſo great a conformity with our ſight, that it is neither wholly neceſſary, nor wholly voluntary. Men, that have ſenſes, cannot chooſe but receive ſome ideas by them; and if they have memory, they cannot but retain ſome of them; and if they have any diſtinguiſhing faculty, cannot but perceive the agreement or diſagreement of ſome of them, one with another: as he that has eyes, if he will open them by day, cannot but ſee ſome objects, and perceive a difference in them, yet he may chooſe whether he will turn his eye towards an object, curiouſly ſurvey it, and obſerve accurately all that is viſible in it; but what he does ſee, he cannot ſee otherwiſe than he does: it depends not on his will to ſee that black which appears yellow. Juſt thus it is with our under-

understanding; all that is voluntary in our knowledge is the employing or with-holding any of our faculties from this or that ſort of objects, and a more or leſs accurate ſurvey of them; but they being employed, our will hath no power to determine the knowledge of the mind one way or other; that is done only by the objects themſelves, as far as they are clearly diſcovered.

KOLLOW, the name of a black kind of earth found in ſeveral parts of the kingdom.

KORAN, or ALCORAN. See ALCORAN.

KOS, in Jewiſh antiquity, a meaſure of capacity, containing about four cubic inches: this was the cup of bleſſing, out of which they drank when they gave thanks after ſolemn meals, like that of the paſſover.

KUTUCHTA, among the Calmuc-Tartars, the name of their high prieſt, or ſovereign pontiff; formerly only the deputy of the delai-lama, or high prieſt of the Tartars; but at preſent independent on him.

L.

L, A ſemi vowel, or liquid, making the eleventh letter of the alphabet.

It was derived from the old Hebrew Lamed, or Greek Lambda λ. It is ſounded by intercepting the breath between the top of the tongue and forepart of the palate, with the mouth open, and makes a ſweet ſound, with ſomething of an aſpiration; and therefore the Britons and Spaniards uſually doubled it, or added an *h* to it in the beginning of words, as in *llan*, or *lhan*, a temple, ſounding nearly like *ſl*, &c. In Engliſh words of one ſyllable it is doubled at the end, as *tell*, *bell*, *knell*, &c. but in words of more ſyllables than one it is ſingle at the end, as *evil*, *general*, *conſtitutional*, &c. It is placed after moſt of the conſonants in the beginning of words and ſyllables, as *black*, *glare*, *ad-le*, *ea-gle*, &c. but before none. Its ſound is clear in *Abel*, but obſcure in *able*, &c.

L, among the ancients, was a numeral letter, and is ſtill ſo in the Roman cyphering, and denotes fifty, according to the verſe,

Quinquies L denos numero deſignat habendos.

being half a C, which ſignifies a hundred, and was formerly written thus Ɛ. When a line was added at top L̄, it ſtood for 50,000.

LA, in muſic, the ſyllable by which Guido denoted the laſt ſound of each hexachord; if it begins in C, it anſwers to our A; if in G, to E; and if in F, to D.

LABARUM, in Roman antiquity, the ſtandard borne before the Roman emperors; being a rich purple ſtreamer, ſupported by a ſpear.

LABDANUM, or LADANUM, a reſinous juice, exuding upon the leaves of a ſmall ſhrub, which grows plentifully in Candy, and ſome of the other iſlands of the Archipelago. It is collected by lightly bruſhing the ſhrub, in the ſummer heats, with a kind of rake, having ſeveral ſtraps or thongs of leather fixed to it inſtead of teeth: the unctuous juice adheres to the thongs, and is afterwards ſcraped off with knives. The ſhrub is ſaid to be very plentiful alſo in Spain, but it does not appear that any labdanum is brought from thence.

Two ſorts of this reſin are met with in the ſhops. The beſt, though very rare, is in dark-coloured black maſſes, of the conſiſtence of a ſoft plaſter, growing ſtill ſofter on being handled: the other is in long rolls coiled up, much harder than the preceding, and not ſo dark. The firſt has commonly a ſmall, and the laſt a very large admixture of fine ſand, which in the labdanum examined by the French academy, amounted to three fourths of the maſs. It is ſcarcely indeed to be collected pure, independently of deſigned abuſes; the duſt blown on the plant by winds from the looſe ſands among which it grows, being retained by the tenacious juice.

Labdanum has been ſometimes exhibited as a reſinous corroborant and reſtringent, but principally employed in external applications and perfumes: the ſoft kind makes an uſeful ingredient in the cephalic and ſtomachic plaſters of the ſhops. This ſort has a very agreeable ſmell, and a lightly pungent bitteriſh taſte: the hard is much weaker; and the common means of purifying theſe kinds of ſubſtances, though they ſeparate the ſandy matter mixed with it, render it weaker ſtill.

LABEL, in heraldry, a fillet uſually placed in the middle, along the chief of the coat, without touching its extremities. Its breadth ought to be a ninth part of the chief. It is adorned with pendants; and when there are above three of theſe, the number muſt be ſpecified in blazoning.

This is a kind of addition to the arms of a ſecond brother, to diſtinguiſh him from the firſt, and is eſteemed the moſt honourable of all differences.

LABEL, in law, a narrow ſlip of parchment hanging from a deed, writ, or other writing, in order to hold the appending ſeal.

LABEL *of a Circumferentor*, a long thin braſs-ruler, with a ſight at one end, and a center-hole at the other; chiefly uſed with a tangent line, to take altitudes.

LABIA, the lips, in anatomy. See the article LIPS.

LABIAL LETTERS, thoſe pronounced chiefly by means of the lips. See LETTER.

LABIATED FLOWERS, monopetalous flowers, conſiſting of a narrow tube, with a wide mouth, divided into two or more lips. See BOTANY and FLOWER.

LABORATORY, or ELABORATORY. See ELABORATORY.

LABOUR, in general, denotes a cloſe application to work or buſineſs. Among ſeamen, a ſhip is ſaid to be in labour when ſhe rolls and tumbles very much, either a hull, under ſail, or at anchor. It is alſo ſpoke of a woman in travail, or child-birth. See DELIVERY.

LABOURING, in the marine, a violent rolling or pitching, ſo as to endanger the maſts and hull, by carrying away or ſpringing the former, and ſtraining the latter, ſo as to occaſion a leak or other diſaſter.

LABYRINTH, in anatomy, the internal cavity of the ear, ſo called from its ſinuoſities and windings. See the article EAR.

LABYRINTH, in gardening, a winding, mazy, and intricate turning to and fro, through a wilderneſs, or a wood.

The deſign of a labyrinth is, to cauſe an intricate and difficult labour to find out the center; and the aim is, to make the walks ſo intricate, that a perſon may loſe himſelf in them, and meet with as great a number of ſtops and diſappointments as is poſſible, they being the moſt valuable that are moſt intricate.

As to the contrivance of them, it will not be poſſible to give directions in words; there are ſeveral plans and deſigns in books of gardening: they are rarely met with but in great and noble gardens, as Hampton-Court, &c.

There are two ways of making them; the firſt is with ſingle hedges: this method has been practiſed in England. Theſe, indeed, may be beſt, where there is but a ſmall ſpot of ground to be allowed for the making them; but, where there is ground enough, the double are moſt eligible.

Double ones, or thoſe that are made with double hedges of a conſiderable thickneſs of wood between hedge and hedge, are approved as much better than ſingle ones; as

is the manner of making them in France, and other places; of all which, that of Verſailles is allowed by all to be the nobleſt of its kind in the world.

It is an error in labyrinths in making them too narrow, for by that means the hedges muſt be kept cloſe clipped: whereas if the walks be made wider, according to the foreign practice, they will not ſtand in need of it.

The walks are made with gravel, uſually ſet with hornbeams: the paliſades ought to be ten, twelve, or fourteen feet high: the hornbeam ſhould be kept cut, and the walks rolled. *Miller's Gard. Dict.*

LAC, Milk, among phyſicians, &c. See the article Milk.

LACCA, Lac, or Stick-Lac, improperly called gum-lac, in natural hiſtory, a concrete brittle ſubſtance, of a dark red colour; brought from the Eaſt-Indies incruſted on pieces of ſticks; internally divided into ſeveral cells; ſaid to be the reſinous juice of certain trees, collected by winged red inſects of the ant kind, impregnated with the tinging matter of the inſects, and by them depoſited either on the branches of the trees, or on ſticks faſtened in the earth for that purpoſe. In the cells are often obſerved ſmall red bodies, which appear to be the young inſects.

The tinging red animal matter of the ſtick-lac diſſolves both in water and in rectified ſpirit, and appears to be of the ſame general nature with that of cochineal; like which it is made dull by alkalies, and brighter by acids, and turned to a ſcarlet by a ſolution of tin.

Seed Lac.—If the lac be broken in ſmall pieces, or grains, and infuſed in warm water, till it ceaſes to give any tincture to the liquor; the remainder will appear of a tranſparent yellowiſh or browniſh colour, and, on raiſing the heat ſo as to make the water boil, melts and riſes to the ſurface, and is thence called ſhell-lac.

The grains, or the plates formed from them by liquefaction, thus robbed of the greateſt part of the animal tincture, ſeem to be of an intermediate nature between that of wax and reſins, or to partake of the nature of both: they crumble on chewing, and do not ſoften or ſtick together again: laid on a red-hot iron, they inſtantly catch fire, and quickly burn off, with a ſtrong and not diſagreeable ſmell: diſtilled, they yield, like wax, an acid ſpirit and a butyraceous oil: alkaline lixivia, and volatile alkaline ſpirits, diſſolve them into a purpliſh liquor: they diſſolve alſo, by the aſſiſtance of heat, in rectified ſpirit of wine, and communicate to it a yellowiſh or browniſh red colour, an agreeable ſmell, and a bitteriſh, ſub-aſtringent, not unpleaſant taſte. The lac in ſubſtance, whether entire, or freed from ſo much of its colouring matter as boiling water is capable of extracting, has no manifeſt taſte or ſmell.

A ſpirituous tincture of ſtick-lac has been ſometimes given as a mild reſtringent and corroborant, in female weakneſſes, and in rheumatic and ſcorbutic diſorders. But the principal medicinal uſe of this concrete is as a topical corroborant and antiſeptic, in laxities and ſcorbutic bleedings and exulcerations of the gums: ſome employ for this purpoſe a tincture of the lac in alum water; others, a tincture made in vinous ſpirits impregnated with the pungent antiſcorbutics: an ounce of the powdered lac, with half an ounce of the powdered myrrh, is by the college of Edinburgh directed to be digeſted in a ſand heat, for ſix days, in a pint and a half of ſpirit of ſcurvy-graſs.

Artificial Lacca, or Lake, in painting, a white earthy body, as cuttle-fiſh bone, the baſis of alum, or chalk, tinged with ſome crimſon vegetable dye, ſuch as is obtained from cochineal or Braſil-wood, diſſolved or taken up by means of ſome alkaline ſalt, and precipitated on the earth by the addition of ſome acid.

Lake is uſed in all kinds of painting, except enamel; but particularly in oil, where it ſupplies the place of carmine, which does not at all agree with that vehicle. It is valuable both for its brightneſs and crimſon teint; which make it uſeful for carnations to the portrait painters; for ſkies to the landſcape or ſhip painters; and for flowers to thoſe who paint ſtill life. Its tranſparency in oil renders it alſo of great ſervice in glazing, as it is called, over vermilion; and in painting ſcarlet draperies, and the red parts of the lips and its acquiring a dark hue, by this tranſparency, when uſed without the addition of any opake pigment, gives it an unrivalled excellence in the ſhades of red draperies, or other ſimilar caſes. Notwithſtanding theſe qualities, lake is not at preſent univerſally approved; nor without reaſon; for there is a defect which makes it to be frequently rejected, where its uſe can be avoided. This defect is the uncertainty of its ſtanding, when prepared in that manner which moſt conduces to its perfection in other reſpects: for though ſome parcels will hold their colour entirely well, yet others prepared in the ſame manner, as far as art can aſſure it, will fly in a degree that makes the uſe of it deſtructive to any painting: and if this defect be effectually remedied, as it may be by ſecuring the tinging particles by gums, from all attacks of the air; yet this is generally as the expence of the brightneſs and tranſparency; the earth, which is the baſis of the pigment, being locked up by the gums, and rendered incapable of being combined intimately with, or imbibing the oil. Beſides the perfections of lake, which it may have in common with other colours, there is yet another that relates only to itſelf, which is the inclining to the ſcarlet hue, that makes it more valuable for almoſt all the purpoſes to which it is applied; and where this quality, joined to the others, happens to be found in it, there is ſcarcely any limits to be ſet on its value with eminent painters of any kind.

Lake was moſt probably firſt made from the colour found in the grains of the ſtick-lac, from whence it ſeems to have taken its name; but it may be made from a great variety of ſubſtances which afford a crimſon tinge; though at preſent it is ſeldom prepared from any other than cochineal, ſcarlet rags, and Braſil-wood.

The beſt of what is commonly ſold is made from the colour extracted from ſcarlet rags, and depoſited on the cuttle-bone, which may be done in the following manner:

"Take a pound of the beſt pearl-aſhes, and having diſſolved them in two quarts of water, purify them by filtering through paper. Add then to this ſolution two more quarts of water; and having put in a pound of ſcarlet ſhreds, procured from the taylors, for they muſt be entirely clean, boil them in a pewter boiler made for that purpoſe, till the ſhreds appear to have wholly loſt their ſcarlet colour. Take them out of the ſolution, and preſs them well; dipping them after in water, and preſſing them again, that all the fluid they had imbibed may be got from them, which muſt be put back to the reſt. Take then another pound of the ſhreds, and repeat the like treatment of them in the ſame ſolution; as alſo a third and fourth pound. While this is doing, diſſolve a pound and half of cuttle-fiſh in a pound of ſtrong aqua-fortis, in a glaſs receiver, adding more of the bone, if it appear to produce any ebullition in the aqua-fortis; and having ſtrained off this ſolution through flannel, pour it into the other by degrees; obſerving whether it produce any effervеſcence on putting in the laſt quantity; which if it do in any great degree, more of the cuttle-fiſh bone muſt be diſſolved in aqua-fortis; and the ſolution very gradually added, till no ebullition appear to be raiſed by it in the mixture. If this be properly managed, the fluid will ſoon become clear and colourleſs, and the tinging particles extracted from the ſhreds, together with the cuttle-fiſh bone, will ſubſide to the bottom, and form a crimſon ſediment, which is the lake. The water muſt then be poured off; and two gallons of hard ſpring-water muſt be put to the lake, and well ſtirred about to mix them; which, being likewiſe poured off, after the lake has again ſettled to the bottom, muſt be replaced by another two gallons; and the ſame method muſt be repeated four or five times; but if hard water cannot be procured, or the lake appear too purple, half an ounce of alum ſhould be added to each quantity of water before it be uſed. When the lake is thus ſufficiently freed from the ſalts, it muſt have the water drained from it in a filter, covered with a linen cloth, which has been ſo worn as to have no knap or down remaining on its ſurface. After the lake has drawn to a proper dryneſs, it muſt be dropped, on clean boards, by means of ſticks of elder, mountain-aſh, or other hollow wood, cut into the form of pens, and ſuffered to dry; when the drops will appear in the form of little cones or pyramids."

If this lake be of a deeper colour than be deſired, the proportion of ſcarlet ſhreds may be diminiſhed; or if it be wanted yet deeper, they may be increaſed.

This lake, when the proceſs ſucceeds well, will be very bright; and will ſtand equally to any whatever: but it is not ſo tranſparent and fit for glazing as that where earth of alum is the baſis.

Lake may be prepared from cochineal in the following manner:

"Take two ounces of cochineal, and infuſe it in a gallon of ſtale but very clean urine for ſeveral days. Take alſo half an ounce of pearl-aſhes in a pint of water; filter both the ſolutions, and mix them. Make then a ſolution of cuttle-fiſh bone, as in the above proceſs; and to a pint of it add two ounces of alum diſſolved in half a pint of water. Put this mixture gradually to that of the urine and pearl-aſhes, as long as any ebullition appear to ariſe; and proceed as to the reſt according to the directions of the above proceſs."

This lake will be very fine if luckily managed, and will ſtand extremely well: it will alſo be very ſcarlet if the cochineal and annatto be good.

Preparation of beautiful LAKE *from Braſil-wood.*—"Take of Braſil-wood, not coloured in the grinding by the addition of pearl-aſhes, three pounds, and boil it an hour in a ſolution of three pounds of common ſalt in three gallons of water; and then filter the fluid through paper, while hot: prepare then a ſolution of five pounds of alum in three gallons of water; which add to the filtered ſolution of common ſalt, tinged with the colour. Make alſo a ſolution of three pounds of the beſt pearl-aſhes in a gallon and a half of water, and purify it by filtering: put this to the other gradually, till the whole of the colour appear to be precipitated, and leave the fluid clear and colourleſs; but if any appearance of purple be ſeen, add a freſh quantity of the ſolution of alum by degrees, till a ſcarlet hue be produced. The proportion of alum muſt however in this caſe be nicely adjuſted: for a ſmall exceſs will cauſe part of the tinging matter to be diſſolved again, which will appear by the fluid's being coloured; and in ſuch caſe, a ballance muſt again be made by the addition of a ſmall quantity of the ſolution of pearl-aſhes. When the fluid is thus rendered clear of colour, and the ſediment, being ſubſided, appears of a crimſon teint tending to ſcarlet, the directions in the firſt proceſs muſt be followed in every point."

This lake cannot be confided in for either painting in oil or water; but in varniſh, or for any other purpoſe, where it is defended from air, it is ſuperior to any other whatever, on account of its great brightneſs and tranſparency.

It may be rendered ſafe, however, with reſpect to ſtanding, if half a pound of ſeed-lac be added to the ſolution of pearl-aſhes; and diſſolved in it before its purification by the filter: but in this caſe, two pounds of the wood, and a proportionable quantity of the common ſalt and water muſt be uſed in the coloured ſolution. This will produce a lake that will ſtand well in either oil or water, and will ſometimes be extremely beautiful; but it is not ſo tranſparent in oil as without the ſeed-lac.

The lake with Brazil-wood may be made, alſo, with the addition of half an ounce of annatto to each pound of the wood: which will render it much more ſcarlet where it is ſo wanted. But the annatto muſt be diſſolved in the ſolution of pearl-aſhes, and not in that of the common ſalt along with wood.

The goodneſs of lake cannot be poſitively known but by the actual trial of it; which, with reſpect to its ſtanding, requires ſome time; but its other qualities may be more eaſily judged of.

With reſpect to the brightneſs, its merit may be eaſily proved by grinding a little of it, on a pallet or ſtone, with white lead and oil; where it may either be judged of by the memory of thoſe who are very converſant in the uſe of it, or by comparing it with a ſample of any other. In relation to the tranſparency, it is alſo eaſy to judge of it, by grinding a little, in the ſame manner, with oil only; where a muddineſs will be perceived, if the lake be in the leaſt opake: or a little of it may be put, in this ſtate, on the glaſs of a window; where its thickneſs or clearneſs will of courſe be apparent to the minuteſt degree. This indeed is the only method uſed in general by colourmen for deciding on all the qualities of lake; but it is very inconcluſive with regard to any but tranſparency.

There is another defect, with reſpect to ſome purpoſes, which is apt to be found in lake: it is the fatning in oil. This can only be known, by grinding ſome of it in the oil, and keeping it the proper time in bladders; when, if it be found to have this fault, it may be deemed utterly unfit for the uſe of colourmen. If nevertheleſs it have no other bad qualities, it is not at all the worſe for this, with regard to thoſe who have no occaſion to keep colours in bladders, but mix them as wanted on the pallet.

There is another kind of lake brought from China, which is extremely beautiful; but as it will not mix well with either water or oil, though it diſſolves entirely in ſpirit of wine, it is not of any uſe in our kinds of painting hitherto. This lake has, by ſome unaccountable blunder, got the name of ſafflower among thoſe who paint in water colours: and has, indeed, been ſo called by different perſons who have wrote on the uſe of water colours: but there is not the leaſt affinity betwixt it and the real ſafflower; which is the died flowers of the carthamus or baſtard ſaffron, and is a well known ſubſtance, as being a common dying drug.

Orange LAKE.—This lake is the tinging part of annatto precipitated together with earth of alum. It is of a very bright orange colour, and would work well with either oil or water, but cannot be depended upon, when uſed either of thoſe ways, for ſtanding long. It is, however, a very fine colour for varniſh painting, where the fear of flying is out of queſtion; and is alſo of an admirable good effect for putting under cryſtal for the imitation of the vinegar garnet; for which purpoſe it has been uſed with great ſucceſs.

The manner of preparing this lake is in the following manner.

"Take of the beſt annatto four ounces, and of pearl-aſhes one pound. Put them together into a gallon of water, and boil them half an hour; and then ſtrain the ſolution through paper.—Make, in the mean time, a ſolution of a pound and a half of alum, in another gallon of water: and mix it gradually with the ſolution of the pearl-aſhes and annatto; obſerving to ceaſe any further addition when the fluid becomes colourleſs, and no further ebullition enſues on the commixture. Treat the ſediment or precipitated matter, then, in the ſame manner as has been before directed for other kinds of lake; only this need not be formed into drops; but may be dried in ſquare bits or round lozenges."

LACHYRYMAL, in anatomy, an appellation given to ſeveral parts of the eye, from their ſerving to ſecrete the tears.

The lachrymal gland is ſituated in the orbit above the ſmaller angle, and its excretory ducts under the upper eye-lid: theſe are much more eaſily demonſtrated in the eye of an ox, than in a human one.

The lachrymal caruncle is ſituated in the larger angle, or canthus, ſerving to direct the tears to the two puncta lachrymalia; which are ſituated in the ſame angle, at the extremities of the tarſi or cartilages, and terminate in the lachrymal ſaccus, the naſal canal, and in the noſe itſelf. See the article EYE.

LACHRYMALIS FISTULA, in ſurgery and medicine. See FISTULA.

LACHRYMATORY, in antiquity, a veſſel wherein were collected the tears of a deceaſed perſon's friends, and preſerved along with the aſhes and urn.

LACONISM, λακονισμὸς, in matters of ſtyle, a ſhort, pithy obſervation or ſaying; ſo called from the Lacedæmonians, who were remarkable for the conciſeneſs of their diſcourſe: See STYLE.

LACTEA, or VIA LACTEA, the ſame with galaxy. See GALAXY.

LACTEAL VESSELS, in anatomy, long ſlender tubes for the conveyance of the chyle from the inteſtines to the common reſervatory. See the article CHYLE.

LACTIFEROUS PLANTS, in botany, ſuch plants as abound with a milky juice, as the lithymalus, ſonchus, and lettuce.

LACUNÆ, in anatomy, certain oſcula or orifices, proceeding from the glandulæ ſubſtratæ in the vagina,

and often ſo large as to admit a briſtle. Their uſe is to ſecrete a fluid for lubricating the vagina, and ſtimulating to venery.

LACUNAR, in architecture, an arched roof or ceiling, more eſpecially the planking or flooring above porticos and piazzas.

LADANUM, or LABDANUM, in pharmacy. See the article LABDANUM.

LADY's BEDSTRAW, a plant called by botaniſts gallium. See GALLIUM.

LADY's COMB, a plant otherwiſe called ſcandix. See the article SCANDIX,

LADY's FINGER, a ſpecies of vulneraria. See the article VULNERARIA.

LADY's MANTLE, the Engliſh name of alchimilla. See ALCHIMILIA.

LADY's SMOCK, the Engliſh name of cardamine. See CARDAMINE.

LADY's SLIPPER, the Engliſh name of the cypripedium. See CYPRIPEDIUM.

LADY's TRACES, a name by which ſome call orchis. See ORCHIS.

LADY-DAY, in law, the 25th of March, being the annunciation of the holy virgin. See the article ANNUNCIATION.

LAGOECIA, round-headed cummin, in botany, a genus of plants, the flower of which conſiſts of five petals, very ſhort, and bicornate: there is no pericarpium, the ſeed, which is ſingle, being contained in the cup.

This plant has neither the ſmell, appearance, or taſte of cummin; its ſmell being more like that of the carrot.

LAGOPHTHALMIA, in ſurgery, an everſion and gaping of the eye-lids, otherwiſe called ectropium. See the article ECTROPIUM.

LAIR, among ſportſmen, the place where the deer harbour by day. This term is alſo uſed to ſignify a place where cattle uſually reſt under ſome ſhelter: by which means the ground generally becomes enriched with their dung.

LAKE, a collection of waters contained in ſome cavity in an inland place, of a large extent, ſurrounded with land, and having no communication with the ocean.

Lakes may be divided into four kinds. 1. Such as neither receive nor ſend forth rivers. 2. Such as emit rivers, without receiving any. 3. Such as receive rivers, without emitting any. And, 4. Such as both receive and ſend forth rivers.

Of the firſt kind, ſome are temporary, and others perennial: moſt of thoſe that are temporary owe their origin to the rain, and the cavity or depreſſion of the place in which they are lodged: thus in India there are ſeveral ſuch lakes made by the induſtry of the natives, of which ſome are a mile, and ſome two in circuit; theſe are ſurrounded with a ſtone wall, and being filled in the rainy months, ſupply the inhabitants in dry ſeaſons, who live at a great diſtance from ſprings or rivers. There are alſo ſeveral of this kind formed by the inundations of the Nile and the Niger; and in Muſcovy, Finland, and Lapland, there are many lakes formed partly by the rains and partly by the melting of the ice and ſnow; but moſt of the perennial lakes, which neither receive nor emit rivers, probably owe their riſe to ſprings at the bottom, by which they are conſtantly ſupplied.

The ſecond kind of lakes, which emit, without receiving rivers, is very numerous. Many rivers flow from theſe as out of ciſterns; where their ſprings being ſituated low within a hollow place, firſt fill the cavity, and make it a lake, which not being capacious enough to hold all the water, it overflows and forms a river: of this kind is the Wolga, at the head of the river Wolga; the lake Odium, at the head of the Tanais; the Adac, from whence one branch of the river Tigris flows; the Ozero, or white lake in Muſcovy, is the ſource of the river Shackſna. The great lake Chaamay, which emits four very large rivers, which water the countries of Siam, Pegu, &c. viz. the Menau, the Aſa, the Caipoumo, and the Laquia, &c.

The third ſpecies of lakes, which receive rivers, but emit none, apparently owe their origin to thoſe rivers, which in their progreſs from their ſource, falling into ſome extenſive cavity, are collected together; and form a lake of ſuch dimenſions, as may loſe as much by exhalation, as it continually receives from theſe ſources: of this kind is that great lake improperly called the Caſpian ſea; the lake Aſphaltites, alſo called the Dead ſea; the lake of Geneva, and ſeveral others.

Of the fourth ſpecies, which both receive and emit rivers, we reckon three kinds, as the quantity they emit is greater, equal, or leſs than they receive. If it be greater, it is plain that they muſt be ſupplied by ſprings at the bottom; if leſs, the ſurplus of the water is probably ſpent in exhalations; and if it be equal, their ſprings juſt ſupply what is evaporated by the ſun.

Lakes are alſo divided into thoſe of freſh water, and thoſe of ſalt. Dr. Halley is of opinion, that all great perennial lakes are ſaline, either in a greater or leſs degree; and that this ſaltneſs encreaſes with time: and on this foundation he propoſes a method for determining the age of the world.

Large lakes anſwer the moſt valuable purpoſes in the northern regions, the warm vapours that ariſe from them moderating the pinching cold of thoſe climates; and what is ſtill a greater advantage, when they are placed in warmer climates at a great diſtance from the ſea, the exhalations raiſed from them by the ſun, cauſe the countries that border upon them to be refreſhed with frequent ſhowers, and conſequently prevent their being barren deſarts.

LAMA, the ſovereign pontiff or rather god of the Aſiatic Tartars, inhabiting the country of Barantola. The lama is not only adored by the inhabitants of the country, but alſo by the kings of Tartary, who ſend him rich preſents, and go in pilgrimage to pay him adoration, calling him *Lama-Congiu*, i. e. God the everlaſting father of heaven. He is never to be ſeen but in a ſecret place of his palace, amidſt a great number of lamps, ſitting croſs-legged upon a cuſhion, and adorned all over with gold and precious ſtones; where, at a diſtance, they proſtrate themſelves before him, it not being lawful for any to kiſs even his feet. He is called the great lama, or lama of lamas, that is, prieſt of prieſts. And to perſuade the people that he is immortal, the inferior prieſts, when he dies, ſubſtitute another in his ſtead, and ſo continue the cheat from generation to generation. Theſe prieſts perſuade the people, that the lama was raiſed from death many hundred years ago, that he has lived ever ſince, and will continue to live for ever.

LAMB, in zoology, the young of the ſheep-kind. See the article SHEEP.

LAMENTATIONS, a canonical book of the Old Teſtament, written by the prophet Jeremiah. The two firſt chapters of this book are employed in deſcribing the calamities of the ſiege of Jeruſalem. In the third, the author deplores the perſecutions he himſelf had ſuffered. The fourth turns upon the deſolation of the city and temple, and the misfortune of Zedekiah. The fifth chapter is a prayer for the Jews in their diſperſion and captivity; and at the end of all, he ſpeaks of the cruelty of the Edomites, who had inſulted Jeruſalem in her miſery. The four firſt chapters of the Lamentations are an abecedary, every verſe or couplet beginning with one of the letters of the Hebrew alphabet, in the alphabetical order. The ſubject is of the moſt moving kind, and the ſtile throughout lively, pathetic, and affecting. "Did we ever find, ſays Dr. South, ſorrow flowing forth in ſuch a natural prevailing pathos, as in the Lamentations of Jeremy? One would think, that every letter was wrote with a tear; that every word was the noiſe of a breaking heart; that the author was a man compacted of ſorrows, diſciplined to grief from his infancy; one who never breathed but in ſighs, nor ſpoke but in a groan."

LAMIÆ, in heathen mythology, a kind of dæmons, in the form of women, ſaid to have devoured children. See DÆMON.

LAMINÆ, in phyſiology, the thin plates whereof many ſubſtances conſiſt.

LAMIUM, dead nettle, in botany, a genus of plants, the flower of which conſiſts of one labiated and ringent petal: the ſeeds are four, triangular, and contained in the bottom of the cup.

The

The flowers of this plant are ſaid to be good in the fluor albus dyſentery, and ſcrophulous diſorders. The herb is aperient, emollient, and vulnerary.

LAMMAS-DAY, a feſtival celebrated on the firſt of Auguſt by the Romiſh church, in memory of St. Peter's impriſonment.

LAMP, λαμπας, a veſſel containing oil, with a lighted wick. See OIL, FLAME, FIRE, &c.

LAMPADARY, an officer in the ancient church of Conſtantinople, ſo called from his employment, which was to take care of the lamps, and to carry a taper before the emperor or patriarch when they went to church, or in proceſſion.

LAMPAS, LAMPERS, or LAMPRASS, among farriers, a ſwelling and inflammation in the roof of a horſe's mouth, ſo called becauſe it is cured by burning with a lamp or hot iron, in which operation great care ſhould be taken not to touch the bone.

LAMPERN, in ichthyology, a ſpecies of petromyzon, with a ſingle row of little teeth in the verge of the mouth, beſide the lower large ones. It grows to about a foot long, though moſt of thoſe uſually caught are under that ſtandard. See the article PETROMYZON.

LAMPREY, *Lampetra*, another ſpecies of petromyzon, with about twenty rows of teeth. It grows to two feet and an half, or more, in length. It is caught in ſome large rivers near the ſea, but is much leſs frequent than the former ſpecies.

LANCEOLATED LEAF, one reſembling a ſpear's point.

LANCET, a chirurgical inſtrument, ſharp pointed and two edged, chiefly uſed for opening veins in the operation of phlebotomy, or bleeding; alſo for laying open abſceſſes, tumors, &c.

LAND, in a limited ſenſe, denotes arable ground. See the articles EARTH, SOIL, HUSBANDRY.

It is alſo uſed for meadow-ground, paſture, wood, commons, &c. See the articles MEADOW, PASTURE, &c.

There are various methods of improving lands, as, 1. By incloſing and dividing the ſame into ſeveral fields, for paſture or tillage, which is one of the moſt principal ways of improvement; firſt, by aſcertaining to every man his juſt property, and thereby preventing a number of treſpaſſes and injuries, that lands in general are ſubjected to, beſide the diſadvantage of being obliged to keep the ſame ſeaſons with the other people who have land in the ſame field; ſo that the ſowing, fallowing, and tilling the ground, muſt be equally performed by all the land-holders; and, when there happens a ſlothful negligent perſon, who has land intermixed with others, it is one of the greateſt nuiſances imaginable. Secondly, it being of itſelf a very great improvement: for, where land is properly incloſed, and the hedge-rows planted with timber trees, &c. it preſerves the land warm, and defends and ſhelters it from the violent cold nipping winds, which in ſevere winters deſtroy much of the corn, pulſe, or whatever grows on the open field, or champain grounds. And where it is laid down for paſture, it yields much more graſs than the open fields, and the graſs will begin to grow much ſooner in the ſpring. The hedges and trees alſo afford ſhelter for the cattle from the cold winds in winter; as alſo ſhade for them in the great heats of ſummer. And theſe hedges afford the farmer plenty of fuel, as alſo plough-boot, cart-boot, &c. and, where they are carefully planted and preſerved, furniſh him with timber, and maſt for his ſwine: or, where the hedge-rows are planted with fruit-trees, there will be a ſupply of fruit for cyder, perry, &c. which, in moſt parts of England, are of no ſmall advantage to the huſbandman.

By this method of incloſing, there is alſo much more employment for the poor, and is therefore a good remedy againſt beggary; for in thoſe open countries, where there are great downs, commons, heaths, and waſtes, there is nothing but poverty and idleneſs to be ſeen amongſt the generality of their inhabitants. It is very obſervable of late years, how much advantage the incloſing of the land in Worceſterſhire, and ſome other counties at a diſtance from London, has been to the inhabitants; for, before this method was introduced amongſt them, the lands, for the moſt part, lay in commons, &c. upon which the poorer ſort of people built themſelves cottages with mud walls, where they contented themſelves with a cow or two, and ſome ſwine: and thoſe of them who were more induſtrious than the reſt, travelled to the neighbourhood of London every ſpring, where they were employed in the gardens and fields for the ſummer ſeaſon; and in autumn they returned to their native counties, where they lived, in winter, upon what money they had ſaved in ſummer. But, ſince they have converted their waſtes and commons into incloſures, there are but few of the inhabitants of thoſe counties who come to London for work, in compariſon to the numbers that formerly came; ſo that moſt of the labourers who come to London for employment, are either Welch, or inhabitants of ſome diſtant counties, where this improvement hath not as yet been introduced.

The advantages of incloſing land are now ſo generally known, that there is no occaſion for us to enumerate them here; ſince the improvements which have been made of late years, in ſeveral parts of England, and the increaſe of rent, that is every-where made by thoſe that incloſe, are ſufficient arguments to enforce the practice, and render it general; more eſpecially in the north, where it is much neglected; becauſe it would greatly ſhelter the lands, and render them much warmer than they now are.

In incloſing of land, there ſhould be regard had to the nature of the ſoil, and what it is intended for; becauſe corn land ſhould not be divided into ſmall parcels; for, beſides the loſs of ground in hedges, &c. the corn ſeldom thrives ſo well in ſmall incloſures, as in more open fields; eſpecially where the trees are large in the hedge-rows. The graſs alſo in paſtures is not ſo ſweet near hedges, or under the drip of trees, as in open expoſures; ſo that where the incloſures are made too ſmall, or the land is overplanted with trees, the herbage will not be near ſo good, nor in ſo great plenty, as in larger fields: therefore, before a perſon begins to incloſe, he ſhould well conſider how he may do it to the greateſt advantage: as, for inſtance, it is always neceſſary to have ſome ſmaller incloſures near the habitation, for the ſhelter of cattle, and the conveniency of ſhifting them from one field to another, as the ſeaſon of the year may require; and hereby the habitation, barns, ſtables, and outhouſes, will be better defended from ſtrong winds, which often do great damage to thoſe that are expoſed to their fury. Theſe ſmall incloſures may be of ſeveral dimenſions; ſome of them three, four, ſix, or eight acres in extent; but the larger diviſions for corn ſhould not contain leſs than twenty or thirty acres, or more, according to the ſize of the farm.

The uſual method of incloſing land is, with a ditch and bank ſet with quick. But in marſh land, where there is plenty of water, they content themſelves with only a ditch, by the ſides of which they uſually plant fallows or poplars, which, being quick of growth, in a few years, afford ſhade to the cattle; and when they are lopped, produce a conſiderable profit to their owners. See FENCE.

2. The draining of land is alſo another great improvement to it: for though paſtures and meadows, which are capable of being overflowed, produce a greater quantity of herbage than dry land; yet, where the wet lies too long upon the ground, the graſs will be ſour, and extremely coarſe; and where there is not care taken in time to drain this land, it will produce little graſs, and ſoon be over-run with ruſhes and flags, ſo as to be of ſmall value. See BOG and FEN.

As the draining of cold wet lands is a great improvement to them, ſo the floating or watering of dry looſe lands is not a leſs advantage to them. This may be eaſily effected where there are rivers, or reſervoirs of water, which are ſituated above the level of the ground deſigned to be floated, by under-ground drains, through which the water may be conveyed at proper ſeaſons, and let out on the ground: in order to this, there muſt be good ſluices made at the heads of the drains, ſo that the water may never get out, but at ſuch times as is required; for if this be not taken care of, the water, inſtead of improving the land, will greatly damage it.

But where the land lies ſo high, as that there is no water in the neighbourhood lying above its level, it will be more expenſive; becauſe, in ſuch caſe, the water muſt be raiſed, by machines, from reſervoirs or ſtreams which lie below it. The moſt common engine for this purpoſe is the Perſian wheel. See the article PERSIAN WHEEL.

Yet notwithſtanding the expence of raiſing the water, it has been found very advantageous, in many parts of England, to drown the lands; for the profit has many times more than doubled the charge.

The time for drowning of land is uſually from November to the end of April: but though this is the general practice, yet for many reaſons it is not to be approved of: the firſt is, that by the water lying continually on the ground in the winter, the roots of the finer ſorts of graſs are rotted and deſtroyed; and by letting on of the water, at the ſeaſon when the ſeeds of docks, and other bad weeds, which commonly grow by river-ſides, are falling, theſe ſeeds are carried upon the land, where they remain and grow, and fill the ground with bad weeds; which is commonly the caſe with moſt of the water meadows in England, the graſs in general being deſtroyed; ſo that ruſhes, docks, and other trumpery, make up the burden of theſe lands; but if theſe meadows were judiciouſly managed, and never floated till March or April, the quantity of ſweet good graſs would be thereby greatly increaſed, and the beautiful verdure of the meadows preſerved: but there is little hope of convincing thoſe perſons by arguments, who are ſo much wedded to their own prejudices, as to ſhut their eyes and ears againſt experiments or reaſon. Where the land is very hot and dry, and it lieth convenient to be watered at a ſmall expence, it ſhould be repeated every week in dry hot weather, which will prove a great advantage to the land. But, whenever this is done, there ſhould no cattle be admitted while it is wet; for they will poach, and ſpoil the turf.

3. Another great improvement of land is by burning of it; which, for ſour, heathy, and ruſhy land, be it either hot or cold, wet or dry, is a very great improvement; ſo that ſuch lands will, in two or three years after burning, yield more, excluſive of the charges, than the inheritance was worth before: but this is not to be practiſed on rich fertile land; for as the fire deſtroys the acid juice, which occaſions ſterility in the poor land, ſo it will in like manner conſume the good juices of the richer land, and thereby impoveriſh it; ſo that it hath been with great reaſon diſuſed in deep rich countries. See BURNING *of Land*.

4. It is alſo a very great improvement, where land is overgrown with broom, furz, &c. to ſtub them up by the roots; and when they are dry, lay them on heaps, and cover them with the parings of the earth, and burn them, and ſpread the aſhes over the ground. By this method vaſt tracts of land, which at preſent produce little or nothing to their owners, might be made good at a ſmall expence, ſo as to become good eſtates to the proprietors.

LANDSKIP, or LANDSCAPE, in painting, the view or proſpect of a country, extended as far as the eye will reach.

LANGUAGE, an aſſemblage of expreſſions among any people, whereby to communicate their thoughts to each other. And this chance or caprice has eſtabliſhed at firſt; ſo that uſage is the rule of a language, nor has reaſon any thing to do therein, unleſs to ſtudy or teach it, ſuch as it is. Here then commences grammar, which only furniſhes reflections, called rules, to which the manners of ſpeaking uſed in that language may be reduced.

Uſage may be divided into good and bad. The difference between theſe is, that the one is better eſtabliſhed than the other. In dead languages, that which makes the good uſage is the writings of the beſt authors in that language, and thoſe authors are allowed the beſt, who wrote when the ſtate was in its greateſt glory. Thus the age of Auguſtus being the moſt diſtinguiſhed period in the Roman hiſtory, we call that good Latin which is conformable to the manners of ſpeaking uſed by authors who wrote within fifty years before, or after the reign of that emperor. As to the living languages, the good uſage, or mode, is that which obtains amongſt the moſt eminent perſons, whether as to quality and authority, or as to learning, and the reputation of writing well.

There is found a conſtant reſemblance between the genius of each people, and the language they ſpeak. Thus the Greeks, a polite but voluptuous people, had a language perfectly ſuitable, full of delicacy and ſweetneſs. The Romans, who ſeemed only born to command, had a language noble, nervous, and auguſt; and their deſcendants, the Italians, are ſunk into ſoftneſs and effeminacy, which is as eaſily perceivable in their language, as in their manners. The language of the Spaniards is full of that haughtineſs which conſtitutes the diſtinguiſhing character of the people. The French, who have a world of vivacity, have a language that runs extremely briſk and lively. And the Engliſh, who are naturally blunt, thoughtful, and of few words, have a language exceeding ſhort, conciſe, and ſententious. See the articles GREEK, LATIN, ITALIAN, SPANISH, FRENCH, and ENGLISH.

The diverſity of languages is generally allowed to have taken its riſe from the confuſion at the Tower of Babel, both by Jews, Chriſtians, and Mahometans; but the manner in which this diverſity was effected, is ſtill in diſpute among the learned.

As to the point of antiquity and priority among languages, that too has been extremely controverted. The Egyptians and Phrygians diſputed concerning the antiquity of their languages: the Arabs diſpute the point of antiquity with the Jews; but theſe, jealous even to exceſs of the honour of their nation, poſitively inſiſt that the Hebrew tongue, ſuch as is found in the Holy Scriptures, is the primitive language, and that ſpoken by the firſt man; while others contend that the Hebrew, Chaldee, and Arabic, are only dialects of the original tongue: however that be, the Arabic is held to be the moſt copious of all languages. See the articles ARABIC, CHALDEE, HEBREW, EGYPTIAN, and PHRYGIAN, &c.

Languages are divided into 1. Original or mother tongues, as the Hebrew and Arabic in the eaſt; Kircher adds the Cophtic; the Teutonic and Sclavonic in the weſt. And Du Jon maintains the Gothic to be the mother of the Teutonic tongues, namely, thoſe ſpoken in the north; and ſome add the Biſcayan or Bas Briton, as the mother-tongue of the Celtæ or Gauls.

2. Derivative languages, which are thoſe formed out of a mixture of ſeveral others, as Latin, French, &c.

Learned or dead languages are thoſe which only ſubſiſt in books, and which muſt be learned by the rules of grammar, as the Greek, Hebrew, Syriac, and Chaldee.

Living languages are thoſe ſtill ſpoken in ſome country, or other, and which may be learned by converſation. The moſt popular among theſe are the French, Italian, Spaniſh, and Engliſh.

Speech is a privilege peculiar to man, and he is likewiſe furniſhed with organs proper for forming an articulate voice: hence it is eaſy to conceive men might form a ſettled and uniform language, by only affixing an idea to a word, and making others acquainted with it. And it is alſo eaſy to conceive that, the connexion betwixt moſt words and things being perfectly arbitrary, they may be changed at different places, at different times, and by different perſons. And it is not very unlikely that variety of capacities and inclinations, the different occaſions people have to expreſs themſelves, different terms of imagination, the eaſe people find in delivering themſelves rather one way than another, the forgetting old words, the many new things met with requiring new names, ſtrangers ſettling among natives, &c. it is not unlikely that theſe and many other cauſes ſhould occaſion an alteration in living languages.

When all mankind inhabited the ſame country, and kept up a commerce with each other, living through many ages, it is no great wonder that the common language was continued amongſt them, without any conſiderable alterations, till after the flood; ſince Noah himſelf was born not long after Adam's death, and a great many antediluvians living in Noah's time might have converſed with Adam and Eve ſome hundred years. Since all the world was then deſtroyed, except Noah and his family, the tongue ſpoken by this patriarch muſt be the only remaining language, and which might be eaſily handed down to his poſterity, as long as they dwelt in the ſame country

But when, before their parting, they attempted to build a city and tower, God confounded the language, inſomuch that, not being able to underſtand each other, they were forced to ſeparate and leave the building unfiniſhed.

LANGUED, in heraldry, is applied to ſuch animals whoſe tongues appear out of their mouths, being of a different colour from that of the body.

LANGUOR, a faintneſs or relaxation of the members, owing either to a want or decay of ſpirits.

LANIGEROUS, among herbaliſts, trees that bear ſuch a woolly or downy ſubſtance as is commonly contained in the catkins of the willow, &c.

The word is derived from the Latin, *lana*, wool, and *gero*, to bear.

LANIUS, the butcher-bird, in ornithology, a ſpecies of falcon, with black legs, a grey back, and variegated belly.

LANNAR, or LANNERET, the blue-legged falcon, with oblong black and white ſpots. It is a very beautiful bird, about the ſize of a common crow, very bold, and uſually kept for the diverſion of hawking.

LANTERN, or LANTHORN, a well known invention for ſhewing light in the night.

The word is derived from the French *lanterne*, which ſignifies the ſame thing.

Feaſt of LANTERNS, a Chineſe feſtival obſerved on the fifteenth day of the firſt month, when every Chineſe ſets out a large lanthorn illuminated with a great number of wax candles. Theſe lanthorns are more or leſs ſplendid, in proportion to the circumſtances of the owner: ſome of them are valued at ten thouſand crowns, on account of the decorations beſtowed on them; theſe are from twenty to thirty feet diameter, and ſerve as a kind of halls, in which they make ſumptuous entertainments.

Magic LANTERN, an optic machine, whereby little painted images are repreſented ſo much magnified, as to be accounted the effect of magic by the ignorant.

The contrivance is briefly this: ABCD (pl. LXXVII. *fig.* 5.) is a lantern, from whoſe ſide there proceeds a ſquare tube *bnklmc*, conſiſting of two parts; the outermoſt of which *nklm* ſlides over the other, ſo as that the whole tube may be lengthened or ſhortened by that means. In the end of the arm *nklm*, is fixed a convex glaſs *kl*; about *de*, there is a contrivance for admitting and placing an object, *de*, painted in dilute and tranſparent colours, on a plane thin glaſs; which object is there to be placed inverted. This is uſually ſome ludicrous or frightful repreſentation, the more to divert the ſpectators: *bhc* is a deep convex glaſs, placed in the other end of the tube, the only uſe of which is to caſt the light of the flame ſtrongly on the picture *de*, painted on the plane thin glaſs. Hence, if the object *de* be placed farther from the glaſs *kl* than its focus, it is manifeſt that the diſtinct image of the object will be projected by the glaſs *kl*, on the oppoſite white wall FH, at *fg*; and that in an erect poſture: ſo that, in effect, this appearance of the magic lantern is the ſame with that of the camera obſcura, or darkened room; ſince here the chamber EFGH is ſuppoſed quite dark, excepting the light in the lantern ABCD. See CAMERA OBSCURA.

And here we may obſerve, that if the tube *bnklmc* be contracted, and thereby the glaſs *kl* brought nearer the object *de*, the repreſentation *fg* ſhall be projected ſo much the larger, and ſo much the more diſtant from the glaſs *kl*; ſo that the ſmalleſt picture at *de* may be projected at *fg*, in any greater proportion required, within due limits: whence it is, that this lantern got the name of *lanterna megalographica*. On the other hand, protracting the tube will diminiſh the object. Inſtead of the convex glaſs to heighten the light, ſome prefer a concave ſpeculum, its focus being nearer than that of a lens; and in this focus they place the candle.

LANTERN, in architecture, a little dome raiſed over the roof of a building, to give light, and ſerve as a crowning to the fabric.

LANTERNISTS, a denomination aſſumed by the academicians of Thouloufe.

LANUGO, the ſoft down of plants, like that growing on the fruit of the peach-tree; whence ſuch plants are termed lanuginous.

LAPATHUM, the dock, in botany, a perennial plant bearing numerous imperfect flowers ſet in double cups; the outermoſt of which conſiſts of three ſmall green leaves, the inner of three larger reddiſh ones, which become a covering to a gloſſy triangular ſeed.

LAPATHUM *acutum folio plano*, ſharp-pointed wild dock, with long narrow acuminated leaves not curled about the edges, and the ſeed-covers indented and marked with little tubercles. The roots are of a browniſh colour on the outſide, and of a yellowiſh within, which grows deeper in drying.

The roots of the ſharp-pointed dock have a bitteriſh aſtringent taſte, and no remarkable ſmell: the roots of the other common wild docks are nearly of the ſame quality, equally diſcover their aſtringent matter both to the taſte and by ſtriking an inky blackneſs with a ſolution of chalybeate vitriol, and have been often ſubſtituted in our markets for thoſe of the ſharp-pointed kind; which laſt are generally, and, ſo far as can be judged from their taſte, juſtly, accounted the moſt efficacious. They are ſuppoſed to have an aperient and laxative, as well as an aſtringent and corroborating virtue; approaching in this reſpect to rhubarb, but differing widely in degree, their ſtypticity being greater, and their purgative quality, if really they have any purgative quality at all, far leſs. They ſtand recommended in habitual coſtiveneſs, obſtructions of the viſcera, ſcorbutic and cutaneous maladies: in which laſt intention, fomentations, cataplaſms, or unguents of the roots have been commonly joined to their internal uſe: in many caſes, the external application alone is ſaid to be ſufficient. A decoction of half an ounce or an ounce of the freſh roots, or of a dram or two of the dry roots, is commonly directed for a doſe.

LAPATHUM *aquaticum folio cubitali*, great wild water dock. See BARDANA.

LAPATHUM *rhabarbarum monachorum*, Monks rhubarb, garden patience; with large, broad, acuminated leaves; reddiſh, branched ſtalks; the leaves that cover the ſeeds unindented, and a tubercle on one of them: the root is of a yellow colour, with red veins, approaching in appearance to rhubarb.

This root is ſuppoſed to poſſeſs the virtues of rhubarb, in an inferior degree. It is obviouſly more aſtringent than rhubarb; but comes very far ſhort of it in purgative virtue, though given, as uſually directed, in double its doſe; nauſeating the ſtomach, without producing any conſiderable evacuation. It communicates a deep yellow tincture both to water and ſpirit.

LAPIDARY, an artificer who cuts precious ſtones. See the article GEM.

The art of cutting precious ſtones is of great antiquity. The French, though they fell into it but lately, have notwithſtanding carried this art to a very great perfection, but not in any degree ſuperior to the Engliſh. See DIAMOND.

LAPIDARY STYLE denotes the ſtyle proper for monumental or other inſcriptions; being a ſort of medium between proſe and verſe. The jejune and brilliant are equally to be avoided.

LAPIDESCENT, that which has the faculty of turning bodies to a ſtony nature.

LAPIS, in general, is uſed to denote a ſtone of any kind. See STONE.

LAPSA denotes a patron's neglect or omiſſion to preſent to a church within ſix months after it becomes vacant. When after a vacancy the patron does not preſent in ſix months, the ordinary has the next ſix months to collate to the benefice; and if he does not preſent within that time, the metropolitan has farther ſix months to do it in; and if he ſhould fail in doing it in his time, the next ſix months devolves to the crown.

LAQUEUS, in ſurgery, a kind of ligature ſo contrived, that when ſtretched by any weight, or the like, it draws up cloſe. Its uſe is to extend broken or disjointed bones, to keep them in their places when they are ſet, and to bind the parts cloſe together.

LARCENY, in law, a felonious carrying away another perſon's goods; and this, according to the value of the thing ſtolen, is either grand, or petit larceny; the firſt being ſtealing effects above the value of 1s. and the laſt ſuch as are either of that value, or under it: but

where two perſons together ſteal goods to the value of only 13d. it is grand larceny in both; and if one perſon at different times ſteal ſeveral different things from the ſame perſon, which amount upon the whole to above 12d. value, they may be joined in one indictment, and the offender found guilty of grand larceny; but this is very ſeldom practiſed; on the contrary, the jury, where the theft appears to be the firſt offence, frequently bring in their verdict, as they lawfully may, that the things are not above 10d. value, and by that means reduce the offence to petit larceny, though the offender may perhaps be indicted for ſtealing to the value of 30 or 40s. and upwards. The crime of grand larceny is puniſhable with death, and that of petit larceny, only with the corporal puniſhment of whipping, &c.

LARES, certain inferior deities among the ancient Romans, who were the guardians of houſes; they were alſo ſometimes taken for the guardians of ſtreets and ways, and Tibullus makes them the guardians of the fields.

LARGO, in the Italian muſic, a ſlow movement, one degree quicker than the grave, and two than the adagio. See the articles ADAGIO and GRAVE.

LARIX, the Larch tree, in botany, a genus of trees, whoſe leaves, which are long and narrow, are produced out of little tubercles, in form of a painter's pencil: the cones are produced at remote diſtances from the male flowers on the ſame tree: the male flowers are very like ſmall cones at their firſt appearance, but afterwards ſtretched out in length.

Theſe trees are propagated by ſeeds, which ſhould be ſown in the beginning of March, upon a bed of light ſoil, expoſed only to the morning ſun: or otherwiſe it may be ſown in pots or boxes of light earth, and placed near an hedge, where they may have the morning ſun only. The ſeed ſhould be covered about half an inch thick with fine light earth, and in very dry weather ſhould be gently refreſhed with water. In about ſix weeks, if your ſeeds were good, your plants will come up, at which time you ſhould careſully guard them againſt the rapacious birds, which would otherwiſe pull off the heads of the plants, as they thruſt themſelves out of the ground with their covers on them; and obſerve to refreſh them with water in dry weather, eſpecially if they are ſown in pots or boxes; as alſo to keep them clear from weeds, which, if ſuffered to grow among the young plants, will ſoon deſtroy them: nor ſhould they be too much expoſed to the ſun, or ſtrong winds; both which are very injurious to theſe plants, while they are young: but in October you ſhould, if they are in boxes or pots, remove them into a ſituation where they may be defended from ſharp winds, which are ſometimes hurtful to them, while young; but afterwards they will endure the ſevereſt weather of our climate.

Theſe trees are very proper for the ſides of barren hills, where few other ſorts will thrive ſo well; nor is this tree very delicate in its ſoil, but will grow much better on poor ſtrong ſtony land, than in rich ground: and, during the ſummer, they appear very beautiful; but in autumn they caſt their leaves, whereby ſome people have been deceived, by ſuppoſing them dead, and have deſtroyed them.

From the wounded bark of this tree exudes the pureſt Venice turpentine; and on the body and branches of it grows the agaric, which is a drug uſed in medicine: the wood is very durable, and, by ſome, reported to be very difficult to burn. But I do not know how this ſhould be, to a tree which abounds with turpentine; though it is ſaid alſo to be ſo ponderous as to ſink in water. It will poliſh exceeding well, and is by the architects abroad much coveted, both for houſes, and building of ſhips. Witſen, a Dutch writer upon naval architecture, mentions a ſhip to be long ſince found in the Numidian ſea, twelve fathoms under water, being chiefly built of this timber and cypreſs, both which woods were reduced to that hardneſs, as to reſiſt the ſharpeſt tools; nor was any part of it periſhed, though it had lain above a thouſand years ſubmerged. And it was upon tables of this wood that Raphael, and ſeveral of the greateſt artiſts, eterniſed their ſkill, before the uſe of canvas was introduced. *Miller's Gard. Dict.*

LARK, *Alauda*, in ornithology, a diſtinct genus of birds; the characters of which are theſe: the tongue, which is membranaceous and pointed, has a rim or margin round it; the beak is ſtraight, and pointed; the two chaps equal in ſize; and the claw of the hinder toe longer than any of the other toes.

To this genus belong, 1. The ſky-lark, with the long winged feathers, variegated with white and brown. 2. The tit lark, with a white line over the eyes. 3. The wood-lark, with the wings obliquely variegated with white. 4. The yellow-breaſted lark. 5. The ſnow-bird, or pied chaffinch, with the tail feathers black, except the three lateral ones, which are white.

LARK-SPUR, delphinium, in botany. See the article DELPHINIUM.

LARMIER, in architecture, a flat ſquare maſſive member of the corniche, between the cymatium and ovolo.

The word is derived from the French *larme*, a tear, as it cauſes the rain-water to fall at a diſtance from the wall drop by drop like tears. See CORNICHE.

LARUS, the gull, in ornithology, a genus of the anſeres order of birds, thus characterized: the beak is ſtraight all the way, except juſt at the point, where it turns down; add to this, that it is obtuſe, not denticulated along the ſides, and its lower chap gibbous or protuberant underneath.

LARYNGOTOMY, or BRONCHOTOMY. See the article BRONCHOTOMY.

LARYNX, in anatomy, forms the protuberance in the upper and anterior part of the neck, called pomum Adami: it is termed the head of the trachea arteria, being more prominent in men than in women. It principally conſiſts of five cartilages, as the cartilago thyroides, cricoides, two arytenoides, and the epiglottis; they are connected together by ligaments, and have muſcles, glands, and membranes belonging to them. The cartilago thyroides, which is the anterior and largeſt, is folded ſo as to have a longitudinal convexity on the foreſide, and two lateral portions which may be termed alæ.

The cricoid cartilage, which is the inferior and baſis of the reſt, reſembles a thick irregular ring, very broad on one ſide, and narrow on the other. It may be diſtinguiſhed into a baſis and top, into an interior, poſterior, and two lateral ſides. To the baſis the aſpera arteria is connected, ſo that the cricoides is the upper extremity of the trachea.

The cartilagines arytenoidææ are two ſmall, equal, and ſimilar cartilages, which joined together reſemble the ſpout of an ewer, and are ſituated on the top of the cricoides.

The epiglottis is an elaſtic cartilage, nearly like a purſlane leaf. It is ſituated above the anterior portion of the thyroides, and its lower extremity is tied by a ſhort, pretty broad, and very ſtrong ligament to the upper edge of that cartilage.

The cartilago thyroides is connected to the cricoides by ſeveral ſhort, ſtrong, ligaments, as alſo to the os hyoides by ſlender round ligaments, about a quarter of an inch in length.

In the middle of each of theſe ligaments we often meet with a ſmall cartilage of an oval figure, and much thicker than the ligaments. The thyroides is likewiſe connected to the os hyoides by a ſhort, broad, ſtrong ligament. It has alſo two ligaments which belong to the arytenoidææ.

The cricoides is tied to the lower part of the thyroides by a ſtrong ligament, and by the ligaments already mentioned to the inferior cornua of that cartilage. Its baſis is fixed to the firſt cartilaginous ring of the trachea arteria by a ligament exactly like thoſe by which the other rings are connected, and the membranous portion of the trachea is likewiſe fixed to the poſterior part of the baſis of the cricoides.

The cartilagines arytenoidææ are connected to the cricoides by ligaments which ſurround their articulations with the top of that cartilage. Anteriorly the baſis of each arytenoides is fixed to one end of a ligamentary cord, which by its other end is inſerted about the middle of the concave ſide of the anterior portion of the thyroides. At their inſertions in the thyroides theſe two ligaments touch each other; but a ſmall ſpace is left behind them; this is what is called the glottis.

Under theſe two ligamentary cords are two others, which run

run likewiſe from behind forward. The interſtice between the ſuperior and inferior cords on each ſide forms a tranſverſe fiſſure. Theſe two ſacculi are the ventricles of the ancients, and reſtored by Morgagni. They are principally formed by a continuation of the internal membrane of the larynx, and the inner ſurface of their bottom appears ſometimes glandulous.

On the anterior ſurface of the arytenoid cartilages there is a ſmall depreſſion filled by a glandulous body, which not only covers each arytenoid, but is alſo extended forward over the poſterior extremity of the neighbouring ligamentary cord. Theſe glands were diſcovered by Morgagni.

The epiglottis has alſo two lateral ligaments, by which it is connected to the arytenoides. It has alſo a membranous ligament, which ties it to the root of the tongue. This ligament is a duplicature of the membrane which covers the epiglottis. Laſtly, there are two lateral membranous ligaments fixed near the glandulous bodies called amygdalæ.

The epiglottis is not only perforated by regular holes, like the leaves of St. John's wort, but has alſo a great many irregular ſciſſures or breaks, which are ſo many lacunæ.

The larynx gives inſertion to ſeveral muſcles, which may be divided into common, proper, and collateral: the common are all thoſe which move the whole body of the larynx, and are four in number; two on each ſide, the ſterno-thyroidæi, and the thyro-hyoidæi, or hyo-thyroidæi.

The proper muſcles are thoſe inſerted wholly in the larynx, and which move the cartilages ſeparately. Theſe may be reduced to the following pairs, crico thyro-hyoidæi, crico-arytenoidæi laterales, crico-arytenoidæi poſteriores, thyro-arytenoidæi, arytenoidæi, thyro-epiglottici, aryteno-epiglottici, and hyo-epiglottici.

The collateral muſcles are thoſe which are inſerted by one portion in the larynx, without appearing to contribute to its motion; ſuch are the thyro-pharyngæi and crico-pharyngæi.

The larynx may alſo be moved by muſcles, which are not immediately inſerted therein; ſuch as the mylo-hyoidæi, genio-hyoidæi, ſtylo-hyoidæi, omo-hyoidæi, ſterno-hyoidæi, and eſpecially the digaſtrici of the lower jaw, by reaſon of their particular adheſion to the os hyoides. It is probable that theſe muſcles of the pharynx, which are inſerted in the baſis cranii, may move the larynx in ſome ſmall degree.

The larynx ſerves particularly to admit and let out the matter of reſpiration; and the ſolidity of its pieces hinders not only external objects, but alſo any hard thing, which we ſwallow, from diſordering this paſſage. The glottis, being a narrow ſlit, modifies the air we breathe, and as it is very eaſily dilated and contracted, it forms the different tones of the voice, by means of the different muſcles inſerted in the cartilagines arytenoidææ, to which the other muſcles, both proper and common, are aſſiſtants.

The whole larynx is alſo of uſe in deglutition, by means of its connection with the os hyoides, to which the digaſtric muſcles of the lower jaw adhere, which muſcles raiſe the larynx with the os hyoides every time we ſwallow.

The faculty of varying and changing the tone of the voice depends on the flexibility of the cartilages of the larynx, and decreaſes in proportion as we advance in age.

The muſculi ſterno-thyroidæi ſerve in general to pull down the thyroid cartilage, and the whole larynx with it: they may alſo aſſiſt the ſterno-hyoidæi, and compreſs the thyroid gland.

The thyro-hyoidæi may either draw up the larynx toward the os hyoides, or draw that bone downward toward the cartilago thyroides.

The crico-thyroidæi may either pull the cricoides obliquely backward, or thyroides obliquely forward.

Both the lateral and poſterior crico-arytenoidæi may ſeparate the arytenoid cartilages, and thereby dilate the glottis, the lateral muſcles ſeparating theſe cartilages obliquely forward, and at the ſame time relaxing the ſides of the glottis; but the poſterior muſcles ſeparate them obliquely backward, and at the ſame time ſtretch the ſides of the glottis; and when both muſcles act equally, they ſeparate the cartilages directly.

The thyro-arytenoidæi acting together, draw both the arytenoid cartilages forward, and ſo looſen the glottis, and render it capable of the ſmalleſt quaverings of the voice. They may alſo probably compreſs the lateral ſinuſes of the larynx, and alſo the arytenoid glands.

The arytenoidæi draw the arytenoid cartilages cloſe together, and preſs them againſt each other, and when in this ſituation, they may be inclined either forward by the thyro arytenoidæi, or backward by the crico-arytenoidæi poſteriores. By this means the glottis, when ſhut, may be either relaxed or tenſe; and in the laſt caſe, it is entirely ſhut, as when we hold in our breath in ſtraining.

The general uſe of the epiglottis is to cover the glottis like a penthouſe, thereby to hinder any thing from falling into it when we eat or drink, and for this purpoſe it is depreſſed. It alſo ſerves to hinder the air which we inſpire from ruſhing directly upon the glottis; but by ſplitting it, obliges it to enter in an oblique courſe. In deglutition the epiglottis may be ſufficiently depreſſed by the baſis of the tongue, and it may raiſe itſelf again by its own elaſticity without the aſſiſtance of its muſcles. The thyro-epiglottici and aryteno-epiglottici may ſerve to ſhut any lateral openings, that might remain, when the epiglottis is depreſſed by the baſis of the tongue; and the hyo-epiglottici may pull it a little forward in ſtrong reſpirations, as in ſighing or yawning. *Winſlow's Anat.*

LASERPITIUM, Laſer-wort, a genus of plants, the general corolla of which is uniform; the partial one conſiſts of five nearly equal petals, inflexo-cordated at the ends; there is no pericarpium; the fruit is oblong and ſeparable into two parts, and is ridged with eight longitudinal membranes; the ſeeds are two, very large, oblong, and ſemi-cylindric, plane on the one ſide, but on the other ornamented on the back and edges with four membranes.

LASSITUDE, *Laſſitudo*, in phyſic, a morbid ſenſation that comes on ſpontaneouſly without any previous motion, exerciſe, or labour. This is a frequent ſymptom in acute diſtempers. It ariſes either from an increaſe of bulk, a diminution of proper evacuation, or too great a conſumption of the fluid neceſſary to maintain the ſpring of the ſolids, or form a vitiated ſecretion of that juice.

The remedy in the firſt caſe is evacuation, and in the other a proper diet, or ſuch alterative medicines as influence ſuch a ſecretion.

LAST, in general, ſignifies the burden or load of a ſhip.

It ſignifies alſo a certain meaſure of fiſh, corn, wool, leather, &c. A laſt of cod-fiſh, white herrings, meal, and aſhes for ſope, is twelve barrels; of corn or rape-ſeed, ten quarters; of gun-powder, twenty-four barrels; of red-herrings, twenty cades; of hides, twelve dozen; of leather, twenty dickers; of pitch and tar, fourteen barrels; of wool, twelve ſacks; of ſtock-fiſh, one thouſand; and of flax or feathers, one thouſand and ſeven hundred pounds weight.

LAST, in the marſhes of Kent, is applied to a court held by the twenty four jurats, in which orders are given for the impoſing and levying of taxes for preſerving the ſaid marſhes.

LAST-HEIR, in law, he to whom lands come by eſcheat, for want of lawful heirs; who, in many caſes, is the lord of whom they are held, but in others the king.

LATERAL EQUATION, in algebra, a ſimple equation, whoſe root is only in one dimenſion.

LATERAN COUNCILS, thoſe councils held in the Baſilica of the Latin church at Rome. See the article COUNCIL.

There have been five councils held in this place, viz. in the years 1123, 1139, 1179, 1215, and 1513.

A LATERE, a term uſed to denote the qualifications of cardinals whom the pope ſends as legates into foreign courts, who are called legates a latere, as being aſſiſtants to his holineſs, and counſellors in ordinary; theſe are the moſt conſiderable of the three other legates, being ſuch as the pope commiſſions to take his place in councils,

and

and ſo called in regard that he never gives this office to any but his favourites and confidants, who are always *a latere*, at his ſide.

De LATERE, legates who are not cardinals, but yet are entruſted with an apoſtolical legation.

LATH, in building, a long, thin, and narrow ſlip of wood, nailed to the rafters of a roof or ceiling, in order to ſuſtain the covering.

Theſe are diſtinguiſhed into three kinds, according to the different kinds of wood of which they are made, viz. heart of oak, ſap laths, and deal laths; of which the two laſt are uſed for ceilings and partitions, and the firſt for tiling only.

Laths are alſo diſtinguiſhed according to their length, into five feet, four feet, and three feet laths, though the ſtatute allows but of two lengths, thoſe of five, and thoſe of three feet, each of which ought to be an inch and a half in breadth, and half an inch in thickneſs, but they are commonly leſs.

Of Cleaving LATHS.—The lath-cleavers having cut their timbers into lengths, they cleave each piece with wedges, into eight, twelve, or ſixteen, according to the ſize of their timber; theſe pieces are called bolts: this is done by the felt-grain, which is that grain which is ſeen to run round in rings at the end of a piece of a tree. Thus they are cut out for the breadth of the laths, and this work is called felting.—Afterwards they cleave the laths into their proper thickneſs with their chit, by the quarter grain, which is that which runs in ſtraight lines towards the pith. See the article GRAIN.

LATH-BRICKS, bricks much longer than ordinary, uſed inſtead of laths, for drying malt; for which purpoſe they are extremely proper, as not being liable to catch fire, and retaining the heat much longer than thoſe of wood; ſo that a very ſmall fire will ſerve, after they are once heated. See BRICK and MALT.

LATHE, an engine uſed in turning wood, ivory, and other materials. See plate LXXVII. *fig.* 6. It is compoſed of two legs or ſtyles, *a a*, which are commonly about two feet ten inches high, on the upper-part of which are faſtened two pieces of wood called cheeks, *b*, *b*, parallel to the horizon; between theſe are two pieces of wood, called puppets, *c*, *c*, made to ſlide between the cheeks, and to be fixed down at any point at pleaſure; near the upper end of one of theſe puppets is faſtened a ſtrong ſpike of tempered ſteel, *d*, and oppoſite to it, in the other, is an iron-ſcrew, *f*; by theſe the piece to be turned is ſuſtained, and is turned round by means of the ſtring *m*, put round it, and faſtened above to the pliable pole *l*, and underneath to the treddle or board, *i*, moved with the foot: there is alſo a piece of wood between the cheeks, called a reſt, *e*, whoſe office is to reſt the tool upon, that it may lie in a ſteady poſition while the workman uſes it.

When turners perform heavy work, which the pole and treddle will not command, they uſe inſtead of theſe a wheel (*fig.* 7.), which is turned about ſometimes with one, and ſometimes with two handles, according to the weight of the work; its ſtring hath both its ends neatly faſtened together, and this being fixed in a groove round the edge of the wheel, and after being croſſed, put round a groove in the work, it is eaſily turned round with a ſwift and regular motion. This is the moſt expeditious method of working; for the ſpringing up of the pole makes an intermiſſion in the turning of the work, but with the wheel it always turns the ſame way, ſo that the tool need never be taken off, unleſs it be to examine the work as it is doing.

Braziers, who turn pots, kettles, &c. have their lathe made in a different manner from that uſed by turners, as may be ſeen in *fig.* 8.

The puppets and reſts are much ſtronger than thoſe uſed by the turners: their edge-tools, which they call hooks, are alſo of a different ſhape from the chiſſels and other tools uſed by turners, as may be ſeen *ibid.* marked B 1, B 2, B 3, being bent backwards and forwards at the cutting end. And as the common turners work with a round ſtring made of gut, the braziers work with a flat leather-thong, which wrapping cloſe and tight about the rowler of their mandril, commands it with the greater eaſe, and turns it more forcibly about.

Small work in metal is turned in an iron-lathe, called a turn-bench, repreſented in *fig.* 9. When this is uſed, it is fixed in the chaps of a vice, and the work being fitted on a ſmall iron-axis, with a drill barrel fitted upon a ſquare ſhank near the end of it, the workman turns it round with a drill-bow, which he holds in his left hand, while he forms the moulding with a graver or other tool, which he holds in his right.

In turning oval or roſe-work, the common turner's lathe muſt be provided with the additional parts repreſented in *fig.* 10. which repreſents the whole machine with all its parts ready for working, A being the fore-puppet, with its apparatus; B, the hinder-puppet; C, a hollow axis, turned into a ſcrew-faſhion, to direct the weight D, by means of the nut E; and F, the ſupport of the tools, which may be raiſed or lowered at pleaſure.

LATHE, or LETH, as uſed in Kent and Suſſex, is part of a county, containing three or four hundreds.

LATHRÆA, great tooth-wort, in botany, a genus of plants, the corolla whereof conſiſts of a ſingle petal; the tube is longer than the cup; the limb is ringent and ventricoſe; the upper lip is concave, galeated, and broad, with a narrow crooked apex; the inferior one is leſs, and is reflex, obtuſe, and trifid; the fruit is a roundiſh elaſtic capſule, conſiſting of two valves, and containing only one cell; it is covered with a very large patent cup; the ſeeds are few and roundiſh.

LATHYRUS, chickling pea, in botany, a genus of plants, the corolla of which is papilionaceous; the fruit is a very long, cylindric or compreſſed, acuminated pod, conſiſting of two valves; the ſeeds are numerous, of a cylindric, globoſe, or ſomewhat angular figure.

LATIN, a dead language, firſt ſpoken in Latium, and afterwards at Rome; and ſtill uſed in the Romiſh church, and among many of the learned.

This language is principally derived from the Greek, and particularly from the Eolic dialect of that tongue, though it has a great number of words which it borrowed from the languages of the Etruſci, Oſci, and other antient people of Italy; and foreign commerce and wars, in courſe of time, added a great many more.

The Latin is a ſtrong nervous language, perfectly ſuitable to the character of the people who ſpoke it: we have ſtill works of every kind, admirably well written in the Latin, though there are vaſt numbers loſt. The Latin is more figurative than the Engliſh, more harmonious than the French, leſs copious than the Greek, leſs pompous than the Spaniſh, leſs delicate than the Italian, but cloſer and more nervous than any of them.

The Latin tongue was for a while confined almoſt wholly within the walls of Rome; nor would the Romans allow the common uſe of it to their neighbours, or to the nations they ſubdued: but, by degrees, they in time became ſenſible of the neceſſity of its being generally underſtood, for the conveniency of commerce; and accordingly uſed their endeavours that all the nations ſubject to their empire, ſhould be united by one common language, ſo that at length they impoſed the uſe of it, by a particular law for that purpoſe. After the tranſlation of the ſeat of the empire from Rome to Conſtantinople, the emperors of the eaſt being always deſirous of retaining the title of Roman emperors, appointed the Latin to be ſtill uſed; but at length neglecting the empire of the weſt, they abandoned all the care of the Latin tongue, and uſed the Greek. Charlemagne coming to the empire of the weſt, revived this language; but at length it gave way, and the French took place of the Latin.

The Latin, however, was prodigiouſly degenerated; for the incurſions of the Goths and Vandals brought an inundation of foreign words into it. But that was not all: when it once got into the courts of juſtice, it was ſtill worſe handled; till at laſt, being introduced amongſt the monks, it was debauched to that degree, that it was almoſt ſcandalous to uſe it.

In this condition it was found at the Reformation, where Lud. Vives, Eraſmus, &c. began to open the way for its recovery; ſince which time endeavours have been uſed to retrieve the pure Latinity of the Auguſtan age. See LANGUAGE.

LATISSIMUS, in anatomy, a large muſcle of the back, ſo called from its great breadth.

5 JA 59

Fig. 1. Latitude.

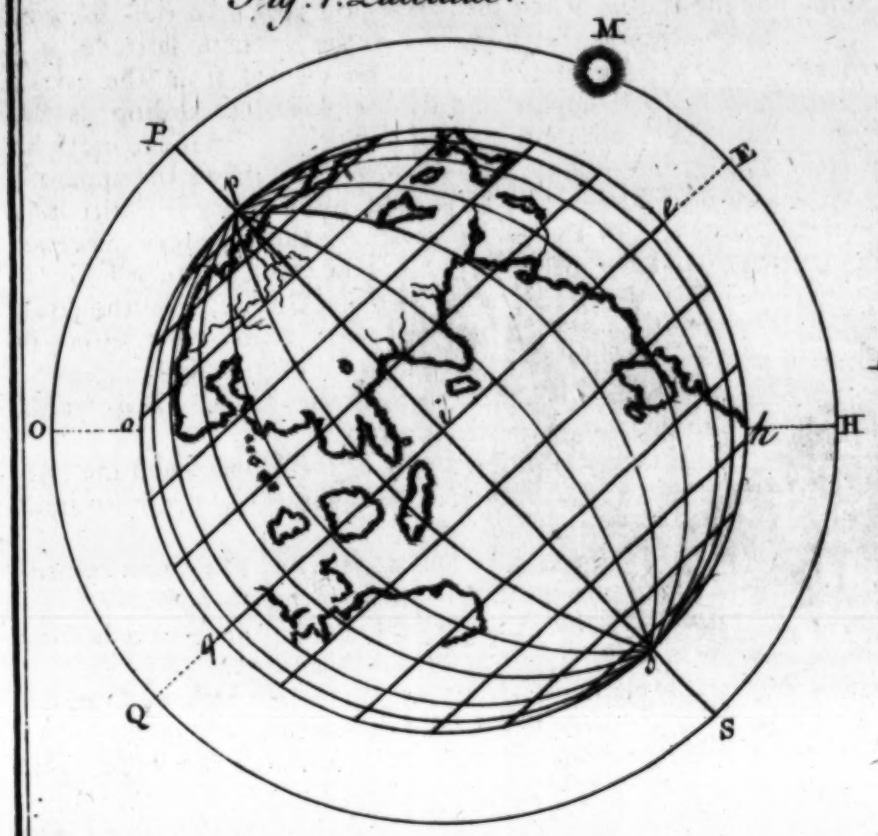


Fig. 2. Latitude.

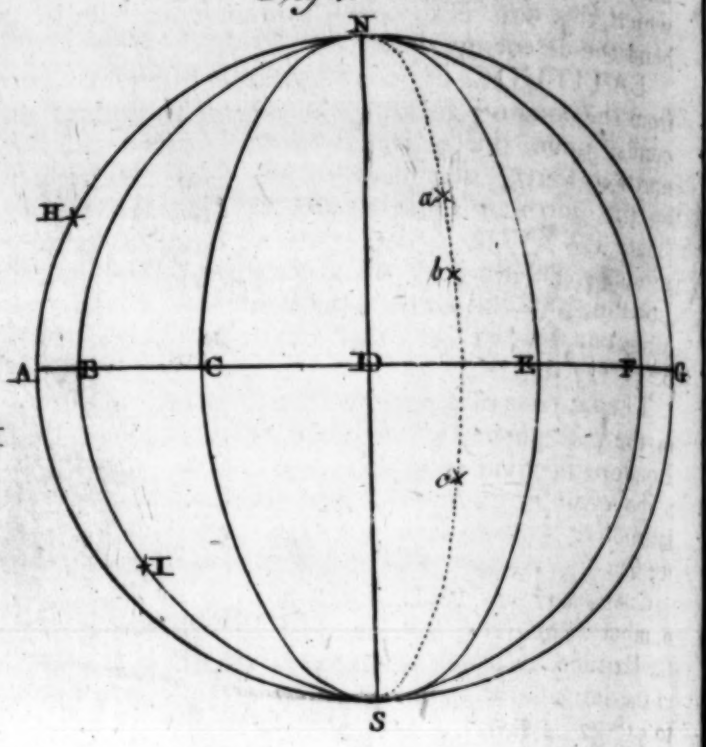


Fig. 4. Latus Transversum.

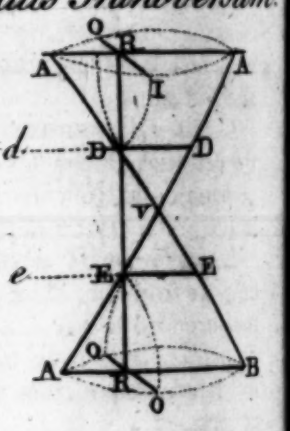
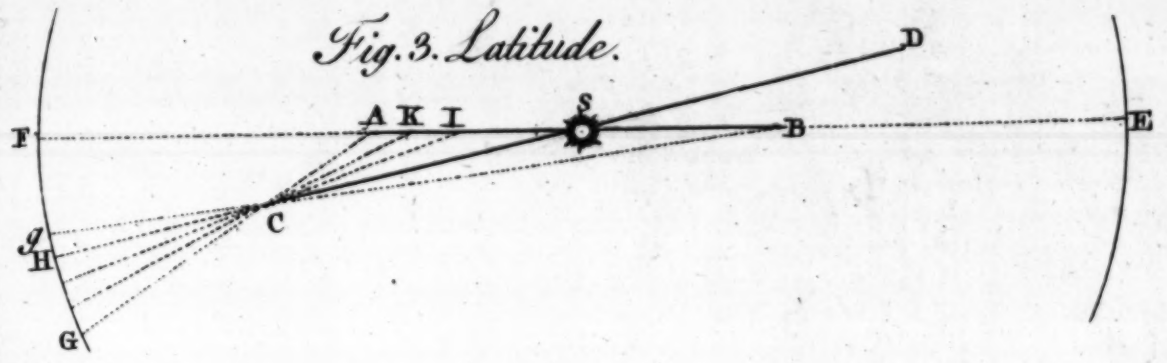
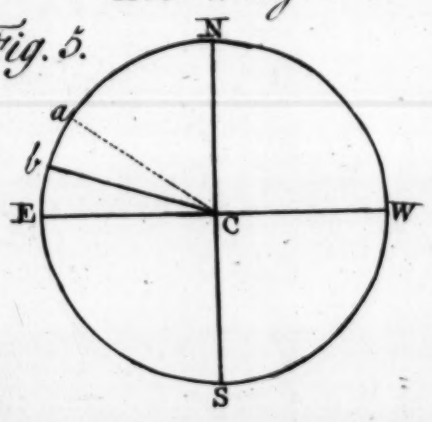


Fig. 3. Latitude.



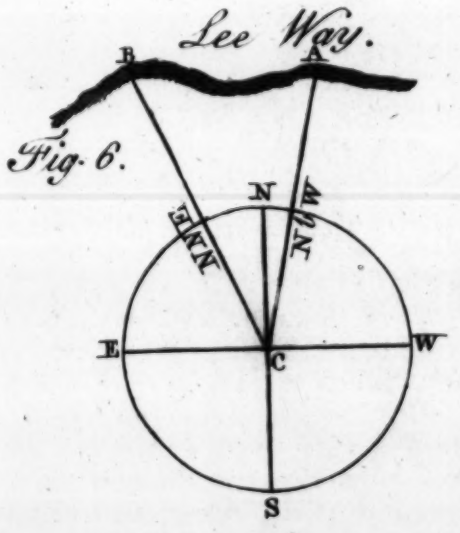
Lee Way.

Fig. 5.



Lee Way.

Fig. 6.



Lens

Fig. 7.

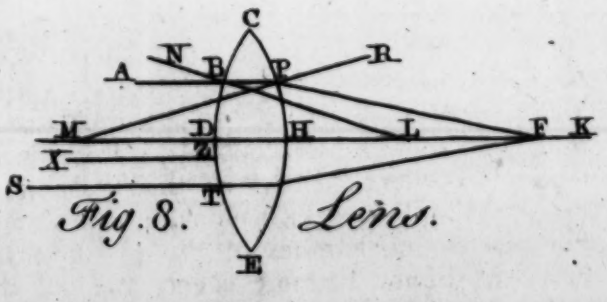


Fig. 8. Lens.

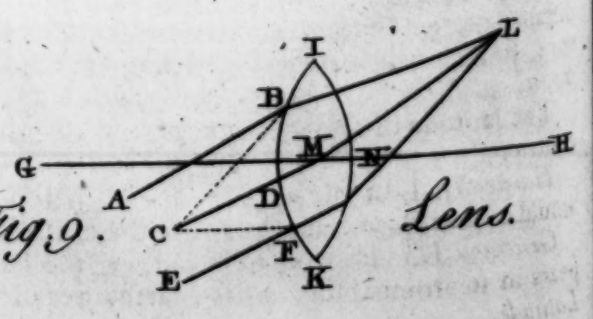


Fig. 9. Lens.

LATITAT, in law, a writ whereby all men in perſonal actions are called originally to the king's-bench: it is ſo called, as the defendant is ſuppoſed to lurk and cannot be found in the county of Middleſex to be taken by bill; but is gone to ſome other county, to the ſheriff of which this writ is directed, commanding him to apprehend the defendant there.

LATITUDE, in geography, the diſtance of any place from the equator, meaſured in degrees, minutes and ſeconds, upon the meridian of that place; and is either north or ſouth, according as the place is ſituated either on the north or ſouth ſide of the equator: Thus let *l* (plate LXXVIII. *fig.* 1.) repreſent London, *p* the north pole, *eq* the equator; then will *p l e s* be the meridian of London, and the arch *e l* the latitude of London, which being equal to 51° 32′, the latitude of London, is ſaid to be 51° 32′ north.

The latitude of a place is always equal to the elevation of the pole above the horizon: Thus *l e*, the latitude of London, is equal to the arch *p o*, the elevation of the pole *p* above the horizon *h o*.—For the method of finding the latitude of a place from obſervations of the ſun or ſtars, ſee OBSERVATION.

Complement of the LATITUDE, in geography, is the number of degrees, minutes, and ſeconds, which, added to the latitude, make it equal to 90°: Thus the complement of the latitude of London is 38° 28′; for 38° 28′ added to 51° 32′ is equal to 90°.

The complement of the latitude is always equal to the elevation of the equator above the horizon, or the angle intercepted between the plane of the equator and the plane of the horizon. Thus let *l* (plate LXXVIII. *fig.* 1.) be London, the latitude of London is the arch *e l*; the complement of the latitude is the arch *e h*, which meaſures the elevation of the equator *e q*, above the horizon *h o*, or the angle *e i h*, intercepted between the planes of the equator and horizon.

Circles of LATITUDE, in aſtronomy, are ſecondaries to the ecliptic, or circles drawn on the ſphere of the heaven, perpendicular to the ecliptic, and interſecting each other in the poles of the ecliptic.

LATITUDE *of a Star or Planet*, in aſtronomy, is its diſtance from the ecliptic in degrees, minutes, and ſeconds, meaſured on a circle of latitude drawn through that ſtar or planet, and may be either north or ſouth, as the object is ſituated either on the north or ſouth ſide of the ecliptic.

The ecliptic is drawn on the common celeſtial globes, by which we may ſee what conſtellations it paſſes through; there are alſo uſually ſix circles of latitude, which by their mutual interſections ſhew the poles of the ecliptic, as well as divide it into twelve equal parts, anſwerable to the numbers of months in a year. Plate LXXVIII. *fig.* 2. repreſents a celeſtial globe, where A G is the ecliptic, N the north, S the ſouth pole of the ecliptic, N A S, N B S, N C S, N D S, &c. are circles of latitude, or rather halves of them, which is as much as can be ſeen at one view upon the convex of the ſolid globe. The ſtar H is in ſo many degrees, minutes, and ſeconds of north latitude as the arch H A amounts to; the ſtar I is in ſouth latitude, the quantity whereof is meaſured by the arch I B.

From what has been ſaid it appears, that we muſt carefully diſtinguiſh the different notions of latitude, when applied to ſtars in the heaven, or places on the earth; that is, between latitude in aſtronomy, and latitude in geography; for in the heaven, or upon the celeſtial globe, it is the diſtance from the ecliptic; but upon the earth, or upon the terreſtrial globe, it is the diſtance from the equator. Indeed, ſometimes we conſider the diſtance of the heavenly bodies from the celeſtial equator; but this is called declination. See DECLINATION.

The latitude of a planet is either heliocentric, or geocentric.

Heliocentric LATITUDE *of a Planet* is the latitude it would appear in to a ſpectator placed in the ſun.

Geocentric LATITUDE *of a Planet* is the latitude it appears in to an inhabitant of the earth. See GEOCENTRIC *Latitude*.

To illuſtrate the difference between the heliocentric and geocentric latitude of a planet, let A B (plate LXXVIII. *fig.* 3.) be the orbit of the earth, C D the orbit of Mars, both viewed with the eye in their common ſection continued, whereby they appear ſtraight lines; let E and F be oppoſite points of the ecliptic: ſuppoſe Mars to be in his ſouth limit at C; if he were at that time viewed from S, the center of the ſun, he would appear in the ſphere of the heaven at the point H; his heliocentric latitude then is F H. But let Mars in C be viewed from the earth, and he will appear in different places, according as the earth is in different parts of her orbit; for if the earth be at B, a line drawn from B through C ſhews the apparent place of Mars to be at *g*, and his geocentric latitude is then F *g*; if the earth be at A, the apparent place of Mars will be in G, and his geocentric latitude F G; if the earth be in any other part of her orbit, as at the point I or K, it is eaſy to ſee, by a line drawn from either of thoſe points through Mars at C, that he will appear in different places in the ſphere of the heaven, and would be in different geocentric latitudes.

North aſcending LATITUDE *of the Moon*, when ſhe proceeds from the aſcending node towards her northern limit or greateſt elongation.

North deſcending LATITUDE is when the moon returns from her northern limit to the deſcending node.

South deſcending LATITUDE, when ſhe proceeds from the deſcending node to her ſouthern limit.

South aſcending LATITUDE, when ſhe returns from her ſouthern limit to her aſcending node.

And the ſame things hold good of the other planets.

LATITUDINARIAN, a perſon of moderation, with regard to religious opinions, who believes there is a latitude in the road to heaven, which may admit people of different perſuaſions.

LATTEN, a name formerly given to the plates of iron covered with tin, and now uſually called tin, of which our mugs, tea-canniſters, and the like, are made. The method of preparing thoſe plates of tin, as they are called, is as follows: plates of iron are prepared of a proper thinneſs; theſe are cut into ſquares fitted to receive the tinning; but it is not every kind of iron that will ſerve for this purpoſe, but only ſuch as is moſt diſtenſible, eaſily beating out to any degree of thinneſs when hot, and malleable even when cold, without danger of flying to pieces. Of this the Germans have large quantities, which they always ſelect for this purpoſe. This ſort of iron is firſt formed into ſquare bars of an inch in diameter; theſe they beat out a little into flatneſs, and then cut into pieces, which they call ſemelles, or ſoles. They fold theſe together, and having made them into parcels, containing forty pieces each, they beat them all at once with a hammer which weighs ſix or ſeven hundred weight. When they have done this, the principal part of the whole work is to prepare the leaves, now beat out to a proper thinneſs, ſo as that they ſhall readily receive the tin; for if there be but the ſmalleſt particle of duſt on them, or only the ſlighteſt ruſt in any part, the tin will never fix there.

This ſmoothing of the plates may be brought about by filing them, but that would be too expenſive, wherefore they do it by ſteeping them in acid waters. Thus preparing a great number at a time, they leave them in this liquor till the ſurface is a little preyed upon by it, and then they are ſcowered with ſand, which makes them very ſmooth and fine. By this means a woman cleans more plates in an hour, than the moſt expert workman can do in many days. Mr. Reaumur, to whom the world owes the diſcovery of this proceſs, mentions ſeveral waters, any one of which will ſucceed; but the Germans themſelves uſe nothing but common water, made eager with rye. This they make a great ſecret of, but the preparation is very eaſy. After they have ground the rye groſly, they leave it to ferment in common water for ſome time; and they are thus ſure of a ſharp and eager menſtruum, excellently fitted for their purpoſe. With this liquor they fill certain troughs, or tons, and into theſe they put ſeveral bundles of the plates of iron: and to make the liquor be more eager; and act the better on them, they keep it in ſtoves, where it has little air, and is kept warm with ſmall charcoal fires. The workmen go into theſe vaults once or twice a day, to turn the

plates, that they may be the better wrought upon, and put in others in their room. The more acid the liquor is, and the warmer the ſtove, the ſooner the plates are cleanſed: it requires, however, at leaſt two days to effect this, and frequently ſomething more.

This was the method which the German labourers, employed in the tin works in France, always made uſe of, in order to prepare the iron to receive the covering of tin; but the author, finding that this was a very laborious employ, and that the heat in the ſtoves was ſo great, that they could hardly bear it, propoſed ſome other methods in the place of this, which were attended with much leſs trouble, and as ſmall expence, if not leſs; and theſe, upon trial, were found to ſucceed equally well.

Having obſerved that the iron leaves, or plates, are covered with a ſmall layer of a ſort of ruſt, which they contract in the fire, and which the acid liquor took very little hold of; he judged it might be better to expoſe the plates to ruſt, in order to the cleanſing them eaſily of it; as ruſt is always accompanied with a ſort of fermentation, and the particles of ruſt, found on the ſurface of the iron, would be ſure to raiſe up every thing in their way. To this purpoſe he ſteeped the plates of iron in waters in which were ſeparately diſſolved alum, common ſalt, and ſal armoniac. Some other plates he did not ſteep in theſe liquors, but only juſt dipped them in, and then expoſed them to the air to ruſt. All theſe liquors, thus uſed, cauſed the iron to ruſt very freely, but the ſal armoniac beſt of all. After two days, during which every plate had been dipped into this menſtruum only twice or thrice, he ordered both theſe, and thoſe which had been left ſteeping during the ſame ſpace of time, to be ſcowered; and on comparing them together, it was found, that thoſe which had been dipped, and expoſed to the air, became much cleaner than thoſe which had been all the time ſteeped. The ruſt covered all the ſurface in the latter, without raiſing the ſcale; whereas, in the former, the ſurface was raiſed into bliſters of ruſt, which carried it wholly off with them. The diſſolvents, though very weak, are obſerved to produce the deſired effect, as well as ſtronger, which muſt be much dearer; but, among the latter, he prefers vinegar in France, which ſucceeds very well, and, being plentiful there, is very cheap. This operates ſo quick on the iron, that the plate need only be once dipped into it, and immediately taken out again, and ſet in a moiſt place, where it will ruſt in eight and forty hours. If the dipping is repeated three or four times, the ruſting will be ſtill more expeditious, and eſpecially if a ſmall quantity of ſal armoniac be diſſolved in the vinegar, about a pound to the puncheon. This will make a very efficacious menſtruum, the vinegar diſſolving iron very well, and the ſal armoniac ruſting it ſooner than any other ſalt. This however muſt be uſed very moderately, and the plate muſt be ſteeped in cold water afterwards, to take off any particle that might yet remain upon it, otherwiſe it would be ſubject to ruſt after it was tinned.

There are ſeveral other ways of making iron ruſt, as keeping it in a moiſt cellar, expoſing it to the dew, ſprinkling it with ſimple water, or, which is ſtill better, with water in which ſal armoniac has been diſſolved, ſeveral times a day; and in thoſe countries where the pyrites is common, the vitriolic waters, which partake of it, will do it very well. This water may be prepared at little or no expence, only by heaping up large quantities of the pyrites, and letting it moulder in the air, then putting it into common water, and making a lixivium of it.

The leaves of tin, when they are finiſhed, are always found to be more bright and gloſſy on one ſide than on the other, which is owing to the plates of iron having always ſeveral roughneſſes on one ſide, where it has been moſt expoſed to the hammer. Theſe roughneſſes are what are principally to be eaten down by the menſtruums; for which reaſon Mr. Reaumur greatly prefers ſprinkling, or wetting them, to ſteeping; becauſe, in ſteeping, as both ſides are equally expoſed to the force of the menſtruum, the ſmooth ſide muſt be conſequently eaten away too far, while the other is but eaten barely enough; this occaſions a loſs of the iron, which the author propoſes to ſave by ſprinkling, or ſimply wetting, as the bad ſide only might be ſubjected to the action of the menſtruum.

There are two other cautions, very neceſſary to be obſerved in this part of the work. The firſt is in the management of the plates, before they come to be prepared; which is, in the beating of them, to turn them continually about, ſo that all parts of every plate may be equally extended. And the other is, to plunge them into ſome ſoft clay, or fuller's earth, before they are heated, that they may not ſolder themſelves together.

Which ever method of ruſting the plates be uſed, it is always neceſſary to ſcower them with ſand, as ſoon as it is done; and, when they are thus cleaned, they muſt be immediately plunged into water, to prevent their ruſting again; and they are to be left in this water till the inſtant in which they are to be tinned, or, in the language of the workmen, blanched. The people employed in this part of the operation are called blanchers, and the others, who aſſiſt at the cleaning the plates, the ſealers. The blancher makes as great a ſecret of his art, as the ſealer does of his; and it was with great difficulty that Mr. Reaumur obtained it. The manner of doing it is this:

They flux the tin in a large iron crucible, which has the figure of an oblong pyramid with four faces, of which two oppoſite ones are leſs than the two others. The crucible is heated only from below, its upper part being luted with the furnace all round.

The crucible is always deeper than the plates, which are to be tinned, are long; they always put them in downright, and the tin ought to ſwim over them. To this purpoſe artificers of different trades prepare plates of different ſhapes, but Mr. Reaumur thinks them all exceptionable. But the Germans uſe no ſort of preparation of the iron, to make it receive the tin, more than the keeping it always ſteeped in water till the time; only, when the tin is melted in the crucible, they cover it with a layer of a ſort of ſuet which is uſually two inches thick, and the plate muſt paſs through this before it can come to the melted tin. The firſt uſe of this covering is to keep the tin from burning; as, if any part ſhould take fire, the ſuet would moiſten it, and reduce it to its primitive ſtate again. The blanchers ſay, this ſuet is a compounded matter. It is indeed of a black colour, but Mr. Reaumur ſuppoſes that to be only an artifice to make it a ſecret, and that it is only coloured with ſoot, or the ſmoke of a chimney; but he found it true ſo far, that the common unprepared ſuet was not ſufficient; for after ſeveral attempts, there was always ſomething wanting, to render the ſucceſs of the operation certain. The whole ſecret of blanching, therefore, was found to lie in the preparation of this ſuet; and this he at length diſcovered to conſiſt only in the firſt frying and burning it. This ſimple operation not only gives it the colour, but puts it into condition to give the iron a diſpoſition to be tinned, which it does ſupriſingly.

The melted tin muſt alſo have a certain degree of heat; for if it is not hot enough, it will not ſtick to the iron; and if it is too hot, it will cover it with too thin a coat, and the plates will have ſeveral colours, as red, blue, and purple; and upon the whole, will have a caſt of yellow. To prevent this, by knowing when the fire has a proper degree of heat, they might try with ſmall pieces of iron; but, in general, uſe teaches them to know the degree, and they put in the iron when the tin is at a different ſtandard of heat, according as they would give it a thicker or a thinner coat. Sometimes alſo they give the plates a double layer, as they would have them very thickly covered. This they do by dipping them into the tin, when very hot, the firſt time, and when leſs hot, the ſecond. The tin which is to give the ſecond coat, muſt be freſh covered with ſuet, and that with the common ſuet, not the prepared. *Phil. Tranſ.* N°. 406.

LATTEN-BRASS, plates of milled braſs, reduced to different thickneſs, according to the uſes it is intended for.

LATUS *Rectum*, in conics, the ſame with parameter. See PARAMETER.

LATUS TRANSVERSUM *of the Hyperbola*, a right line intercepted between the vertices of the two oppoſite ſections; or that part of the common axis, which is between the vertices of the upper and lower cones.

Such is the line E D (plate LXXVIII. *fig.* 4.) where alſo D *d* and E *e* may be the parameters or latus rectums be-

belonging to the two oppoſite ſections DLRO and OEOR.

To this latus tranſverſum anſwers the longeſt diameter in the ellipſis, which Apollonius calls the tranſverſe axis or diameter.

LATUS PRIMARIUM, a right line belonging to a conic ſection, drawn through the vertex of the ſection of the cone, and within it, as the line EE or DD. *fig.* 4.

LAVANDULA, lavender, in botany, a ſhrubby plant, with its leaves ſet in pairs, the ſtalks ſquare when young, and round when grown woody; producing on the tops of the branches, naked ſpikes of blue labiated flowers, of which the upper-lip is erect and cloven, the lower divided into three roundiſh ſegments.

LAVANDULA *Minor ſive ſpica*, lavender with oblong, very narrow, ſomewhat hoary, undivided leaves; a native of dry gravelly ſoils in the ſouthern parts of Europe, common in our gardens, and flowering in July.

The flowers of lavender have a fragrant ſmell, to moſt people agreeable, and a bitteriſh, warm, ſomewhat pungent taſte: the leaves are weaker, and leſs grateful. They are often employed as a perfume; and medicinally, as mild ſtimulants and corroborants, in vertigoes, palſies, tremors, and other debilities of the nervous ſyſtem, both internally and externally.

The flowers are ſometimes taken in the form of conſerve; into which they are reduced, by beating them, while freſh, with thrice their weight of double refined ſugar. Their fragrance is leſs injured by beating or bruiſing them, than moſt of the other odoriferous flowers, but is nevertheleſs conſiderably diminiſhed: the flavour of the leaves is of a much leſs deſtructible kind.

Water extracts by infuſion nearly all the virtue, both of the leaves and flowers. In diſtillation with water, the leaves yield a very ſmall portion of eſſential oil; the flowers a much larger, amounting, in their moſt perfect ſtate, when they are ready to fall off ſpontaneouſly, and the ſeeds begin to ſhew themſelves, to about one ounce from ſixty. The oil is of a bright yellowiſh colour, a very pungent taſte, and poſſeſſes, if carefully diſtilled, the fragrance of the lavender in perfection. It is given internally from one drop to five, and employed in external applications for ſtimulating paralytic limbs, and for deſtroying cutaneous inſects. The decoction, remaining after the diſtillation of the oil, is diſagreeably bitteriſh, and ſomewhat ſaline.

Rectified ſpirit extracts the virtue of lavender more completely than water. The ſpirit elevates alſo in diſtillation a conſiderable part of the odoriferous matter of the leaves, and greateſt part of that of the flowers; leaving, in the inſpiſſated extracts, a moderate pungency and bitteriſhneſs, with very little ſmell. A ſpirit prepared by pouring a gallon of proof ſpirit on a pound and a half of the freſh gathered flowers, and drawing off five pints by the heat of a water bath, is richly impregnated with the fragrance of the flowers. More compound ſpirits of this kind, in which other aromatics are joined to the lavender, have been diſtinguiſhed by the name of Engliſh or palſy drops. The college of London directs three pints of the ſimple ſpirit of lavender, and one pint of ſpirit of roſemary, to be digeſted on half an ounce of cinnamon, half an ounce of nutmegs, and three drams of red ſaunders, as a colouring ingredient: the college of Edinburgh orders a gallon and a half of rectified ſpirit of wine to be drawn over from three pounds of freſh lavender flowers, one pound of thoſe of roſemary, and three ounces of lemon peel; and afterwards three ounces of cinnamon, one of cloves, one of cubebs, and two of red ſaunders, to be macerated for three days in the diſtilled ſpirit. Theſe preparations are taken internally, on ſugar or in any convenient vehicle, from ten to an hundred drops, and uſed externally in embrocations, &c.

LAVANDULA *Major ſive vulgaris*, broad lavender, with longer, wider, and hoarier leaves, and much larger ſpikes, though ſmaller flowers; common in the ſouthern parts of Europe, but rare among us. The name ſpike is applied by foreign writers to this ſpecies, by ſome of ours to the firſt.

The broad-leaved lavender is ſtronger both in ſmell and taſte than the narrow, and yields in diſtillation almoſt thrice as much eſſential oil; but the flavour both of the oil and of the plant itſelf, is much leſs grateful: the oil is likewiſe of a much darker colour, inclining to green. Watery and ſpirituous extracts, made from the two ſorts of lavender, are very nearly alike; the difference ſeeming to reſide only in the volatile parts. *Lewis's Materia Medica.*

LAVATORY, or LAVOREDO, an appellation given to certain places in Chili and Peru, where gold is ſeparated from the earth by means of waſhing.

LAUDANUM, a preparation of opium. See the article OPIUM.

LAVENDER, the ſame with lavandula. See LAVANDULA.

LAVER, a ſacred utenſil in the temple of Jeruſalem, conſiſting of a baſon, whence they drew water by cocks.

LAUNCH, among ſailors, a ſort of boat uſed by the French, Italian, and Spaniſh ſhips; and is peculiar to thoſe which are employed in the Mediterranean trade, being better fitted for the ports of that ſea than a long-boat, than which it is generally much longer, and more flat-bottomed, and alſo ſharper before. See BOAT.

LAUNCHING *a Ship or Boat*, puſhing them into the water from an aſcent.

When the ſhips of the ancients, particularly thoſe of Greece, were launched, they were ornamented with garlands and flowers; the mariners alſo adorned with crowns, who ſhouted with loud acclamations and other expreſſions of mirth and joy; and being purified by a prieſt, with a lighted torch, and egg and brimſtone, or after ſome other manner, were conſecrated to the god whoſe image they bore.

In the launching of ſhips now-a-days, the ſame or ſimilar expreſſions of joy and feaſting are uſed, colours are diſplayed, and ſometimes muſic performed.

The greateſt ſhip ever launched in England was the Britannia of 100 guns, at Portſmouth; ſuch very large ſhips being uſually built in dry docks, and afterwards floated out by throwing open the flood-gates, and ſuffering the water to enter, when they are finiſhed.

LAUNDER, among miners, a place where they waſh the powdered ore.

LAUNIARD, a rope paſſing alternately through two dead-eyes, to draw them together. See the article DEAD-EYE.

In every dead-eye there are three holes, and two of theſe dead-eyes being faſtened in two ropes, oppoſite to each other, and the launiard paſſing alternately through the firſt hole in the upper, then the firſt hole in the lower, then the ſecond hole in the upper, proceeds till the whole purchaſe is compleated: after which the launiard, being well greaſed, is drawn extremely tight thro' all its parts, and draws the rope tight, to which the dead-eyes are faſtened: thus the ſhrouds of the maſts are drawn tight by fixing a dead-eye in the lower-end of each, with another directly underneath it, which is bolted to the ſhip's ſide by a ſhort chain; the launiard paſſing through theſe, is drawn tight by mechanical powers, and conſequently draws tight the ſhroud to which it is connected. See SHROUD.

LAUNIARD is alſo a ſmall cord or line by which any thing is held faſt, and can be occaſionally looſened, as the launiard of the buoy, the launiard of a port, &c.

LAURA, in church hiſtory, a name given to a collection of little cells, at ſome diſtance from each other, in which the hermits, in ancient times, lived together in a wilderneſs.

Theſe hermits did not live in community, but each monk provided for himſelf in his diſtinct cell. The moſt celebrated lauras mentioned in eccleſiaſtical hiſtory, were in Paleſtine; as the laura of St. Euthymius, at four or five leagues diſtance from Jeruſalem; the laura of St. Saba, near the brook Cedron; the laura of the Towers, near the river Jordan, &c.

LAUREATION, in the univerſities of Scotland, ſignifies the act of taking the degree of maſter of arts, which the ſtudents are permitted to do after four years ſtudy.

LAURENCE, or *Canons regular of St.* LAURENCE, a religious congregation in France, ſaid to have been founded by St. Benedict.

LAW denotes the command of ſome perſon or power, whoſe precept carries along with it the reaſon of obedience.

The word is derived from the Saxon *lah*, which ſignifies the ſame thing.

Thus the commands of God, a city, ſtate, or ſovereign power, are called their laws.

As all human actions depend upon the will, and the will of every ſingle man is different; therefore, to preſerve decency and order among mankind, there ſhould be ſome rule by which they are to be regulated; for otherwiſe it could not but give occaſion to vaſt confuſions. See the article GOVERNMENT.

This rule or law is nothing but a decree, by which the ſuperior obliges thoſe ſubject to him to accommodate their actions to the directions preſcribed therein. But that a law may exert its force in the minds of thoſe to whom it is promulgated, it is requiſite that the law-giver and the law be likewiſe known. The legiſlator of the laws of nature can be no other than the Creator of the univerſe. No man in civil ſociety can be ignorant who it is that has power over him; and of the laws he has notice given him, by a publication plainly and properly made, in which theſe two things ought to be aſcertained, that the author of the law is he who hath the ſupreme authority in the community, and that this or that is the true meaning of the law. The firſt is known, if it be promulged with his own mouth, under his own hand, or if it be done by proper delegates regularly admitted to that office: they muſt be thus judiciouſly executed, and, beſides that, contain nothing derogatory to the ſovereign power. As to the true ſenſe, after the greateſt plainneſs uſed by the promulgers, an explication is to be ſought of the legiſlator, or thoſe who are publicly appointed to give judgment according to law. See JUDGE.

Every perfect law has two parts; the one directing what is to be done, or omitted; the other declaring the puniſhment incurred, by neglecting to do what is commanded, or attempting what is prohibited. And herein all the force of law conſiſts. See PUNISHMENT.

Law may be divided, with reſpect to its authors, into divine and human: the former may be conſidered as twofold, to wit, natural or moral, and poſitive. Natural law is that which God has made known to mankind by the light of natural reaſon. Poſitive law is that which he has revealed by his prophets; ſuch were the laws delivered to the Jews relating to the divine worſhip and polity peculiar to that people.

Civil or human laws, conſidered with reſpect to the legiſlator's two offices, of judging and compelling, may be divided into diſtributive and penal. Diſtributive law is that which gives every ſubject what properly belongs to him, forbidding others to injure him either in his privileges or property: and penal law is that which determines or appoints what puniſhments ſhall be inflicted on thoſe who violate the diſtributive laws; it is mandatory, and ſpeaks only to the public officers, or magiſtrates.

The laws of any kingdom, or ſtate, firſt began with the ſtate itſelf; and if we conſider the world as one univerſal ſociety, or Europe as one great commonwealth, the law by which ſeparate nations are governed, with reſpect to treaties, alliances, the ſending embaſſadors, &c. is called jus gentium, or the law of nations: but when it is conſidered as made up of particular ſtates, the law which regulates the public order of each, is called jus publicum; and that law which determines the private rights of men, is called jus civile, or civil law. See CIVIL LAW.

The laws of England are at preſent divided into the common law, which is the moſt ancient law of the kingdom; the ſtatute-law, made by the king and both houſes of parliament; and particular cuſtoms in ſeveral parts of the kingdom: but our laws are more largely divided into the crown-law; the law and cuſtom of parliament; the common law; the ſtatute-law; reaſonable cuſtoms; the law of arms; eccleſiaſtical or canon-law; the civil law; the foreſt-law; the law of marque and repriſals; the law of merchants; martial-law, &c. See the articles COMMON-LAW, STATUTE, PARLIAMENT, &c.

Our laws have great reſpect to life, liberty, freehold, and inheritance: their uſe is to ſecure the continuance of thoſe bleſſings we enjoy; and they have therefore a particular relation to perſons and their eſtates, to crimes and miſdemeanors, &c. See the articles ESTATE, CRIME, &c.

LAW *of Arms*, is a law which gives precepts how to proclaim a war, to attack the enemy, and to puniſh offenders in the camp.

LAWS *of Nature or Motion*, in phyſics, are axioms or general rules of motion and reſt, obſerved by all natural bodies in their actions on one another; of theſe Sir Iſaac Newton has eſtabliſhed the three following.

1. All bodies continue their ſtate of reſt or uniform motion in a right line, till they are made to change that ſtate by ſome external force impreſſed upon them.

This law is no other than that univerſal property of bodies, called paſſiveneſs or inactivity; whereby they endeavour to continue the ſtate they are in, whatever it be. Thus a top only ceaſes to run round, on account of the reſiſtance it meets with from the air, and the friction of the plane whereon it moves. And a pendulum, when left to vibrate in vacuo, where there is nothing to ſtop it but the friction ariſing from the motion of the pin on which it is ſuſpended, continues to move much longer than one in the open air.

2. The change of motion, produced in any body, is always proportionable to the force whereby it is effected; and in the ſame direction wherein that force acts.

This is an immediate conſequence of this axiom, the effect is always proportionable to its cauſe. For inſtance, if a certain force produces a certain motion, a double force will produce double the motion; a triple force, triple the motion, &c. If a body is in motion, and has a new force impreſſed on it in the direction wherein it moves, it will receive an addition to its motion, proportional to the force impreſſed; but if the force acts contrary to its motion, the body will then loſe a proportional part of its motion: again, if the force is impreſſed obliquely, it will produce a new direction in the motion of the body, more or leſs different from the former, in proportion to its quantity and direction.

3. Re-action is always contrary and equal to action; or the actions of two bodies upon each other are equal, and in contrary directions.

Thus, ſuppoſe a ſtone or other load to be drawn by a horſe; the load re-acts upon the horſe, as much as the horſe acts upon the load; for the harneſs, which is ſtretched equally between them both ways, draws the horſe towards the ſtone, as much as it does the ſtone towards the horſe; and the progreſſive motion of the horſe is as much retarded by the load, as the motion of the load is promoted by the endeavours of the horſe. This will be better explained from the following inſtance; let a perſon ſitting in a boat draw another boat equally heavy towards him, they will both move towards each other with equal velocities: let the boat he ſits in be the lighteſt, and it will move the faſteſt; becauſe the action being equal on both ſides, the ſame quantity of motion will be given to each boat, that is, the leſſer will have the greater velocity.

We have a farther confirmation of this from attraction. Suppoſing two bodies attracting one another, but prevented from coming cloſe together by ſome other body placed between them: if their reſpective actions, by which they tend towards each other, were not equal on both ſides, then would the intermediate body be preſſed more one way than the other, and ſo all three would begin to move by themſelves the ſame way; but that three bodies ſhould be put in motion after this manner, when no external force acts upon them, is contrary to experience; conſequently, whatever different degrees of force any two bodies may be capable of exerting, their mutual actions on each other are always equal. This may be tried with a loadſtone and iron; which being put into proper veſſels, contiguous to one another, and made to float on the ſurface of water, will be an exact counterbalance to each other, and remain at reſt, whatever be the attractive power of the loadſtone, or the proportion of their reſpective magnitudes.

Theſe laws receive an abundant additional proof from hence, viz. that all the concluſions that are drawn from them

them in relation to the phænomena of bodies, how complicated ſoever their motions be, are always found to agree perfectly with obſervation. The truth of which ſufficiently appears in all parts of the Newtonian philoſophy.

LAWN, a large plain in a park, or adjoining to ſome grand ſeat. The moſt convenient ſituation is on the ſouth or ſouth-eaſt ſide of the houſe. If the lawn be a ſquare, three avenues may break out from three of the angles, and meet in the fourth angle oppoſite to the houſe: it may be bounded with walks or a ſingle row of lime-trees ſet at a good diſtance from one another. A circle is a good figure for a lawn, but muſt break off before it comes againſt the front. A triangle is a very proper figure, but ſhould be obtuſe or right-angled next the front.

Many perſons have preferred the lime-tree for this purpoſe, on account of their regular growth: but as the leaves of this tree often change their colour, and begin to fall very ſoon in the autumn, occaſioning a great litter in the garden; and from the end of July the trees make but an indifferent appearance; ſo they are not to be eſteemed for theſe plantations.

The elm, oak, beech, and chefnut, among the deciduous trees, are to be preferred to all others, as they keep their leaves late in autumn: and theſe are all of them large-growing trees; ſo are very proper for this purpoſe.

If there are ſome clumps of ever-green trees intermixed with the deciduous trees in this plantation, it will add to the beauty of it, eſpecially in the winter ſeaſon: the beſt ſorts for this purpoſe, are, the lord Weymouth's pine, the ſilver and ſpruce firs, which will grow faſt, and become large trees: and as the two latter ſorts always grow pyramidically, ſo they will have a good effect to the ſight, when properly diſpoſed with the deciduous trees: but as theſe generally feather out their branches near the ground, they ſhould be planted where they do not obſtruct the view of any diſtant objects.

But as moſt perſons who take pleaſure in beautifying their ſeats in the country, are in haſte for ſhade, they generally plant the trees too cloſe together, and often in ſuch a manner as to render it difficult, when the trees are advanced, to reduce their number, without injury to the deſign: therefore thoſe trees ſhould be firſt planted, which are deſigned to remain; and then there may be ſome few others planted for preſent ſhade, which may afterwards be taken away. When perſons who are beautifying their ſeats, meet with full grown trees on the ſpot, it is a great pleaſure; for theſe ſhould not be deſtroyed if they can poſſibly ſtand. *Miller's Gard. Dict.*

LAXATIVE MEDICINES are ſuch as regard either the belly or entire habit, and produce this effect by ſome ſoftening quality that takes away the tenſity of the fibres, and facilitates the paſſage of the contents in the internal tube.

LAY *Brothers*, among the Romaniſts, thoſe pious, but illiterate perſons, who devote themſeves, in ſome convent, to the ſervice of the religious.

LAY *Land*, or LEY *Land*, in huſbandry, fallow-ground, or ſuch as lies untilled. See LEYS.

LAY *Man*, one who follows a ſecular employment, or has not entered into holy orders.

LAY *Man*, among painters, a ſmall ſtatue, either of wax or wood, whoſe joints are ſo formed, that it may be put into any attitude or poſture. Its principal uſe is for adjuſting the drapery in cloathing of figures.

LAYERS, in gardening, are tender ſhoots or twigs of trees, laid or buried in the ground; till having ſtruck root, they are ſeparated from the parent-tree, and become diſtinct plants. The manner of performing this operation is as follows.

1. Take ſome of the boughs, and lay them into the ground about half a foot deep in fine freſh mould, leaving them with the end of the layer about a foot or a foot and a half out of the ground, and keep them moiſt during the ſummer-ſeaſon, and they will probably have taken, and be fit to remove, in autumn; and if they have not by that time taken root, they muſt lie longer.

2. Tie a piece of wire hard round the bark of the bough, at the place you intend to lay in the ground; and twiſt the ends of the wire, ſo that they may not untie; and prick the place above the wire, through the bark, with an awl in ſeveral places; and then lay it in the ground, as before directed.

3. Cut a ſlit upwards at a joint, as is practiſed in laying of carnations, which, by gardeners, is called tonguing the layers.

4. Twiſt the place which you deſign to lay in the ground like a withy, and lay it into the ground, as directed in the firſt way of laying.

5. Cut a place round about the bough, that is deſigned to be laid, an inch or two, at the place that is moſt convenient to lay into the ground, and manage it as is directed in the firſt method of laying.

The ſeaſon for laying hardy trees, that ſhed their leaves, is in October; but for ſuch as are tender, in March; for ever-greens, June or Auguſt are good ſeaſons.

Though layers may be laid at any time in the year, the before-mentioned ſeaſons are moſt proper, for the reaſons following; becauſe they have the whole winter and ſummer to prepare and draw root; for at thoſe times of the year the ſun has ſufficient power on the ſap of the tree to ſeed the leaf and bud, but has not power ſufficient to make a ſhoot.

And if that ſmall quantity of ſap that does ariſe be hindered, as it will by ſome of the preceding ways of laying, the leaves and buds will gently crave of the layer, and by that means will prepare the layer to take root, or put forth roots a little to maintain itſelf, finding it cannot have it from the mother-plant.

And therefore, becauſe it wants but little nouriſhment at that time of the year, it is better to lay layers of trees, or to ſet cuttings, than at other times, either in the winter, when the ſap ſtirs but little, or in the ſummer, when the ſap abounds, or in the ſpring, when it begins to riſe; becauſe it is then apt to come too ſuddenly to draw ſap from the layer, before the layer has drawn or prepared for root.

However, the ſpring or ſummer may do well for ſmall plants; becauſe ſuch plants, being but ſhort-lived, draw root the quicker.

If you would lay young trees from an high ſtandard, the boughs of which cannot be bent down to the ground, then you muſt make uſe of oſier-baskets, boxes, or pots, filled with fine ſifted mould, mixed with a little rotten willow-duſt, which will keep moiſture to aſſiſt the layer in taking root: this baſket, box, &c. muſt be ſet upon a poſt or treſſel, &c. and the bough muſt be laid according to either of the four firſt ways of laying; but too much head muſt not be left on, leſt that be injured by the wind, or by its own motion rub off the tender root; and the ſmaller the boughs are, the leſs way they ſhould be ſet out of the ground, and care muſt be taken to keep them clear from weeds.

The harder the wood is, the better will the young wood take root; but if the wood be ſoft, the older boughs will take root the beſt. *Miller's Gard. Dict.*

LAZARETTO, or LAZAR HOUSE, a public hoſpital for the reception of the ſick poor; and in ſome countries it is a detached edifice for perſons coming from places ſuſpected of the plague, to perform quarantine in.

LAZARUS, or LAZARO, a military order inſtituted at Jeruſalem by the Chriſtians of the Weſt, when maſters of the Holy Land, who received pilgrims under their care, and guarded them on the roads from the inſults of the Mahometans.

This order was inſtituted in the year 1119, and confirmed by a bull of pope Alexander IV. in 1255, who gave it the rule of St. Auguſtine.

LAZULA, or LAPIS LAZULI, a ſort of ſtone, from whence the celebrated colour called ultramarine is made.

This is one of the ores of copper, the baſis of which is a debaſed cryſtalline matter, coloured with the elegant and beautiful blue, which this matter gives in our experiment to all alkaline liquors. It is a very hard and compact ſtone, inſomuch as to come into the rank of thoſe that take a high poliſh, and are not liable to be ſcratched by accidents; and therefore is worked in a number of

different toys. It is found in detached lumps uſually of the ſize of a man's fiſt, often ſmaller, and ſometimes of four or five pounds weight: it is never covered with any coat or cruſt, but reſembles thoſe ſtones which have been waſhed off from whole ſtrata, and ſmoothed or rounded by accidents afterwards. It is of a naturally ſmooth and gloſſy ſurface; and its general colour is the elegant colour already mentioned; but this is variegated in a very beautiful manner with ſpots or clouds of white, and with veins of a fine ſhining gold colour. It has theſe variegations, in different degrees, in ſeveral maſſes, and in general moſt to be valued, as it has leaſt of them; for though very beautiful to the eye, they are foreign to all the uſes they are put to, except when it is cut as a gem. The white clouds or veins, for this matter is ſometimes, though more rarely, diſpoſed of in the laſt form, are uſually of a dead and opake hue; but ſometimes they are bright and pellucid as cryſtal; this laſt ſtate of them adds greatly to the beauty of the ſtone: the yellow ones are always bright and gloſſy; they have been ſuppoſed by many to be veins of gold, and the ſtone has been thence called a gold ore; but they are in reality only marcaſite. Sometimes that gold-like matter is not diſpoſed in veins, but in ſpots and ſtars, and in this caſe the ſtone is the ſapphire of the ancients; for they knew the gem we call the ſapphire by a very different name, calling it the ſky-blue beryl; and deſcribing what they meant by the word ſapphire to be a ſtone, opake, of a fine blue, and variegated with ſpots of a gold colour in form of ſtars. All the variations of this ſtone are ſubject, beſides, to other accidental foulneſſes, and are ſometimes debaſed to the ſtate of a mere common blue copper-colour.

The lapis lazuli is found in many parts of the world, but that of Aſia and Africa, in both which countries it is frequent, is vaſtly ſuperior, both in beauty and real value, to the Bohemian and German kind, which is brought too often to us in its place. It is to be choſen heavy, of a fine cloſe texture, and of a deep indigo blue colour, with a little white matter about it, and with as few of the ornamental gold coloured veins in it as poſſible, and ſuch as, when put in the fire, calcines without emitting any ſmell. Its virtues in medicine are thoſe of a very violent purgative and emetic, which are owing to the copper it contains. Chemical writers give us proceſſes for magiſteries, tinctures, and elixirs of lapis lazuli, but they are wholly out of uſe: whatever may be the preſent credit of the beautiful ſtone in medicine, the painters however are indebted to it for one of the nobleſt colours they are acquainted with; their ultramarine being only a calcination of this ſtone. The German lapis lazuli does not anſwer well in this proceſs, and diſcovers itſelf by its calcining eaſier than the African or Aſiatic, and turning greeniſh. The Oriental kind calcines to a finer blue than it naturally has, and retains the colour for ever. After calcining the ſtone in a clear fire of charcoal, they grind it to an impalpable powder on a porphyry, and then mixing it up in a paſte, compoſed of pitch, wax, and oil, they work it about with the hands; and, finally, kneading this in a veſſel of clear water, as the powder ſeparates from the viſcid matter, it ſinks to the bottom: when all that is perfectly fine in this is worked out, they let the water be drained off, and dry the powder for uſe. What remains embodied in the paſte, is afterwards ſeparated, and makes a worſe kind than the former, though even the very meaneſt ultramarine is a very beautiful colour.

LEAD, *Saturn*, in natural hiſtory, a pale or livid white metal, ſoon loſing its brightneſs in the air, and contracting a blackiſh or greyiſh aſh-colour; very ſoft and flexible; unelaſtic, and unſonorous; the heavieſt of all metallic bodies but gold, quickſilver, and platina: it is upwards of eleven times heavier than an equal bulk of water.

It melts in a very ſmall degree of fire, long before it grows red-hot: in a ſtrong red heat it emits viſible fumes. It loſes of its malleability in proportion as it is heated: by nimble agitation, when it is juſt ready to melt, or when returning from a fluid to a conſiſtent ſtate, it may be divided into ſmall grains, or powder. Granulated lead is commonly prepared, by pouring the melted metal into a wooden box rubbed on the inſide with chalk, and ſtrongly ſhaking it till it ſets or becomes ſolid; when large quantities are prepared, a wooden trough is made uſe of. It is formed into round granules or ſhot, by pouring the melted lead into cold water, through a perforated plate; a little orpiment being added to the metal infuſion; this improves its hardneſs, and makes it run more regularly into globules without drawing a tail.

Lead, when juſt become fluid, looks bright like quickſilver; but preſently contracts on the ſurface a variouſly coloured powdery pellicle. Some have ſuppoſed that this was an heterogeneous ſubſtance; and that the lead, by its ſeparation, became purer. But after this imaginary purification, it will ſtill, upon continuing the fire, exhibit a pellicle as at firſt: if this be taken off, or the metal ſtirred, ſo as to expoſe a freſh ſurface to the air, a new one will ariſe, till by degrees the whole quantity is changed into a duſky powder or calx, called plumbum uſtum. The injection of a little fat, charcoal powder, or other inflammable matters, prevents this change, and readily revives the calx into lead again, notwithſtanding Boerhaave's aſſertion that the calx of lead is very hard to reduce.

Calx of lead, expoſed to the fire in a furnace ſo contrived as that the flame may play upon its ſurface, becomes white, yellow, and at length of a bright red colour; hence the yellow lead or maſticot, and the red lead or minium of the painters. See the articles MASTICOT and MINIUM.

If lead be urged with a bright red heat, it changes by degrees into a yellow, flaſhy ſcoria, called litharge, of a paler or deeper colour, according to the degree of fire it has undergone. See LITHARGE.

All the calces and ſcoriæ of lead vitrify more eaſily than thoſe of any other metal: expoſed to a moderately ſtrong fire, they quickly run into a tranſparent yellow glaſs. This glaſs, in fuſion, powerfully diſſolves and vitrifies the more refractory metallic calces and earths; and unleſs ſaturated with theſe kinds of additions, corrodes and ſinks through the common crucible.

If gold or ſilver be mixed with lead, and expoſed to the fire, the lead ſcorifies, as it would by itſelf, and ariſes to the ſurface, ſo as to be raked off in the form of glaſs or litharge; at the ſame time carrying with it any imperfect metal that the gold or ſilver had been mixed with, but leaving thoſe perfect metals themſelves unhurt. Hence gold and ſilver are purified by means of lead from admixtures of the baſer metals; and hence lead is called by the chemiſts, *balneum ſolis & lunæ*, *lavacrum regis & reginæ*, *ſapa metallorum*, &c. The litharge met with in the ſhops is produced in thoſe works where gold and ſilver are thus purified; and contains the heterogeneous metals which the gold or ſilver had been mixed with.

Lead expoſed for ſome time to the ſteam of vinegar or other vegetable acids, is gradually corroded into a white calx, which is the ceruſs or white lead of the ſhops. See CERUSS.

Lead is employed for various mechanic uſes; as in thin ſheets for covering buildings, for pipes, pumps, ciſterns, ſtatues, ſhot, bullets, windows, for ſecuring iron bars in hard ſtones, for ſundry kinds of large veſſels for evaporation, and many other mechanic purpoſes. It has been obſerved that plants do not thrive ſo well in leaden, as in earthen and wooden veſſels. Its principal uſes in the chemical arts are, for promoting the vitrification of earthy and ſtony matters, in the making of glaſs, or in the ſmelting of ores, or in the glazing of earthen veſſels; for the refining of gold and ſilver; for the eliquation of ſilver from copper; for forming with oil the baſis of varniſhes and paints.

The effects of lead on the human body are dangerous: thoſe who are expoſed to its vapours in the fire, and even thoſe who grind its calces, minium, ceruſs, and litharge, for the painters, are ſubject to violent gripes and conſtipations of the bowels, contractions of the limbs, and other diſorders. Much more hurtful is the internal uſe of lead corroded or diſſolved by acids, as ceruſs, ſaccharum ſaturni, the ſolution in vinegar called acetum lithargyrii, or the tincture drawn from the ſaccharum, with ſpirit of wine, commonly called tinctura antiphthiſica. The ſaturnine preparations are applied externally with ſafety, as coolers, repellents, and deſiccatives: its calces, diſſolved in oils, form the baſis of moſt of the officinal plaſters.

Culinary veſſels, lined with a mixture of tin and lead, which is the uſual tinning, are apt to communicate to acid foods pernicious qualities, and require to be uſed with great precaution. In Holland, and perhaps in other places, it has been cuſtomary to correct the more offenſive expreſſed oils, as that of rape-ſeed, ſo as to ſubſtitute them to oil of olive or oil of almonds, by impregnating them with lead: this dangerous abuſe may be diſcovered by mixing a little of the ſuſpected oil with a ſolution of orpiment made in lime-water; on ſhaking them together, and ſuffering them to reſt, the oil, if it has any ſaturnine taint, will appear of an orange-red colour; if pure, of a pale yellowiſh. The ſame abuſe has been extended alſo to acid wines, which diſſolve ſo much lead as to acquire a ſweet taſte, and to become ſlow poiſons. The lead is readily diſcovered in theſe likewiſe, by the ſame ſulphureous ſolution, which changes the colour of wines impregnated with this metal to a browniſh red or blackiſh; lead, whether diſſolved, or in its metallic form, being conſtantly ſtained by ſulphureous liquors or vapours.

Lead is ſometimes found in the earth native, or in its metallic form, though very rarely pure. Its common ores are nearly of the colour of lead itſelf, and appear compoſed of cubes or parallelopipeds, ſometimes large and regular, ſometimes irregular and ſmall. There are lead ores alſo of a white, greyiſh, or greeniſh colour, and priſmatic figure; but theſe are rarely met with. The ores of ſilver, copper, and other metals, except tin and iron, have often a lead ore intermixed. The lead is extracted by fuſion in contact with the fuel; the furnace being ſufficiently heated with wood or charcoal, the powdered ore is thrown in by degrees, and freſh fuel and ore occaſionally ſupplied: the lead, revived by the inflammable matter of the coals, runs down into a baſon at the bottom of the furnace; from whence it is ladled out, and caſt into iron moulds, into large maſſes, called pigs of lead. All the common lead ores contain ſome ſilver; the ſteel-grained, and ſuch as are compoſed of ſmall cubes, have generally more ſilver than the compact and large diced ſorts: the white and green ſcarcely hold any. The ſilver is extracted, when its quantity is conſiderable enough to bear the expence of extracting it, by ſcorifying the lead upon a teſt; the whole being kept in fuſion on a hearth made of bone-aſh or other like materials, the lead partly vitrifies and ſinks into the hearth, and partly turns to litharge, which floats on the ſurface, and is raked or blown by bellows to one ſide; the ſilver at length remaining by itſelf. Lead almoſt always contains ſome portion of copper; and hence the ſilver obtained in this operation is ſcarcely ever free from ſome admixture of that metal.

LEAF, a part of a plant, commonly very thin, and flat, growing in the ſpring, and falling off in autumn.

Leaves are the ornament of the twigs, and conſiſt of a very glutinous matter, being furniſhed every where with veins and nerves. Their office is to ſubtilize the nouriſhing ſap, and convey it to the little buds; and likewiſe they ſerve to cover the flowers and fruits with their ſhade, and keep them from other inconveniences; they are to trees what hair is to the human body.

Dr. Grew obſerves, that the fibres of leaves conſiſt of two general kinds of veſſels, namely, for ſap and for air; and are ramified out of greater into leſs, as veins and arteries are in animals.

Mr. Frederick of Augſbourg, a celebrated gardener, took from the tree a leaf of the opuntia or Indian fig-tree; and ſetting it in the earth, it immediately took root, and produced bloſſoms and fruit.

The diſtinction of leaves, made by thoſe who have written on botany, are the following.

A ſimple leaf is that which is not divided to the middle.

A compound leaf is divided into ſeveral parts, each reſembling a ſimple leaf, as in liquorice, &c.

A digitated leaf is a compound leaf divided into ſeveral parts, all of which meet together at the tail, as in the hemp, black hellebore, &c.

A trifoliated leaf is a digitated leaf, conſiſting of three fingers, as the trefoil, &c.

A quinqueſoliated leaf is a digitated leaf, conſiſting of five fingers, as in the quinque folium.

A pennated leaf is a compound leaf divided into ſeveral parts, each of which is called a lobe, placed along the middle rib, either alternately, or by pairs. When the middle rib is terminated by an odd lobe, it is ſaid to be unequally pennated, as in the goats rue, &c. and equally pennated, when it is not terminated by an odd lobe, as in the caſſia; when the lobes are all nearly of the ſame form and bigneſs, it is called an uniform pennated leaf, as in the liquorice; when they are not ſo, it is ſaid to be difform, as in the agrimonia.

A winged leaf is, as it were, divided into ſeveral pennated leaves, as in the orobus, &c.

A ramoſe leaf is that which is ſtill farther divided than the winged leaf, as in the oſmund royal, female fern, &c.

An entire leaf or lobe is that which has no diviſion on its edges, as in the apple-tree, &c.

A ſinuated leaf is that which is cut about the edges into ſeveral long ſegments, as in common mallows.

A ſerrated leaf is that which is cut about the edges into ſeveral acute ſegments, reſembling the teeth of a ſaw, as in the nettle, &c.

A crenated leaf is that which is cut about the edges into ſeveral obtuſe ſegments, as in the betony, &c.

A laciniated or jagged leaf is that which is cut about the edges into ſeveral pretty deep portions, in an irregular manner, as in the horned poppy, &c.

Leaves are a part of a plant that is ordinarily very thin and flat, growing in the ſpring, and falling off at the autumn; though there are ſome plants without leaves, as the truffles and muſhrooms. *Miller's Gard. Dict.*

The leaves of plants are of the utmoſt conſequence to the life of the whole. Air evidently paſſes in at the leaves, and goes through the whole plant, and out again at the roots. If the leaves have no air, the whole plant will die, as is eaſily proved by the air-pump; but in theſe experiments, if the leaves be left on the outſide of the receiver, and parted by a hole cemented with wax, and have air, the plant will thrive, and grow, though its roots and ſtalk are kept in vacuo in water. The leaves of plants perform the neceſſary work of altering the water, received in at the roots, into the nature of the juices of the plant; and hence it is, that the life of the plants depends ſo immediately upon their leaves. The huſbandman often ſuffers for want of this knowledge. A crop of ſaintfoin is a very valuable thing, and its root being perennial, will yield him increaſe many years; but it is often deſtroyed at firſt, by ſuffering it to be indiſcreetly fed upon by the ſheep, which eating up all the leaves, the root remains without the means of a ſupply of air, and the whole periſhes.

Leaves being thus neceſſary to plants, nature has, in all perennial plants, provided a reverſionary ſtock of them. The leaves of theſe plants are always formed in autumn, though they are not unfolded till the following ſpring. They then open and increaſe gradually, in proportion to the motion of the ſap, and the quantity of pabulum it then receives to be circulated. Theſe leaves may alſo, though not wholly appearing out of the bud, be ſufficient for the extremely ſmall motion of life, which the ſap of perennial plants, that drop their leaves, has in winter. *Tull's Horſe-hoeing Huſbandry.*

The green colour of the leaves of plants is extracted by rectified ſpirit of wine, and by oils. The ſpirituous tinctures are generally of a fine deep green, even when the leaves themſelves are dull coloured or yellowiſh or hoary. The colour, however, ſeldom abides long even in the liquor, much leſs when the tinging matter is ſeparated in a ſolid form, and expoſed with a large ſurface to the air. The editor of the Wirtemberg Pharmacopæia obſerves, that the leaves of acanthus, brankenſine, or bears-breech, give a more durable green tincture to ſpirit, than thoſe of any other herb. Alkalies heighten the colour both of the tinctures and green juices: acids weaken, deſtroy, or change it to a browniſh. Lime-water improves both the colour and durability: by means of lime, not inelegant green lakes are procurable from the leaves of acanthus, lily of the valley, and ſeveral other plants.

There are very few herbs which communicate any ſhare of their green colour to water; perhaps none that give a green of any conſiderable deepneſs. It is ſaid, however, that the leaves of ſome plants give a green dye

to

to woollen, without the addition of any other colouring matter, particularly thoſe of the wild chewil or cow-weed, the common ragunt, and devils bit. The proceſs with this laſt, as deſcribed by Linnæus, is pretty remarkable. The peaſants, he informs us, in ſome of the Swediſh provinces, ſtratify the freſh leaves with woollen yarn, and boil them about as long as it is cuſtomary to boil fiſh. The whole is ſuffered to ſtand in the veſſel for a night: the wool, taken out in the morning, does not appear to have received any colour. The pot is again made hot, and the yarn hung over it, upon a ſtick, covered with an inverted diſh to confine the ſteam; for this ſteam is ſuppoſed to be eſſential to the colour. The yarn is afterwards wrung, the leaves taken out of the boiling liquor, a little freſh water added to the decoction, and the wool frequently dipped therein, till it appears ſufficiently coloured.

The leaves of many kinds of herbs and trees give a yellow dye to wool or woollen cloth that has been previouſly boiled with a ſolution of alum and tartar: weld in particular affords a fine yellow, and is commonly made uſe of for this purpoſe by the dyers, and cultivated in large quantity in ſome parts of England. There is no colour for which we have ſuch plenty of materials as for yellow. Mr. Hellot obſerves, in his *Art de Teindre*, that all leaves, barks, and roots, which on being chewed diſcover a ſlight aſtringency, as the leaves of the almond, peach, and pear-trees, aſh bark, eſpecially that taken off after the firſt riſing of the ſap in ſpring, the roots of wild patience, &c. yield durable yellows, more or leſs beautiful, according to the length of time that the boiling is continued, and the proportions of alum and tartar in the preparatory liquor; that a large quantity of alum makes theſe yellows approach to the elegant yellow of weld; that if the tartar is made to prevail, it inclines them to an orange; that if the roots, barks, or leaves, be too long boiled, the yellow proves tarniſhed, and acquires ſhades of brown; that for dyeing with weld, the beſt proportions of the ſalts are, four parts of alum, and one of tartar, to ſixteen of the wool; and that the wool, prepared with theſe, is to be boiled again with five or ſix times its quantity of weld; that for light ſhades, it is cuſtomary to diminiſh the alum, and omit the tartar; and that in this caſe, the colour is more ſlowly imbibed, and proves leſs durable.

LEAF, in architecture, the repreſentation of the leaf of the acanthus on the capital of the Corinthian and Compoſite orders. See the articles CORINTHIAN and COMPOSITE.

LEAF, in clocks and watches, an appellation given to the notches of their pinions. See the articles CLOCK and WATCH.

LEAGUE, a meaſure of length, containing more or leſs geometrical paces, according to the different uſages and cuſtoms of countries. A league at ſea, where it is chiefly uſed by us, being a land meaſure moſtly peculiar to the French and Germans, contains three thouſand geometrical paces, or three Engliſh miles.

The French league ſometimes contains the ſame meaſure, and in ſome parts of France it conſiſts of three thouſand five hundred paces: the mean or common league conſiſts of two thouſand four hundred paces, and the little league of two thouſand. The Spaniſh leagues are larger than the French, ſeventeen Spaniſh leagues making a degree, or twenty French leagues, or ſixty-nine and an half Engliſh ſtatute miles. The Dutch and German leagues contain each four geographical miles. The Perſian leagues are pretty near of the ſame extent with the Spaniſh; that is, they are equal to four Italian miles; which is pretty near to what Herodotus calls the length of the Perſian paraſang, which contained thirty ſtadia, eight whereof, according to Strabo, make a mile.

LEAGUE alſo denotes an alliance or confederacy between princes and ſtates for their mutual aid, either in attacking ſome common enemy, or in defending themſelves.

LEAK, among ſailors, a cranny or hole through which water enters into a ſhip either through her deck or ſides.

LEAKAGE, the ſtate of a veſſel that leaks, or lets water, or other liquid, ouze in or out.

Leakage, in commerce, is an allowance of 12 per cent. in the cuſtoms, allowed to importers of wines for the waſte and damage it is ſuppoſed to have received in the paſſage: an allowance of two barrels in twenty-two is alſo made to the brewers of ale and beer, by the exciſe-office.

LEAP, *Salto*, in muſic, is when the ſong does not proceed by conjoint degrees, as when between each note, there is an interval of a third, fourth, fifth, &c. See DEGREE and CONJOINT.

LEAP-YEAR, the ſame with biſſextile. See BISSEXTILE.

LEASE, in law, a demiſe or letting of lands, tenements, or hereditaments unto another for life, term of years, or at will, for a rent reſerved.

LEASE and RELEASE, as uſed in our law, ſignifies a certain inſtrument, in writing, for the conveyance of a right or intereſt in lands and tenements in fee to another.

LEASH, among ſportſmen, denotes three creatures of any kind; but chiefly greyhounds, foxes, bucks, and hares.

The term leaſh alſo ſignifies a line to hold in a hunting dog; and a ſmall long thong of leather, by which a falconer holds his hawk.

LEATHER, the ſkin of ſeveral kinds of beaſts dreſſed and prepared for the uſe of the various manufactures, whoſe buſineſs is to make them up. The butcher and others, who flay off their hides or ſkin, diſpoſe of them raw or ſalted to the tanner and tawer, and they to the ſhamoy, Morocco, and other kind of leather-dreſſers, who prepare them according to their reſpective arts, in order to diſpoſe of them among the curriers, glovers, harneſs-makers, coach-makers, ſaddlers, breeches-makers, gilt leather-makers, chair-makers, ſhoe-makers, book-binders, and all in any way concerned in the article of leather.

The three principal aſſortments of leather are tanned or tawed, and oil and alum-leather; and it may be affirmed, with great truth, that the ſkins of our own production, and thoſe imported from our colonies, when dreſſed in this kingdom, make the beſt leather in the world, and that therefore this is an article of great importance to the trade of the nation.

Though there is no little difference between the dreſſing of ſhamoy-leather, alum-leather, Hungary leather, Morocco leather, parchment, and tanning; yet the ſkins which paſs through the hands of theſe ſeveral workmen, ought to have been for the moſt part, at leaſt, waſhed clean from blood and impurities in a running water; ſet to drain, worked with the hands, or pounded with wooden peſtles in a vat; put into the pit, which is a hole lined either with wood, or with ſtone and mortar, filled with water in which quick-lime is diſſolved in order to looſen the hair, that it may be eaſily rubbed off without injuring the ſkin; drawn out, and ſet to drain on the edge of the pit; ſtretched on the leg or horſe, in order to have the hair ſcraped off with a blunt iron-knife, or wooden cylinder; the membranes on the fleſhy ſide, and the ſcabs or roughneſs on the grain-ſide, pared off with a ſharp-knife, and the ſkins rubbed with a whetſtone, to take off any particles of the lime, or any thing elſe that may occaſion hardneſs; thickened by different ſorts of powder, whereby they become greater in bulk, and ſo much lighter, as gradually to riſe to the ſurface of the water; ſtretched out green or half dried, and piled one over another; or put up ſeparate after they are dried, and hung out to air upon poles, lines, or any other way; which muſt be repeatedly done in the dreſſing of ſmall ſkins. This alternate tranſition from the liquid of the air into that of water, and from water into the air, with the aſſiſtance of lime, ſalts, and oils, opens the inmoſt fibres of the ſkin ſo effectually, as greatly to facilitate the introduction of ſubſtances proper for making them pliant without rendering them thinner.

The alum leather-dreſſer dreſſes all ſorts of white leather from the ox-hide to the lamb ſkin; for dreſſing the ſaddler's leather, he uſes bran, ſea-ſalt, and alum; and for that which the glover uſes, after the common preparatives, he firſt employs bran, and then with ſalt, alum, fine flower

flower and yolks of eggs mixed in hot water, he makes a ſort of pap, with which the ſkins are ſmeared in a trough.

The ſhamoy leather-dreſſer ſoaks in oil, not only the ſkins of the true ſhamoy, which is a wild goat, but likewiſe thoſe of all other goats. The tanner uſes the bark of young oaks ground in a tanning mill, in which he ſoaks the ſkins more or leſs, according to the different ſervices expected from them, their chief uſe being to remain firm and keep out water. In certain caſes, inſtead of tan, he uſes redon, which is chiefly uſed for tanning ram, ſheep-ſkins, and dreſſing Ruſſia leather. But for the different methods in which the tanner, currier, Ruſſia and Morocco leather-dreſſers proceed in finiſhing their ſkins, ſee the articles CURRYING, TANNING, &c.

LEAVEN, a piece of ſour dough, uſed to ferment and render light a much larger quantity of dough or paſte.

LECTICA, in Roman antiquity, a vehicle in which people were carried in a reclining poſture.

LECTISTERNIUM, a religious faſt or banquet of the ancient Romans. In times of public danger or calamity, or of thankſgiving for ſome happy event, the Republic ordered ſolemn feaſts to be made for the gods; and this ſolemnity was called lectiſternium, becauſe on this occaſion they ſpread tables, and placed beds around them, on which their heavenly gueſts were to lie and eat.

LECTURERS, in England, are an order of preachers in pariſh churches, diſtinct from the rector or vicar. They are choſen by the veſtry, or chief inhabitants of the pariſh, and are uſually the afternoon preachers.

LEDGER, the principal book wherein merchants enter their accounts. See BOOK-KEEPING.

LEE, in the ſea-language, that part of the hemiſphere to which the wind bloweth, in oppoſition to the weather or windward ſide. This expreſſion however is only uſed in a ſhip, when the wind croſſes the line of her courſe at a greater or leſs angle; and hence

Under the LEE implies farther to lee-ward, or farther from that part of the horizon from which the wind bloweth, as

Under the LEE *of the Shore*, i. e. at a ſhort diſtance from that ſhore which lies to the wind ward, or from the land where the wind blows from. This phraſe is commonly uſed to expreſs the ſituation of a ſhip or boat which may be anchored, or ſailing under the weather ſhore, where there is always ſmoother water and leſs danger of heavy ſeas than at a great diſtance from it.

The Land appears under our LEE, i. e. at ſome diſtance from a ſhip on that ſide to which the wind bloweth, as it thwarts her way: and hence

LEE-LARCHES, the ſudden roll which a ſhip makes to lee-ward in a high ſea, when a large wave ſtrikes her, and bears her weather-ſide violently up, which depreſſes the other in proportion.

LEE-SIDE is the ſide of a ſhip which is fartheſt from the wind, as oppoſed to the weather-ſide, which is neareſt to it.

Thus admit a ſhip to be ſailing north-ward with the wind at weſt, then her ſtar-board or right-ſide is the lee-ſide, and the lar-board or left, the weather-ſide.

To LEE-WARD, towards that part of the hemiſphere which lies under the lee, or to which the wind bloweth.

LEE-WARD-SHIP, a ſhip that, going cloſe hauled, loſes much ground, and deviates further to lee-ward from her courſe than common. See the article CLOSE-HAULED.

LEE-WAY is the angle that the rhumb-line, upon which the ſhip endeavours to ſail, makes with the rhumb upon which ſhe really ſails.

This is occaſioned by the force of the wind, or ſurge of the ſea, when ſhe lies to the windward, or is cloſe hauled; which cauſes her to fall off and glide ſide-ways from the point of the compaſs ſhe capes at. Thus, let NE/S W (plate LXXVIII. *fig.* 5.) repreſent the compaſs, and ſuppoſe a ſhip at C capes at, or endeavours to ſail upon the rhumb C *a*, but by the force of the wind and ſurge of the ſea ſhe is obliged to fall off, and make her way good upon the rhumb C *b*; then the angle *a* C *b* is the lee-way: and if that angle be equal to one point, the ſhip is ſaid to make one point lee-way; or if equal to two points, the ſhip is ſaid to make two points lee-way, &c.

The quantity of this angle is very uncertain; becauſe ſome ſhips, with the ſame quantity of ſail, and with the ſame gale, will make more lee-way than others; it depending much upon the mould and trim of the ſhip, and the quantity of water that ſhe draws. However, the common allowances made for lee-way, are theſe: 1. If the ſhip be cloſe hauled, has all her ſails ſet, the water ſmooth, and a moderate gale of wind, ſhe is ſuppoſed to make little or no lee-way. 2. If it blow ſo freſh, as to cauſe the ſmall ſails to be handed, it is uſual to allow one point. 3. If it blow ſo hard, that the tops muſt be cloſe reeſt, the ſhip then makes about two points lee-way. 4. If one topſail muſt be handed, it is common to allow two and three quarters or three points lee-way. 5. When both topſails muſt be handed, they allow about four points lee-way. 6. When it blows ſo hard as to occaſion the fore courſe to be handed, the allowance is between five and a half and ſix points. 7. When both main and fore courſes muſt be handed, then ſix, or ſix and a half points muſt be allowed for her lee-way. 8. When the mizzen is handed, and the ſhip is trying a hull, ſhe then makes her way good about one point before the beam, that is, about ſeven points lee-way.

Though theſe rules are ſuch as are generally uſed, yet as the lee-way depends much upon the mould and trim of the ſhip, we ſhall here give the method of aſcertaining it by obſervation: thus let the ſhip's wake be ſet by a compaſs in the poop, and the oppoſite rhumb is the true courſe made good by the ſhip; then the difference between this and the courſe given by the compaſs in the bittacle, is the lee-way required. If the ſhip be within ſight of land, the lee-way may be exactly found by obſerving a point on the land which continues to bear the ſame way; for the diſtance between the point of the compaſs it lies on, and the point the ſhip capes at, will be the lee-way. Thus, ſuppoſe a ſhip at C (*fig.* 6.) is lying up at N *b* W, towards A; but inſtead of keeping that courſe, ſhe is carried on the NNE line C B, and conſequently the point B continues to bear always the ſame way from the ſhip: here it is evident, that the angle A C B, or the diſtance between the N *b* W line that the ſhip capes at, and the NNE line that the ſhip really ſails upon, will be the lee-way. See the articles COMPASS, COURSE, JOURNAL, &c.

LEECH, *Hirudo*, in zoology. See the article HIRUDO.

LEECH *of a Sail*, the perpendicular or upward ſloping-edges of a ſquare, oblong, or triangular ſail: in a ſquare or oblong ſail, the leeches are thoſe which are perpendicular, as oppoſed to the upper-edge, which is called the head, and to the lower, which is called the foot of the ſail. In triangular ſails, when there are only three ſides, two of them are called the fore and after-leeches, and the third, which is the lower edge, the foot.

LEECH-LINE, one of the brails of the main-ſail and fore-ſail, or one of thoſe cords which draw them together in a lump, when they are to be furled or reefed. See the article BRAIL and FURL.

The leech-line is ſo called from its being faſtened to the ſail in or near the middle of the leech.

LEECH-ROPE, the rope to which the leech of the ſail is ſewed. See the article BOLT-ROPE.

LEEK, a garden plant, called by botaniſts porrum. See the article PORRUM.

Leeks are commonly ſown along with onions; the onions growing up firſt are pulled up, ſo that the leeks have room to grow to their full ſize.

LEER, in glaſs-making, a furnace where the veſſels are allowed to cool by degrees. See GLASS.

LEES, the more groſs and ponderous parts of liquors, which, being ſeparated by fermentation, fall to the bottom.

A ſpirit of a very agreeable flavour is obtained, by the common proceſs of diſtillation, from wine lees; and as this flavour depends greatly on the eſſential oil of the lees, care ſhould be taken to bring it over with the ſpirit. In order to this, the ſolid lees muſt be ſteeped in ſix or eight times their own weight of water, and well ſtirred at times, before they are put into the ſtill. See DISTILLATION.

LEET, *Leta*, a little court held within a manor, and called the king's court, on account that its authority to puniſh offences originally belonged to the crown, from whence it derived to inferior perſons. See COURT-LEET.

LEG, *Crus*, in anatomy, includes the whole of the lower extremities, from the os innominatum to the toes, being commonly divided into the thigh, leg, and foot. See THIGH and FOOT.

The leg conſiſts of three bones, the tibia, fibula, and rotula. The tibia is a long thick triangular bone, ſituated at the anterior internal part of the leg, and continued nearly in a ſtraight line from the thigh bone, to ſupport the whole ſuperior fabric.

Its ſuperior extremity is large, bulbous, and ſpongy, and is divided into two cavities by a rough protuberance, which again is hollow at its moſt prominent part, as well as at its poſterior and anterior baſes. The internal cavity is oblong and deep to receive the internal condyle of the thigh bone, while the external is more ſuperficial and round for the external condyle.

Below the anterior part of the upper extremity of the tibia, a conſiderable rough protuberance riſes, to which the ſtrong tendinous ligament of the rotula is fixed. On the internal ſide of this, a ſcabrous cavity is formed, where the ſeminervoſus, gracilus gracilis, and ſartorius muſcles are inſerted; whence ſurgeons know at what part the tibia ought to be ſawed. Below the external edge of this ſuperior extremity, a circular flat ſurface, covered, in a recent ſubject, with a cartilage, is found for the articulation of the fibula; between which and the anterior knob is a rough hollow, from which the tibialis anticus and extenſor digitorum longus ariſe. From the ſmooth flat ſurface, a ridge runs obliquely downwards and inwards, to give riſe to the tibialis poſticus. At the inſide of this ridge an oblique plain ſurface is left, where the muſculus poplitæus is inſerted, and part of the ſolæus has its origin. Some way above the middle of the bone, the internal angle terminates, and the bone is made round and rough by the muſculus ſolæus. Near this, the paſſage of the medullary veſſels is ſeen ſlanting obliquely downwards in the poſterior plain ſurface.

The inferior extremity of the tibia is hollow, but ſo that a ſmall protuberance riſes in the middle. The internal ſide of this cavity, which is ſmooth, and in a recent ſubject is covered with a cartilage, is produced into a conſiderable proceſs, called malleolus internus, whoſe extremity is divided by a notch, and from it ligaments are ſent out to the foot. This internal malleolus is ſituated more forwards than the internal condyle of the ſuperior extremity of this bone, which is neceſſary to be remarked in reducing a fracture of the leg. The external ſide of this extremity has a rough ſemilunar cavity for receiving the inferior extremity of the fibula. The poſterior ſide has two lateral grooves and a ſmall middle protuberance. In the internal depreſſion the tendon of the muſculus tibialis poſticus is lodged; and in the external, the tendon of the flexor longus digitorum plays. From the middle protuberance ligamentary ſheaths go out for tying theſe tendons.

The fibula is the ſmall long bone, on the outſide of the leg, oppoſite to the external angle of the tibia, being irregularly triangular.

The ſuperior head of the fibula has a ſuperficial circular cavity on its inſide, which, in a recent ſubject, is covered with a cartilage, but ſo cloſely connected to the tibia, as to allow only a ſmall motion backwards and forwards. This head is protuberant and rough on its outſide, where the biceps is inſerted; and below its internal poſterior ſide, there is a tubercle which gives riſe to the ſtrong tendinous part of the ſolæus.

The external ſurface of this bone is depreſſed obliquely from above downwards and backwards by the two peronæi; and the anterior ſurface bears the prints of the extenſor digitorum longus, nonus, Veſalii, and extenſor pollicis longus. From the internal angle the ſtrong ligament is produced to be continued to the tibia, for the connection of theſe two bones, and origin of ſeveral muſcles. The poſterior ſurface is the ſmootheſt: in the middle of it the paſſage of the medullary veſſels is ſeen ſlanting downwards. The direction of theſe veſſels has been particularly deſcribed, leſt in any chirurgical operation they be opened too near the bone to occaſion an obſtinate hæmorrhage.

The inferior extremity of the fibula is extended into a ſpongy oblong head, on the inſide of which is a convex, irregular ſurface, that is received by the external hollow of the tibia, and ſo firmly joined thereto by a thin cartilage and ſtrong ligaments, that it ſcarce can move. Below this, the extremity of the fibula is ſtretched out into a coronoid proceſs, ſmooth, and covered with a cartilage, and contiguous to the outſide of the firſt bone of the foot, to ſecure the articulation on that ſide. This proceſs is called malleolus externus. This proceſs being farther back than the internal malleolus, and in an oblique direction, we turn the fore-part of the foot outwards. At its inferior internal part, there is a ſpongy cavity for mucilaginous glands; from its points ligaments go out to the foot, and on its back part there is a ſinuoſity made by the tendons of the peronæi muſcles.

The ſuperior extremity is joined to the tibia by arthrodia; and at the lower end the cartilage ſeems to glue the two bones together; not however ſo firmly in young people, but that the motion at the other extremity of the fibula is obſervable. In old ſubjects the two bones of the leg grow together at their lower extremities.

This bone ſerves chiefly for the origin and inſertion of muſcles, and for the more firm articulation of the foot.

The rotula is the ſmall flat bone ſituated at the anterior part of the joint of the knee. It reſembles the ſection of a heart, with its point downwards. Its anterior convex ſurface is pretty ſmooth, only it has ſeveral holes into which fibres of the ſtrong ligament enter; its poſterior ſurface is ſmooth, covered with a cartilage, and divided into two cavities by a convex ridge, both adapted to the pulley of the os femoris. This ſurface is ſurrounded by a rough edge, to which the circular ligament adheres. Below theſe, the point of the bone is ſcabrous, where the ligament from the tubercle of the tibia is fixed. The ſuperior part of this bone is flat and unequal, where the tendons of the extenſors of the leg are inſerted.

The ſubſtance of the rotula is cellular, with very thin external firm plates, and ſcarce any bone of its bulk is ſo ſtrong. Beſides this, it is covered over with a thick ligament to connect its ſubſtance, and is moveable to one ſide or other; ſo that it can reſiſt the actions of the muſcles inſerted in it, or any common external force; yet a tranſverſe fracture in this bone has been obſerved to have happened from the violent effort of the muſcles.

The articulation of the rotula with the os femoris is a plain ginglymus, and with the tibia by a ſtrong ſyndeſmoſis. At the ordinary time of birth, the rotula is cartilaginous, and ſcarce grows bony ſo ſoon as moſt epiphyſes.

The two principal motions of the knee-joint are flexion and extenſion. In the former caſe, the leg may form a very acute angle with the thigh, by the condyles of the thigh-bone being round and ſmooth backwards; ſo that the rotula is pulled down by the tibia. In extending the leg, the rotula is drawn upwards and the tibia forwards by the extenſor muſcles, which, by means of the protuberant joint, and this thick bone, with its ligament, have the cord with which they act fixed to the tibia at a conſiderable angle, but are reſtrained from pulling the leg farther than to a ſtraight line with the thigh, by the poſterior croſs ligament, that the body might be ſupported by a firm column; the thigh and leg being then as little moveable as one continued bone. But when the joint is bent, the rotula is not tightly braced, and the poſterior ligament is relaxed: therefore this bone may be moved a little to either ſide, or with a ſmall rotation, by the motion of the external cavity backwards and forwards on the internal, which ſerves as an axis.

Seeing then one part of the croſs ligament is ſituated perpendicularly, and the poſterior part obliquely from the internal condyle of the thigh outwards, that poſterior part of the ligament will prevent the legs turning inwards, but not from turning outwards almoſt round, nor that motion confined by the lateral ligaments of the joint. For the arteries, veins, and nerves of the inferior extremities, ſee the articles ARTERY, NERVE, VEIN and MUSCLE.

The muſcles that move the bones of the leg on the os femoris are very long, and ſituated near each other quite round that bone. They are ten in number: 1. Rectus anterior ſive gracilis anterior. 2. Vaſtus externus. 3. Vaſtus internus. 4. Crureus. 5. Sartorius. 6. Gracilis internus ſive rectus internus. 7. Biceps. 8. Semi nervoſus. 9. Semi-membranoſus: and, 10. Poplitæus. Of all theſe the poplitæus is ſmall and ſituated below the thigh; a portion of the biceps is alſo ſmall. Theſe muſcles move the leg upon the thigh, and the thigh upon the leg, the poplitæus excepted: and the gaſtrocnemii may likewiſe perform the ſame motions, though commonly confined to the extenſion of the foot. *Winſlow.*

LEGACY ſignifies any thing that is particularly given or bequeathed by a laſt will and teſtament. See WILL and TESTAMENT.

LEGATE, a cardinal or biſhop, whom the pope ſends as his ambaſſador to ſovereign princes. See AMBASSADOR.

There are three kinds of legates, viz. legates a latere, legates de latere, and legates by office, or legati nati: of theſe the moſt conſiderable are the legate a latere, the next are the legates de latere. See the article A LATERE.

Legates by office are thoſe who have not any particular legation given them, but who by virtue of their dignity and rank in the church become legates; ſuch are the archbiſhop of Rheims and Arles; but the authority of theſe legates is much inferior to that of the legates a latere.

LEGATUS, in Roman antiquity, a military officer who commanded as deputy of the chief general.

LEGEND, an idle or ridiculous ſtory told by the Romaniſts concerning their ſaints, and other perſons, in order to ſupport the credit of their religion.

LEGER-LINE, in muſic, one added to the ſtaff of five lines, when the aſcending or deſcending notes run very high or low: there are ſometimes many of theſe lines both above and below the ſtaff, to the number of four or five.

LEGGIARDO, or LEGGIARDAMENTE, in muſic, ſignifies to play or ſing in a lively, briſk, and gay manner.

LEGION, in Roman antiquity, a body of foot which conſiſted of ten cohorts.

The exact number contained in a legion, was fixed by Romulus at three thouſand; though Plutarch aſſures us, that after the reception of the Sabines into Rome, he encreaſed it to ſix thouſand. The common number afterwards, in the firſt times of the free ſtate, was four thouſand; but in the war with Hannibal it aroſe to five thouſand, and after this it is probable that it ſunk again to four thouſand, or four thouſand two hundred, which was the number in the time of Polybius.

LEGISLATOR, or LAW-GIVER, he who frames laws for any ſtate or kingdom.

LEGITIMATION, an act whereby illegitimate children are rendered legitimate. See the article BASTARD.

LEGUME, *Legumen*, among botaniſts, denotes a pericarpium of an oblong compreſſed figure, formed of two valves, joined by a viſible ſuture both on the upper and under parts, and having the ſeeds affixed to the upper limbs of the two valves, in an alternate order.

LEGUMINOUS, an appellation given to all plants whoſe fruit is a legume.

LEMMA, in mathematics, a previous propoſition laid down, in order to clear the way for ſome following demonſtration; and is prefixed either to the theorems or problems.

Thus to prove a pyramid one third of a priſm of the ſame baſe and height with it, as the demonſtration is difficult, this lemma may be premiſed, which is proved in progreſſion, "That the ſum of the ſeries of the ſquares of numbers in arithmetical progreſſion, beginning from 0, 1, &c. is always ſubtriple of the ſum of as many terms equal to the greateſt; or is always one third of the greateſt term multiplied by the number of terms." And in like manner, to find the inflexion of any curve, this lemma is firſt premiſed, "That a tangent may be drawn to the given curve in a given point;" and ſo in phyſics, medicine, &c.

LEMNA, duck weed, in botany, a genus of plants, producing diſtinct hermaphrodite and female flowers: neither of which have any flower petals: the ſtamina are two ſubulated filaments; and the fruit is a globoſe, unilocular capſule.

LEMON, *Limon*, in botany, a genus of trees with large ſtiff leaves like the citron, without any appendage at the bottom; the flower conſiſts of many leaves, which expand in form of a roſe: the fruit is almoſt of an oval figure, and divided into ſeveral cells, in which are lodged hard ſeeds ſurrounded by a thick fleſhy ſubſtance, which, for the moſt part, is full of an acid juice.

All ſorts are propagated by budding or inarching them either on ſtocks of lemons or citrons produced from ſeeds; but they will not readily unite on orange ſtocks; for which reaſon the citrons are preferable to either oranges or lemons for ſtocks, as they readily join with either ſort; and being of larger growth, cauſe the buds of the other ſorts to be much ſtronger than if they were on ſtocks of their own kind.

The culture of the lemon is the ſame with that of the orange-tree, with this difference only, the former being hardier than the latter, will conſequently bring their fruit to maturity with us much better than the orange will, and therefore require to have a greater ſhare of freſh air in winter; for which reaſon they ſhould always be placed nearer to the doors or windows of the green houſe: and in ſome curious gardens theſe trees have been planted againſt walls, where, by covering them with glaſſes in winter, and protecting them from ſevere froſt, they have produced plenty of large fruit: as theſe trees do generally produce ſtronger ſhoots, ſo they require more water to be given them than the orange; but as to the tender ſorts, they muſt be treated with a little more care, otherwiſe their fruit will fall off in winter, and come to nothing. See ORANGE.

LEMONADE, a liquor prepared of water, ſugar, and lemon or citron-juice: it is very cooling and grateful.

LAMURIA, a feſtival of the ancient Romans, ſolemnized on the ninth of May, to pacify the manes of the dead, who were the lemures or phantoms that came in the night to torment the living.

LENITIVE MEDICINES, among phyſicians, thoſe of a mild, ſoftening, and relaxing nature, and deſtitute of all acrimony.

LENS, in dioptrics, a ſmall oblong glaſs like a lentil; it is a medium terminated on one ſide by a ſpherical ſurface, on the other by a ſurface either plain or ſpherical. And of theſe there are five ſorts. The firſt, as A (plate LXXVIII. *fig.* 7.) is plain on one ſide, and convex on the other; the ſecond B convex on both ſides; the third plain on one ſide and concave on the other, as C; the fourth D concave on both ſides; the fifth convex on one ſide and concave on the other, as E, which is by ſome called a meniſcus.

The axis of a lens is a line paſſing perpendicularly through both its ſurfaces: thus the line F G is an axis common to all the five.

Lenſes are diſtinguiſhed into two general kinds, convex and concave: the firſt and ſecond lenſes are conſidered as convex; the third and fourth as concave: the laſt, if its convexity is greater than its concavity, is looked upon as convex; if on the contrary, it is conſidered as concave.

A lens is always ſuppoſed to conſiſt of a medium denſer than the circumambient one, unleſs where the contrary is expreſſed.

When parallel rays fall upon the ſurface of a convex lens, they are refracted towards each other in paſſing through it, and thereby collected to a focus on the other ſide.

To explain this let us trace the progreſs of a ray as A B (*fig.* 8.) through the convex lens C D E H, whoſe axis is I K. Let L be the center of the firſt convexity C D E, and M that of the other C H E: and let this ray A B be parallel to the axis; through B draw the line L N, which will be perpendicular to the ſurface C D E at that point. The ray A B in entering the denſer ſubſtance of the lens will

will be refracted towards the perpendicular, and, therefore, proceed, after it has entered the ſurface at B, in ſome direction inclined towards the axis, as BP. Through M, the center of convexity of this ſurface, and the point P, draw the line MR, which paſſing through the center will be perpendicular to the ſurface at P, and the ray now entering a rarer medium will be refracted from the perpendicular into ſome direction as PF. In like manner and for the ſame reaſons, the parallel ray ST on the other ſide the axis, and alſo all the intermediate ones as XZ, &c. will meet in the ſame point, unleſs the rays AB and ST enter the ſurface of the lens at too great a diſtance from the axis IF, the reaſon of which has already been fully explained. See REFRACTION.

The point F where the parallel rays AB, SF, &c. are ſuppoſed to be collected by paſſing through the lens CE, is called the focus of parallel rays of that lens.

If the rays converge before they enter the lens, they are then collected at a point nearer to the lens than the focus of parallel rays. If they diverge before they enter the lens, they are then collected in a point beyond F; unleſs they proceed from a point on the other ſide at the ſame diſtance with the focus of parallel rays, in which caſe they are rendered parallel. If they proceed from a point nearer than that, they diverge afterwards, but in a leſs degree than before they enter the lens.

If the lens is plain on one ſide and convex on the other, the rays are refracted the ſame way, but in a leſs degree.

Had the rays AB, ST, proceeded from a radiant point on one ſide the lens, and been collected in a focus on the other; then if they ſhould be ſuppoſed to proceed from that focal point as from a radiant, and paſs through the lens the contrary way, they would be collected in that point which was the radiant in the other caſe: and the nearer the radiant point is to the lens, the farther is the focus from it on the other ſide, and vice verſa.

If the rays AB, CD, EF, &c. (*fig.* 9.) be parallel to each other, but oblique to GH, the axis of the lens IK, or if the diverging rays CB, CF, proceed as from ſome point C which is not ſituated in the axis of the lens, they will be collected into ſome point as L, not directly oppoſite to the radiant C, but nearly ſo: for the ray CD which paſſes through M, the middle of the lens, and falls upon the ſurface of it with ſome obliquity, will itſelf ſuffer a refraction at D and N; but then it will be refracted the contrary way in one place to what it is in the other, and theſe refractions will be equal in degree, if the lens has an equal convexity on each ſide, as we may eaſily perceive, if we imagine ND to be a ray paſſing out of the lens both at N and D; for it is evident that the line ND has an equal inclination to each ſurface at both its extremities. Upon which account the difference between the ſituation of the point L and one directly oppoſite to C is ſo ſmall, that it is generally neglected; and the focus is ſuppoſed to be in that line, which a ray, that would paſs through the middle point of the lens, were it to ſuffer no refraction, would proceed in.

All which is ſufficiently clear, from what is ſaid under the article REFRACTION.

When parallel rays fall upon a concave lens, they are refracted from each other in paſſing through it, and thereby made to diverge, proceeding as from an imaginary focus on the firſt ſide of the lens.

In order to comprehend this, let ABCD (pl. LXXIX. *fig.* 1) repreſent a concave lens, EF its axis, GH the radius of the firſt concavity, IK that of the ſecond; produce GH to L, and let MG be a ray of light entering the lens at the point G. This ray, being refracted towards the perpendicular GL, will paſs on to ſome point as K in the other ſurface more diſtant from the axis than G, and being there refracted from the perpendicular IK, will be diverted farther ſtill from the axis, and proceed in the direction KN as from ſome point as O on the firſt ſide of the lens. In like manner other rays as PQ, parallel to the former, will proceed after refraction at both ſurfaces as from the ſame point O; which upon that account will be the imaginary focus of parallel rays of this lens.

If the rays diverge before they enter the lens, their imaginary focus is then nearer the lens than that of the parallel rays. If they converge before they enter the lens, proceeding towards ſome diſtant point in the axis as E, they are then rendered leſs converging; if they converge to a point at the ſame diſtance from the lens with the focus of parallel rays, they then go out parallel; if to a point at leſs diſtance, they remain converging, but in a leſs degree than before they entered the lens.

When the rays enter the lens diverging, the nearer their radiant point is to it, the nearer alſo is their imaginary focus after refraction, and vice verſa.

If the lens is plain on one ſide and concave on the other, the rays ſuffer a like refraction in each caſe, but in a leſs degree.

The truth of what has been ſaid concerning the paſſage of rays through a concave lens, is eaſily to be deduced from the laws of refraction.

But the method of determining the exact focal diſtance of lenſes is to be had from the propoſitions laid down and demonſtrated in the article REFRACTION. Thus the progreſs of the rays, after their refraction at the firſt ſurface where they enter a lens, is had by one of thoſe which determines the focal diſtance of rays entering a denſer medium of ſuch form: and their progreſs, after their refraction at the other ſurface where they go out, is had by computing what progreſs rays, moving in the direction they are found to have after their entrance at the firſt ſurface, will acquire by being refracted at the other; which is to be effected by one who determines the focal diſtance of rays paſſing out of a denſer medium of like form with that of the lens.

When a ray paſſes through a medium terminated by two plain and parallel ſurfaces, it is refracted one way in going out of the ſecond, as much as it was the other in entering the firſt; and, therefore, proceeds afterwards, not in the ſame direction, but in one which is parallel to that which it had before.

Thus, if the ray AB (*fig.* 2.) enters the denſer medium CDEF terminated by the parallel ſurfaces CD and EF, it is refracted at B towards the perpendicular BI, proceeding to a point at G, where it is as much refracted from the perpendicular GK in going out, and proceeds in the direction GH, not the ſame, but parallel to the former ABL.

LENT, a ſolemn time of faſting in the Chriſtian church, obſerved as a time of humiliation before Eaſter, the great feſtival of our Saviour's reſurrection.

Thoſe of the Romiſh church, and ſome of the proteſtant communion, maintain, that it was always a faſt of forty days, and as ſuch, of apoſtolical inſtitution. Others think it was only of eccleſiaſtical inſtitution, and that it was variouſly obſerved in different churches, and grew by degrees from a faſt of forty hours, to a faſt of forty days. This is the ſentiment of Morton, biſhop Taylor, du Moulin, Daillé, and others.

The Chriſtians of the Greek church obſerve four Lents; the firſt commences on the fifteenth of November, or forty days before Chriſtmas; the ſecond is the ſame with our Lent; the third begins the week after Whitſuntide, and continues till the feſtival of St. Peter and St. Paul; and the fourth commences on the firſt of Auguſt, and laſts no longer than till the fifteenth. Theſe Lents are obſerved with great ſtrictneſs and auſterity; but on Saturdays and Sundays they indulge themſelves in drinking wine and uſing oil, which are prohibited on other days.

LENTA FEBRIS, the ſlow fever. See the article FEVER.

LENTIGO, FRECKLES, in medicine. See the article FRECKLES.

LENTISCUS, the lentiſk or maſtich-tree, in botany, a genus of trees, very nearly allied to the terebinthus, or turpentine-tree, in its characters, but differing in that the leaves are pennated; but there is no ſingle leaf to terminate the end of each compound one. See the article MASTICH.

LEO, the lion, in zoology. See LION.

LEO, in aſtronomy, one of the twelve ſigns of the zodiac, the fifth in order, containing, according to Ptolemy, thirty-two ſtars; according to Tycho, thirty-ſeven and

and, in the Britannic catalogue, there are no leſs than ninety-four.

The ſtar called the lion's heart, cor leonis, regulus, and baſilicus, is a fixed ſtar of the firſt magnitude.

LEONINE VERSES, ſuch as rhyme at every hemiſtich, the middle ſyllable of each verſe correſponding to the laſt one.

LEONTODON, dandelion, in botany, a genus of plants, the compound flower of which is imbricated and uniform; and the partial ones, monopetalous and ligulated; the ſtamina are five ſcarcely diſcernible capillary filaments: the ſeed, which is ſolitary, is contained in the cup of each partial flower, or corollula.

Dandelion is ſaid to have much the ſame virtues with endive. See ENDIVE.

LEONURUS, lion's tail, a genus of plants, the flower of which is monopetalous and ringent; and its ſeeds, which are four in number, are contained in the bottom of the cup.

LEOPARD, a beaſt of prey, with the ſpots on the upper part of the body round, and the lower ones virgated. It is a very nimble, as well as fierce animal, ſo that ſcarce any thing eſcapes it.

Authors called the male pardus, and the female panthera.

LEOPARD'S BANE, doronicum, in botany. See the article DORONICUM.

LEPIDIUM, dittander, in botany, a genus of plants, with a tetrapetalous cruciform flower: the ſtamina are ſix ſubulated filaments; and the fruit is a compreſſed bilocular pod.

LEPIDOPTERA, in zoology, an order of inſects, with four wings, which are covered with imbricated ſquamulæ: add to this, that the mouth is commonly ſpiral.

Under this order are comprehended the butterflies, and phalenæ, or moths.

LEPROSY, *Lepra*, in phyſic, a higher degree of cutaneous diſorder than an itch, the ſame with lepra arabum. See ITCH, IMPETIGO, and ELEPHANTIASIS.

The word is derived from the Greek λεπρα, ſignifying the ſame, and that from λεπις, a ſcale.

There is a wide difference between the itch and leproſy, and that ulcerous diſorder in which white ſordid ulcers, ſeizing principally the muſcular parts, ſuch as the back, arms, thighs, &c. diſcharge a putrid ſanies, and ſometimes appearing in one limb, and ſometimes in another, often continue for many years. Large quantities of worms are alſo found lodged within theſe ulcers, ſo that they can hardly be extirpated.

The lepra and elephantiaſis are diſeaſes nearly alike.

The method for the cure of theſe and ſuch like malignant diſorders is to diſcharge the maſs of corrupt, glutinous, and acrid humours, by ſufficient bleeding and abſtinence, by purges both gentle and draſtic, and then by a proper regimen. But if the growing and refractory ſtate of the diſeaſe raiſes a ſuſpicion of malignity, there are no remedies more powerful, if the patient's ſtrength permit, than mercury and its preparations. Some make an unguent of live mercury thoroughly extinguiſhed with pomatum, adding flowers of ſulphur and camphire, with which the joints, ancles, &c. are to be well rubbed. But others chooſe a better and ſafer method of uſing mercury internally; whilſt, by a previous preparation of the body, by alteratives, correctors, and evacuants, mercurius dulcis, with double the quantity of crabs-eyes, and diaphoretic antimony, is duly exhibited. This intention is alſo anſwered by mercurius ſolaris and jovialis, of which a few grains, with conſerve of roſes, may be exhibited every morning, drinking in bed, after it, a pint of ſome proper decoction. Each of theſe methods requires a very temperate air, a ſpare diet, and abſtinence from pinguious or boiled fleſh and acids.

But if the patient be either an infant, or too old, both the ancients and moſt judicious of the moderns have greatly extolled preparations of milk, eſpecially aſſes milk, the whey of cows and goats milk, and milk mixed with water.

Whenever theſe exanthematous diſorders are ſupported by a ſcorbutic lues, or hypochondriac affection, a much greater advantage will be procured, when the milk diet is ſo managed as to alleviate the other diſorder with which they are complicated: for which purpoſe the beſt way is the due uſe of medicinal waters, eſpecially thoſe of a temperate kind, impregnated with a ſaline and ſpirituous principle. But if ſuch waters cannot be had, the end will be beſt anſwered by a decoction of ſuch herbs as depurate the blood, and are particularly deſtined to theſe diſorders, with milk or whey, both ſweet and ſomewhat ſour. *Francis Hoffman.*

LEPUS, the hare, in zoology. See HARE.

LEPUS, in aſtronomy, a conſtellation of the ſouthern hemiſphere; comprehending twelve ſtars, according to Ptolemy; thirteen, according to Tycho; and nineteen in the Britannic catalogue.

LESSONS, among eccleſiaſtical writers, portions of the Holy Scripture, read in Chriſtian churches at the time of divine ſervice.

LETHARGY, *Lethargus*, in phyſic, a kind of diſorder wherein the perſon affected labours under a heavy and perpetual ſleep, with ſcarce any interval of waking.

The word is derived from the Greek λήθη, ſleep, and ἀργὸς, ſlothful.

There are ſeveral ſpecies of this diſorder; the chief are coma vigil, coma ſomnolentum, carus, and a lethargy. See COMA, CARUS, &c.

LETHE, in the ancient mythology, one of the rivers of hell, ſignifying oblivion or forgetfulneſs; its waters having, according to poetical fiction, the peculiar quality of making thoſe who drank of them entirely forget every thing that was paſt.

LETTER, *Litera*, a character either in print or writing, which men have agreed on to ſignify ſomething, by joining of which they make their thoughts known to one another.

The alphabet of every language conſiſts of a certain number of letters or characters, which have a different ſound, form, and ſignification. See ALPHABET.

The articulation of words, or formation of the ſeveral letters, begins when the breath has paſt the throat; and is almoſt performed by the noſtrils, mouth, tongue, and lips.

Some ſay that Fohi, firſt king among the Chineſe, and 2950 years before Chriſt, invented letters, having writ in their language a book called Yexim. Others think from mummies and obeliſks, that hieroglyphics were the firſt manner of writing, they being prior to Moſes, as moſt of the obeliſks and pyramids were made, while the Iſraelites were in Egypt. The Chaldeans or Phœnicians, it is very likely, were the maſters of the Egyptians; whence it was that thoſe letters were called Phœnician by the Greeks: yet, according to Diodorus Siculus, they only changed the form of letters.

Pliny will have the moſt ancient letters to have been the Aſſyrian, and that Cadmus, about two hundred and fifty years before the Trojan war, brought ſixteen of them from Phœnicia into Greece, namely, A, B, C, D, E, F, I, L, M, N, O, P, R, S, T, U, to which Palamedes, during the Trojan war, had added four, Θ Ξ Φ Υ.

Simonides, Evander, and Demaratus, were the firſt that brought letters into Italy.

The Hebrews made a diviſion of their letters into guttural, viz. *a, h, ch, gn,* or *aleph, he, cheth, hain*; dental, as *z, s, r, zain, tſadde, reſh*; labial, *b, m, n, p, beth, mem, vau, phe*; and thoſe of the tongue, *d, t, l, n*; or *daleth, tau, lamed, nun*; and palatal, as *g, i, c, k, ghimel, jod, caph, coph.*

The letters F, G, H, K, Q, X, Y, Z, were formerly unknown to the Romans. One letter was intended to ſignify only one ſound, and not as at preſent now to expreſs one ſound, and then another, which has introduced that confuſion which has rendered the learning of our modern tongue extremely difficult.

Grammarians diſtinguiſh their letters into vowels and conſonants; into mutes, diphthongs, liquids, and characteriſtics. Printers diſtinguiſh their letters into capital, majuſcule, initial, or upper-caſe letters, which ſerve for the titles of books, &c. and minuſcule, ſmall or under-caſe letters, which are again divided into pearl, nonpareil, pica, and great canon.

Letters, again, are of various ſizes, each of which are ſometimes caſt with the Roman, ſometimes Italic, ſometimes

times an Engliſh, or black letter face. There are alſo bodies with the Greek, Hebrew, Arabic, the muſic face, &c.

A ſet or fount of any of theſe ſizes includes current letters, capitals, numeral figures, points, ſpaces, &c. See FOUNT.

Letters are the elements of grammar; an aſſemblage of theſe compoſes ſyllables, of thoſe words, and of theſe ſentences.

Numeral LETTERS, thoſe uſed inſtead of cyphers, in order to expreſs numbers, as C, D, I, L, M, V, X.

LETTER alſo denotes the ſame with epiſtle, a writing addreſſed to any perſon.

LETTER *of Attorney*, a writing authoriſing any perſon to do ſome lawful act for another, as to give ſeizin of lands, receive debts, ſue a third perſon, &c.

LETTER *of Credit*, among merchants, is a letter wrote by a merchant or banker to his correſpondent abroad, requeſting him to credit the bearer as far as a certain ſum. See CREDIT.

LETTER *of Licence*, an inſtrument or writing granted by a perſon's creditors, allowing him a certain time for the payment of his debts; by which means he is enabled to proſecute his buſineſs, without fearing an arreſt.

LETTER *of Mart*, or *Marque*, a letter granted to one of the king's ſubjects, under the privy ſeal, impowering him to make repriſals for what was formerly taken from him by the ſubjects of another ſtate, contrary to the law of mart. See MARQUE.

Monitory LETTERS. See MONITORY.

LETTERS-PATENT, or OVERT, are writings ſealed with the great ſeal of England, ſo called, becauſe they are open with the ſeal affixed to them. Theſe are granted to authoriſe a man to do, or enjoy, what of himſelf he could not do. See the article PATENT.

Paciſic LETTERS, *Literæ Pacificæ*, in church-hiſtory, teſtimonial letters given by the biſhop, or chorepiſcopus, to their prieſts, when they had occaſion to travel abroad, certifying that the bearer was a catholic, and in communion with the church.

Paſchal LETTER, a letter written by the pope to all metropolitans, to inform them on what day Eaſter was to be celebrated.

LEVARI FACIAS, is a writ directed to the ſheriff for levying a certain ſum of money upon the lands, &c. of a perſon who has forfeited his recognizance.

LEVATOR, in anatomy, a name applied to ſeveral muſcles in the body, that ſerve to raiſe the parts to which they belong. See ELEVATOR.

LEVATOR *ſcapulæ proprius*, in anatomy, or rather, according to Winſlow, *angularis*, is a long and pretty thick muſcle, about two fingers in breadth, lying above the ſuperior angle of the ſcapula, along the poſterior lateral part of the neck of that bone. It is inſerted above in the tranſverſe apophyſes of the four firſt vertebra of the neck, by four fleſhy branches ending in ſhort tendons. From thence theſe branches run down a little obliquely, and then uniting are inſerted into the ſuperior angle of the ſcapula and in the edge of its baſis, and from thence to the ſmall triangular ſpace, being there covered a little by the rhomboides: it is alſo covered by the trapezius. By its inſertion in the ſuperior angle of the ſcapula, it moderates the deſcent of that angle, while the trapezius and ſerratus major raiſe the acromium. Afterwards, when theſe two muſcles ceaſe to act, the angularis raiſes the ſuperior angle, and by that means depreſſes the acromium.

LEVATORES *Ani*, in anatomy, are muſcles that ariſe fleſhy from each ſide of the oſſa pubis, internally within the pelvis, as alſo from part of the os iſchium and ſacrum; from thoſe places, like lines drawn from a circumference towards a center, its fibres deſcend, over the muſculi marſupiales, to their implantation at the lower end of the inteſtinum rectum in the anus. They chiefly ſerve to ſuſpend and draw the anus upwards, leſt the fæces ſhould be burdenſome to the ſphincter. In their deſcent, on each ſide forwards, from the oſſa pubis, they paſs cloſe over the glandulæ proſtatæ, in a manner embracing them, whereby they are rendered capable of compreſſing them; and by a retraction of the anus, at the ſame time act on the veſiculæ ſeminales, in order to promote the emiſſion of the ſemen in coitu. *Cowper.*

LEUCADENDRON, in botany, a genus of plants, the general corolla of which is uniform and convex; the partial one of which is oblong, hoary on the outſide, and compoſed of two petals; the upper petal is a long line or unguis, and its limb is lanceolated, undivided, and in its lower part is firmly joined to the lower petal; the lower petal has alſo a long unguis of a linear figure, but three times as broad as that of the upper petal; the cup, ſcarce at all altered, ſerves inſtead of a pericarpium, and contains a ſingle roundiſh ſeed, coronated with hairs.

LETTUCE, *Lactuca*, in botany, a genus of plants, with a fibroſe root, which is, for the moſt part, annual: the leaves are ſmooth, and grow alternately upon the branches; the ſtalks are, for the moſt part, ſlender and ſtiff, and commonly terminate into a ſort of umbel; the cup of the flower is oblong, ſlender, and ſcaly; the ſeeds are oblong, depreſſed, and generally terminate in a point.

It would be beſide my purpoſe to mention in this place the ſeveral ſorts of lettuce that are to be found in botanic writers, many of which are plants of no uſe, and are never cultivated but in botanic gardens for variety; and ſome of them are found wild in many parts of England. I ſhall therefore paſs over thoſe here, and only mention the ſeveral ſorts which are cultivated in the kitchen garden for uſe: 1. Common or garden lettuce. 2. Cabbage lettuce. 3. Cilicia lettuce. 4. Dutch brown lettuce. 5. Aleppo lettuce. 6. Imperial lettuce. 7. Green capuchin lettuce. 8. Verſailles or upright white cos lettuce. 9. Black cos. 10. White cos. 11. Red capuchin lettuce. 12. Roman lettuce. 13. Prince lettuce. 14. Royal lettuce. 15. Egyptian cos lettuce.

The firſt of theſe ſorts is commonly ſown very early for cutting, to mix with other ſmall ſallad-herbs, and is only different from the ſecond ſort, in being a degeneracy therefrom; or otherwiſe the ſecond is an improvement by frequent cultivation from the firſt: for if the ſeeds are ſaved from ſuch plants of the ſecond ſort as did not cabbage cloſely, the plants produced from that ſeed will all degenerate to the firſt ſort; which is by the gardeners called lapped lettuce, to diſtinguiſh it from the other, which they call cabbage lettuce. The ſeeds of the firſt, which are commonly ſaved from any of the plants, without having any regard to their goodneſs, are generally ſold at a very cheap rate, eſpecially in dry ſeaſons, when theſe plants always produce the greateſt quantity of ſeeds; though ſometimes this ſeed is ſold in the ſeed ſhops, and by perſons who make a trade of ſelling ſeeds, for the cabbage lettuce; which is often the occaſion of people's being diſappointed in their crop: ſo that this ſort ſhould never be cultivated, but to be cut up very young; for which purpoſe this is the only good ſort, and may be ſown any time of the year; obſerving only in hot weather to ſow it on ſhady borders, and in the ſpring and autumn upon warm borders; but in winter it ſhould be ſown under glaſſes, otherwiſe it is ſubject to be deſtroyed by ſevere froſts.

The cabbage lettuce may alſo be ſown at different times of the year, in order to have a continuation of it through the whole ſeaſon. The firſt crop is generally ſown in February; which ſhould be upon an open warm ſpot of ground, and when the plants are come up, they ſhould be thinned out to the diſtance of ten inches each way; which may be done by hoeing them out, as is practiſed for turneps, carrots, onions, &c. provided you have no occaſion for the ſuperfluous plants; otherwiſe they may be drawn up, and tranſplanted into another ſpot of good ground at the ſame diſtance; which if done before the plants are too large, they will ſucceed very well, though they will not be ſo large as thoſe which were left upon the ſpot where they were ſown; but they will come ſomewhat later, which will be of ſervice, where people do not ſow every month.

The Cilicia, imperial, royal, black, white, and upright cos lettuces may be ſown at the following times: the firſt ſeaſon for ſowing theſe ſeeds is at the end of February, or the beginning of March, upon a warm light ſoil, and an open ſituation; i. e. not overſhadowed with trees: and, when the plants are come up, they ſhould be either hoed out, or tranſplanted into another ſpot of ground, as was directed for the cabbage lettuce, obſerving

ing to leave theſe ſorts fifteen or ſixteen inches apart each way; which will be full near enough for theſe plants, eſpecially if the ſoil be good; and you muſt carefully keep them clear from weeds, which is the only culture they will require, except the black cos lettuce, which ſhould be tied up when they are full grown, to whiten their inner leaves, and render then criſp; otherwiſe they are ſeldom good for much, rarely cabbaging without this aſſiſtance.

You may alſo continue theſe ſorts through the ſeaſon, by ſowing them in April, May, and June; obſerving to ſow the late crops in a moiſt ſhady ſituation, otherwiſe they will run up to ſeed before they grow to any ſize; but in Auguſt, toward the latter end, you may ſow of theſe ſorts, to abide the winter; which plants ſhould be tranſplanted either under glaſſes, or into a hot-bed, which ſhould be arched over with hoops, in order to be covered in winter, otherwiſe in hard winters they are often deſtroyed; but you muſt conſtantly let theſe plants have as much open free air as poſſible, when the weather is mild; only covering them in hard rains, or froſty weather; for if they are kept cloſely covered in winter, they will be ſubject to a mouldineſs which ſoon rots them.

The moſt valuable of all the ſorts of lettuce in England are the Egyptian green cos, and the Verſailles or white cos, the Cilicia, and black cos; though ſome people are very fond of the royal and imperial lettuces; but they ſeldom ſell ſo well in the London markets as the others, nor are ſo generally eſteemed. Indeed of late years, ſince the white cos has been commonly cultivated, it has obtained the preference of all the other ſorts, until the Egyptian green cos was introduced; which is ſo much ſweeter and tenderer than the white cos, that it is by all good judges eſteemed the beſt ſort of lettuce known. This ſort will endure the cold of our ordinary winters full as well as the white cos; but at the ſeaſon of its cabbaging, if there happens to be much wet, this ſort, being very tender, is very ſubject to rot.

The brown Dutch and green capuchin lettuces are very hardy, and may be ſown at the ſeaſons as was directed for the common cabbage lettuce; and are very proper to plant under a wall or hedge to ſtand the winter; where many times theſe will abide, when moſt of the other ſorts are deſtroyed; and therefore they will prove very acceptable at a time when few other ſorts are to be had; they will alſo endure more heat and drought than moſt other ſorts of lettuce, which renders them very proper for late ſowing; for it often happens, in very hot weather, that the other ſorts of lettuce will run up to ſeed in a few days after they are cabbaged; whereas theſe will abide near three weeks in good order, eſpecially if care be taken to cut the forwardeſt firſt, leaving thoſe that are not ſo hard cabbaged to be laſt. In ſaving of theſe ſeeds, the ſame care ſhould be taken to preſerve only ſuch as are very large, and well cabbaged, otherwiſe the ſeeds will degenerate, and be good for little.

The red capuchin, Roman, and prince lettuces are pretty varieties, and cabbage very early; for which reaſon a few of them may be preſerved; as may ſome of the Aleppo, for the beauty of its ſpotted leaves; though very few people care for either of theſe ſorts at table, when the other more valuable ones are to be obtained; but in a ſcarcity, theſe may ſupply the place pretty well; and theſe ſorts are very proper for ſoups. The ſeeds of theſe muſt alſo be ſaved from ſuch as cabbage beſt, otherwiſe they will degenerate, and be good for little: *Miller's Gard. Dict.*

LEVEL, an inſtrument to draw a line parallel to the horizon, whereby the difference of aſcent or deſcent between ſeveral places may be found, for conveying water, draining fens, &c.

The word is derived from the Latin, *libella*, the croſs beam in a balance, which, to be juſt, muſt ſtand exactly horizontal.

Air LEVEL, that which ſhews the line of level by means of a bubble of air incloſed with ſome liquor in a glaſs tube, whoſe two edges are ſealed hermetically. When the bubble fixes at a mark made exactly in the middle of the tube, the plane where it is fixed is level; otherwiſe the bubble will riſe to one end.

The liquor with which the tube is filled is oil of tartar, or aqua-ſecunda; theſe not being liable to freeze.

Air LEVEL, with ſights, conſiſts of an air level (plate LXXIX. *fig.* 3.) about eight inches long, and ſeven or eight in diameter, ſet in a braſs tube, with an aperture in the middle. The tubes are carried in a ſtrong ſtraight ruler, a foot long, at whoſe ends are fixed two ſights exactly perpendicular to the tubes, and of an equal height, having a ſquare hole, formed by two fillets of braſs, croſſing each other at right angles, in the middle of which is drilled a very little hole, through which a point on a level with the inſtrument is deſcribed.

The braſs tube is faſtened on the ruler by means of two ſcrews; one of which, marked 4, ſerves to raiſe or depreſs the tube at pleaſure, to bring it to a level. The top of the ball and ſocket is rivetted to a little ruler that ſprings, one end of which is faſtened with ſcrews to the great ruler, and the other end has a ſcrew 5, ſerving to raiſe or depreſs the inſtrument when nearly level.

The following is a more commodious inſtrument.

Air LEVEL, with teleſcope ſights; this level (*fig.* 4.) only differs from the laſt, in that, inſtead of plain ſights, it carries a teleſcope.

This was invented by M. Huygens; which has this advantage, that it may be inverted by turning the rule and teleſcope half round; and then, if the hair cut the ſame point that it did before the turn, it is a proof the operation is juſt.

It may be obſerved, that one may add a teleſcope to any kind of level, by applying it upon a parallel to the baſe or ruler, when there is occaſion to take the level of remote objects.

Dr. Deſaguliers contrived an inſtrument, by which the difference of level of two places, which could not be taken in leſs than four or five days with the beſt teleſcope-levels, may be taken in as few hours. The inſtrument is as follows: to the ball C (*fig.* 7.) is joined a recurve tube B A, with a very fine bore, and a ſmall bubble at top, A, whoſe upper part is open. It is evident from the make of this inſtrument, that if it be inclined in carrying, no prejudice will be done to the liquor, which will always be right both in the ball and tube, when the inſtrument is ſet upright. If the air at C, be ſo expanded with heat, as to drive the liquor to the top of the tube, the cavity A will receive the liquor, which will come down again and ſettle at D, or near it, according to the level of the place where the inſtrument is, as ſoon as the air at C returns to the ſame temperament as to heat and cold. To preſerve the ſame degree of heat, when the different obſervations are made, the machine is fixed in a tin veſſel F E, filled with water up to *g h*, above the ball, and a very ſenſible thermometer has alſo its ball under water, that one may obſerve the liquor at D, in each experiment, when the thermometer ſtands at the ſame height as before. The water is poured out when the inſtrument is carried, which one may do conveniently by means of the wooden frame, which is ſet upright by three ſcrews S, S, S, (*fig.* 8.) and a line and plummet P P. The back part of the wooden frame is repreſented by *fig.* 6. where from a piece at top K hangs the plummet P, over a braſs point at N; M *m* are brackets, to make the upright board K N continue at right angles, with the horizontal one at N; *fig.* 5. repreſents a front view of the machine, ſuppoſing the fore-part of the tin-veſſel tranſparent; and here the braſs-ſocket of the recurve-tube, into which the ball is ſcrewed, has two wings at I I, fixed to the bottom, that the ball may not break the tube by its endeavour to emerge, when the water is poured in as high as *g h*.

After the Dr. had contrived this machine, he conſidered, that as the tube is of a very ſmall bore, if the liquor ſhould riſe into the ball at A, in carrying the inſtrument from one place to another, ſome of it would adhere to the ſides of the ball A, and upon its deſcent in making the experiment, ſo much might be left behind, that the liquor would not be high enough at D (*fig.* 7.) to ſhew the difference of the level; therefore, to prevent that inconveniency, he contrived a blank ſcrew, to ſhut up the hole at A, as ſoon as one experiment is made, that in carrying the machine, the air in A may ballance that in C, ſo that the liquor ſhall not run up and down the tube, whatever degree of heat and cold may act upon the inſtrument, in going from one place to another. Now becauſe one experiment may be made in the morning, the water may be

ſo cold, that when a ſecond experiment is made at noon, the water cannot be brought to the ſame degree of cold it had in the morning; therefore, in making the firſt experiment, warm water muſt be mixed with the cold, and when the water has ſtood ſome time before it comes to be as cold as it is likely to be at the warmeſt part of that day, obſerve and ſet down the degree of the thermometer at which the ſpirit ſtands, and likewiſe the degree of the water in the barometer at D; then ſcrew on the cap at A, pour out the water, and carry the inſtrument to the place whoſe level you would know; then pour in your water, and when the thermometer is come to the ſame degree as before, open the ſcrew at top, and obſerve the liquor in the barometer.

The doctor's ſcale for the barometer is ten inches long, and divided into tenths; ſo that ſuch an inſtrument will ſerve for any heights not exceeding ten feet, each tenth of an inch anſwering to a foot in height.

The Dr. made no allowance for the decreaſe of denſity in the air, becauſe he did not propoſe this machine for meaſuring mountains, (though with a proper allowance for the decreaſing denſity of the air, it will do very well) but for heights that want to be known in gardens, plantations, and the conveyance of water; where an experiment that anſwers two or three feet in a diſtance of twenty miles, will render this a very uſeful inſtrument.

Foot LEVEL. See the article FOOT *Level.*

Artillery-Foot LEVEL, in gunnery, is in form of a ſquare, having its two legs or branches of an equal length, at a juncture whereof is a little hole, whence hangs a thread and plummet, playing on a perpendicular line in the middle of a quadrant. It is divided into twice 45 degrees from the middle. Plate LXXIX. *fig.* 9.

This inſtrument may be uſed on other occaſions, by placing the ends of its two branches on a plane; for when the thread plays perpendicularly over the middle diviſion of the quadrant, that plane is aſſuredly level. To uſe it in gunnery, place the two ends on the piece of artillery, which you may raiſe to any propoſed height, by means of the plummet, whoſe thread will give the degree above the level.

Carpenter's and Paviour's LEVEL, conſiſts of a long ruler, in the middle whereof is fitted, at right angles, another ſomewhat bigger, at the top of which is faſtened a line, which, when it hangs over a fiducial line at right angles with the baſe, ſhews that the ſaid baſe is horizontal. Sometimes this level is all of one board.

Gunner's LEVEL, for levelling cannons and mortars, conſiſts of a triangular braſs-plate, about four inches high, (*fig.* 10.) at the bottom of which is a portion of a circle, divided into 45 degrees, which number is ſufficient for the higheſt elevation of cannons and mortars, and for giving ſhot the greateſt range: on the center of this ſegment of a circle is ſcrewed a piece of braſs, by means of which it may be fixed or ſcrewed at pleaſure; the end of this piece of braſs is made ſo as to ſerve for a plummet and index, in order to ſhew the different degrees of elevation of pieces of artillery. This inſtrument has alſo a braſs-foot, to ſet upon cannons or mortars, ſo as when thoſe pieces are horizontal, the inſtrument will be perpendicular. The foot of this inſtrument is to be placed on the piece to be elevated, in ſuch a manner, as that the point of the plummet may fall on the proper degree: this is what they call levelling the piece.

Maſon's LEVEL, is compoſed of three rules, ſo joined as to form an iſoſceles-rectangle, ſomewhat like a Roman A, at the vertex whereof is faſtened a thread, from which hangs a plummet, that paſſes over a fiducial line, marked in the middle of the baſe, when the thing, to which the level is applied, is horizontal; but declines from the mark, when the thing is lower on one ſide than on the other.

Plumb or *Pendulum* LEVEL, that which ſhews the horizontal lines by means of another line perpendicular to that deſcribed by a plummet or pendulum. This inſtrument, (*fig.* 12.) conſiſts of two legs or branches, joined together at right angles, whereof that which carries the thread and plummet is about a foot and a half long; the thread is hung towards the top of the branch, at the point 2. the middle of the branch where the thread paſſes is hollow, ſo that it may hang free every where; but towards the bottom, where there is a little blade of ſilver, whereon is drawn a line perpendicular to the teleſcope, the ſaid cavity is covered by two pieces of braſs, making as it were a kind of caſe, leſt the wind ſhould agitate the thread, for which reaſon the ſilver-blade is covered with a glaſs G, to the end that it may be ſeen when the thread and plummet play upon the perpendicular: the teleſcope is faſtened to the other branch of the inſtrument, and is about two feet long; having an hair placed horizontally acroſs the focus of the object-glaſs, which determines the point of the level. The teleſcope muſt be fitted at right angles to the perpendicular. It has a ball and ſocket by which it is faſtened to the foot, and was invented by Mr. Picard.

Reflecting LEVEL, that made by means of a pretty long ſurface of water, repreſenting the ſame object inverted which we ſee erected by the eye, ſo that the point where theſe two objects appear to meet, is a level with the place where the ſurface of the water is found. This is the invention of M. Mariotte.

There is another reflecting level, conſiſting of a mirror of ſteel, or the like, well poliſhed, and placed a little before the object-glaſs of a teleſcope, ſuſpended perpendicularly. This mirror muſt make an angle of 45° with the teleſcope, in which caſe the perpendicular line of the ſaid teleſcope is converted into a horizontal line, which is the ſame with the line of level. This is the invention of M. Caſſini.

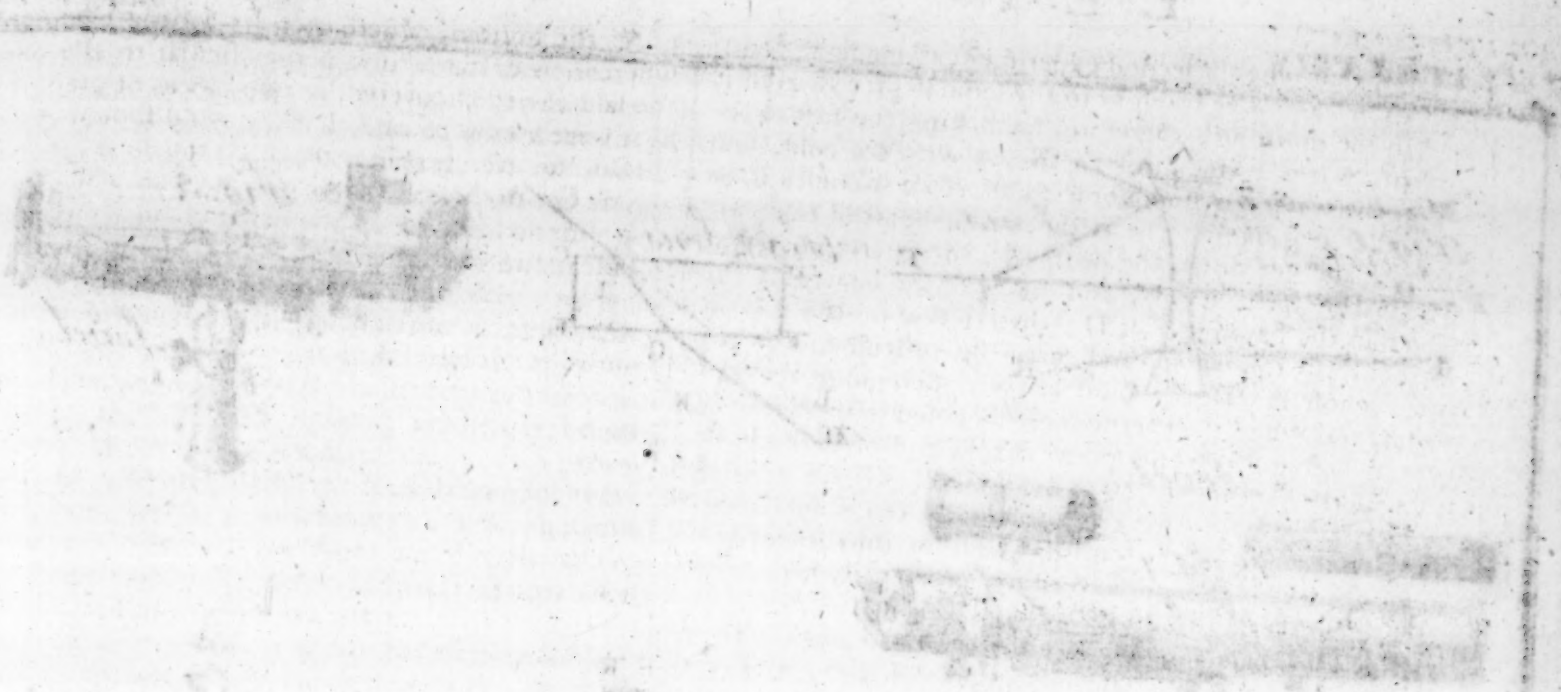
Water-LEVEL, that which ſhews the horizontal line by means of a ſurface of water or other liquor, founded on this principle, that water always places itſelf level. See the article FLUID.

The moſt ſimple is made of a long wooden trough, or canal, whoſe ſides are parallel to the baſe, ſo that being equally filled with water, its ſurface ſhews the line of level. This is the chorobates of the ancients. See CHOROBATES.

It is alſo made with two cups fitted to the two ends of a pipe, three or four feet long, about an inch in diameter, by means whereof the water communicates from the one to the other cup; and this pipe being moveable on its ſtand by means of a ball and ſocket, when the two cups become equally full of water, their two ſurfaces mark the line of level.

This inſtrument, inſtead of cups, may alſo be made with two ſhort cylinders of glaſs three or four inches long, faſtened to each extreme of the pipe with wax or maſtic. Into the pipe is poured ſome common or coloured water, which ſhews itſelf through the cylinders, by means whereof the line of level is determined; the height of the water, with reſpect to the center of the earth, being always the ſame in both cylinders: this level, though very ſimple, is yet very commodious for levelling ſmall diſtances.

LEVEL *of Mr. Huygens's Invention*, conſiſts of a teleſcope *a*, (*fig.* 11.) in form of a cylinder going through a ferril, in which it is faſtened by the middle. This ferril has two flat branches *b b*, one above, and the other below, at the ends whereof are faſtened little moving pieces which carry two rings, by one of which the teleſcope is ſuſpended to an hook at the end of the ſcrew 3, and at *b* the other a pretty heavy weight is ſuſpended, in order to keep the teleſcope in equilibrio. This weight hangs in the box 5, which is almoſt filled with linſeed-oil, oil of walnuts, or other matter that will not eaſily coagulate, for more aptly ſettling the ballance of the weight and teleſcope. The inſtrument carries two teleſcopes cloſe and very parallel to each other; the eye-glaſs of the one being againſt the object-glaſs of the other, that one may ſee each way without turning the level. In the focus of the object-glaſs of each teleſcope muſt a little hair be ſtrained horizontally, to be raiſed and lowered by a little ſcrew. If the tube of the teleſcope be not level, when ſuſpended, a ferril, or ring 4, is put on, to be ſlid along till it be level. The hook on which the inſtrument is hung, is fixed to a flat wooden croſs; at the end of each arm is a hook to keep the teleſcope ſteady: to the flat croſs is applied another hollow one that ſerves as a caſe for the inſtrument; but the two ends are open, that the teleſcope may be ſecured from the weather, and always ready for uſe. The foot of the inſtrument is a round braſs plate, to which are faſtened



5 JA 59

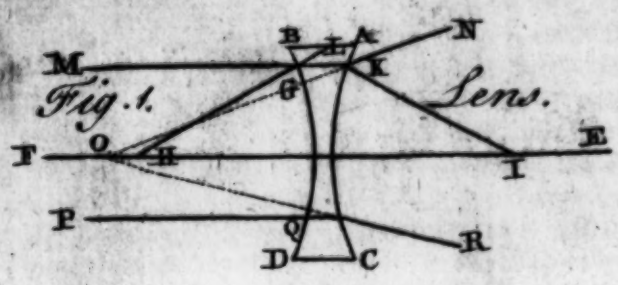


Fig. 1. Lens.

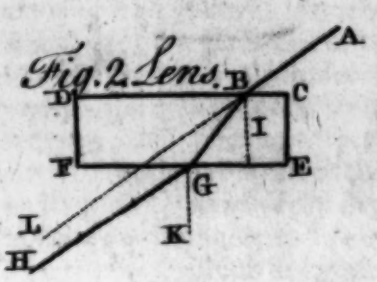
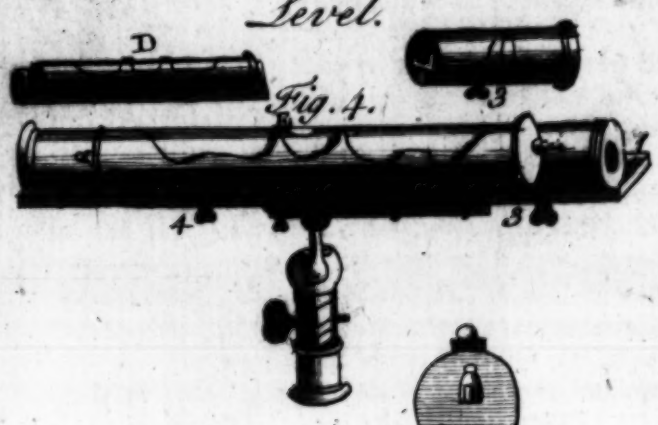


Fig. 2. Lens.

Fig. 3. Level.



Level.
Fig. 4.

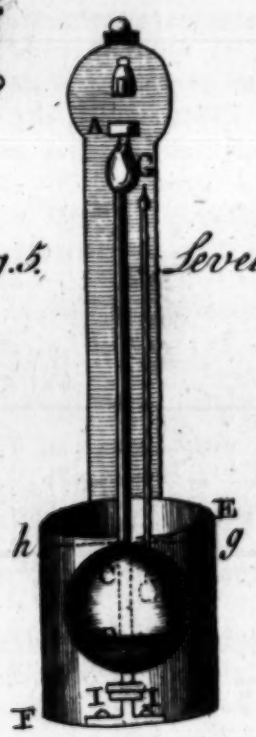


Fig. 5. Level.

Fig. 6. Level.

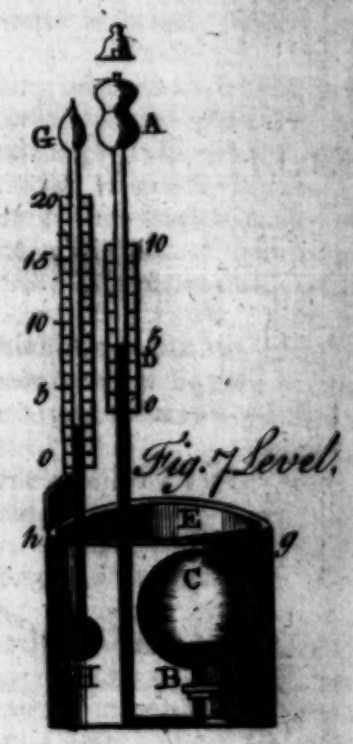


Fig. 7 Level.

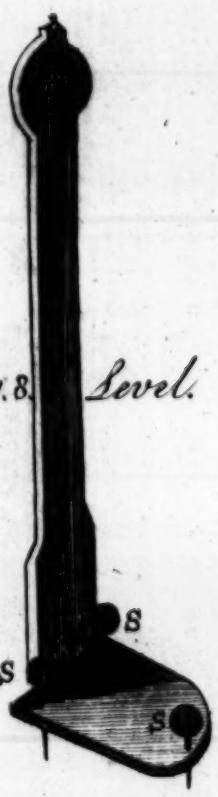
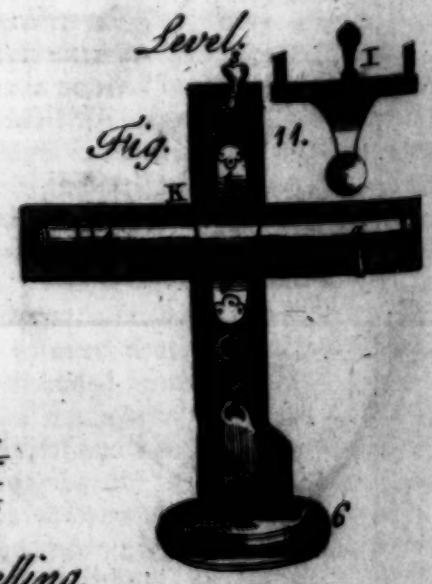


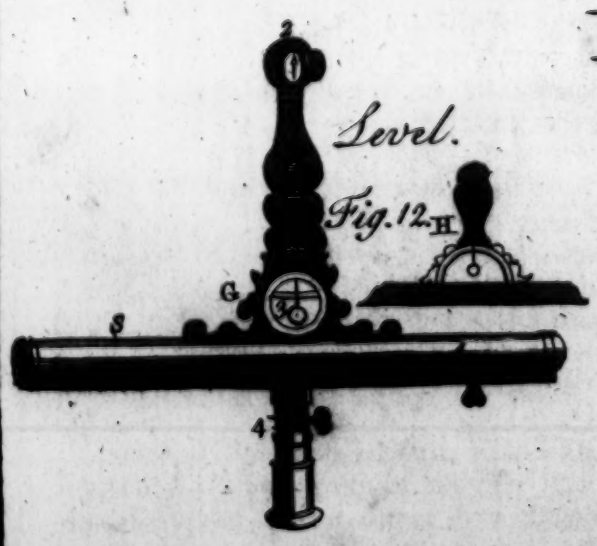
Fig. 8. Level.

Fig. 9. Level.

Fig. 10. Level.



Level.
Fig. 11.



Level.
Fig. 12.

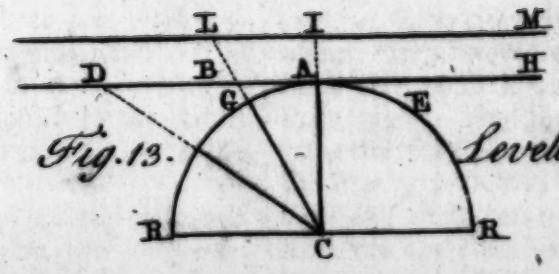


Fig. 13. Levelling.

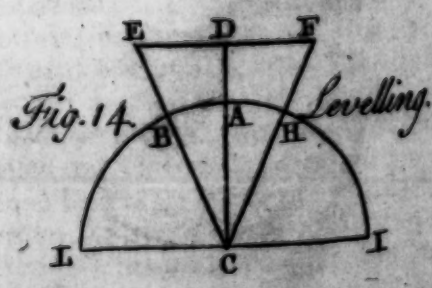


Fig. 14. Levelling.

Levelling.
Fig. 16.
Levelling.
Fig. 15.

faſtened three braſs ferrils, moveable by means of joints, wherein are ſtaves; and on this foot is placed the box.

LEVELLING, the finding a line parallel to the horizon, at one or more ſtations, and ſo to determine the height of one place with regard to another. See LEVEL.

A truly level ſurface is a ſegment of any ſpherical ſurface which is concentric to the globe of the earth. A true line of level is an arch of a great circle which is imagined to be deſcribed upon a truly level ſurface.

The apparent level is a ſtraight line drawn tangent to an arch or line of true level. Every point of the apparent level, except the point of contact, is higher than the true level: thus (plate LXXIX. *fig.* 13.) let EAG be an arch of a great circle drawn upon the earth; to a perſon who ſtands upon the earth at A, the line HD is the apparent level, parallel to his rational horizon RR; but this line, the further it is extended from his ſtation A, the further it recedes from the center; for BC is longer than AC, and DC is longer than BC, &c.

The common methods of levelling are ſufficient for laying pavements of walks, for conveying water to ſmall diſtances, for placing horizontal dials, or aſtronomical inſtruments: but, in levelling the bottoms of canals which are to convey water to the diſtance of many miles, the difference between the apparent and true level muſt be taken into the account; thus (*fig.* 14.) let IALbe an arch of a great circle upon the earth; let it be required to cut a canal, whoſe bottom ſhall be a true level from A to B, of the length of 5078 feet; the common method is to place the levelling inſtrument in the bottom of the canal at A, and, looking through the ſights placed horizontally at a ſtick ſet up perpendicular at B, to make a mark where the viſual ray or line of the apparent level points, as E, and then to ſink the bottom of the canal at B, as much below E as A is below D: but this will not give us a true level, for, according to Caſſini's calculation, at the diſtance of 5078 feet, the apparent level is ſeven inches above the true; and therefore, to make a true level B muſt be ſunk ſeven inches lower than the apparent level directs; ſo that if A be four feet below D, B muſt be four feet ſeven inches below the mark E. We have here mentioned the error which will ariſe from placing the level at one end of the line to be levelled, and ſhewn how to correct it; but in moſt caſes it is better to take a ſtation in the middle of the line to be levelled; thus, if the points H and B are to be levelled, place the inſtrument in the middle at A, and, ſetting up ſticks perpendicular at H and B, make marks upon each ſtick where the apparent level points, as E and F; thoſe points are level: and if you ſink H as much below F as B is below E, HABwill be a true level. When the bottom of a canal is thus truly level, if water be let in at one end, it will riſe to the ſame height at the other. If water be required to run with any velocity, that is of another conſideration: a river will run, though very ſlowly, which hath not above ſix inches deſcent below the true level for a mile in length: if a river whoſe water is foul be required to run with ſuch a velocity as to carry its foulneſs into the ſea, ſixteen inches, or at leaſt one foot fall below the true level, in a mile running, have been thought ſufficient, by perſons ſkilful in that affair. Vid. Riccioli Geogr. Reformat. l. 6. c. 24.

This we thought neceſſary to premiſe before we explained the method uſed in levelling, which is as follows: Suppoſe the height of the point A (plate LXXIX. *fig.* 15.) on the top of a mountain, above that of the point B at the foot thereof, be required. Place the level about the middle diſtance, between the two points, as in D, and ſtaffs in A and B; and let there be perſons inſtructed with ſignals for raiſing and lowering on the ſtaffs little marks of paſteboard, or any ſuch matter. The level being placed horizontally, &c. look towards the ſtaff AE, and cauſe the mark to be raiſed or lowered, till the middle, upper edge, or other moſt conſpicuous part, appear in the viſual ray. Then meaſuring exactly the perpendicular height of the point E above A, which ſuppoſe eight feet ſix inches, ſet that down in your book; then turn the level horizontally about, that the eye-glaſs of the teleſcope may be ſtill next the eye, when you look the other way; (if you have only plain ſights, the inſtrument need not be turned;) and cauſe the perſon at the ſtaff B to raiſe or lower his mark, till ſome conſpicuous part fall in the viſual ray, as at C: Then meaſure the perpendicular of C above B, which ſuppoſe twenty feet eight inches; ſet this alſo down in the book above the other number; ſubtract the one from the other, the remainder will be twelve feet two inches, which is the difference of level between A and B, or the height of the point A above B.

If the point D, where the inſtrument is fixed, be in the middle between A and B, there will be no neceſſity for reducing the apparent level to the true; the viſual ray being then equally raiſed above the true level.

If it be farther required to know whether there be a ſufficient deſcent for conveying water from the ſpring A to the point B; (*fig.* 16.) here, as the diſtance from A to B is conſiderable, it is requiſite that ſeveral operations be made. Having then choſen a proper place for the firſt ſtation, as at I, ſet up a ſtaff in the point A, near the ſpring, with a proper mark to ſlide up and down the ſtaff, as L; and meaſure the diſtance from A to I, which ſuppoſe 2000 yards. Then, the level being adjuſted in the point K, let the mark L be raiſed and lowered till you ſpy ſome conſpicuous part through the teleſcope, or ſights, and meaſure the height AL, which ſuppoſe thirteen feet five inches.

But, in regard the diſtance AI is 2000 yards, you muſt have recourſe to your table for reduction, ſubtracting eleven inches, which will leave the height AL twelve feet ſix inches; and this note down in your book. Now turn the level horizontally, ſo as the eye-glaſs of the teleſcope may be towards the ſtaff at A; and, fixing up another ſtaff at H, cauſe the mark G to be moved up and down, till you can ſpy ſome conſpicuous part: Meaſure the height HG; which ſuppoſe ſix yards, four feet, two inches: Meaſure likewiſe the diſtance of the points IH, which ſuppoſe 1300 yards, for which diſtance, four inches eight lines muſt be ſubtracted from the height HG, which will leave but ſix yards, three feet, nine inches, four lines, to be taken down in your book. This done, remove the level forwards to E, whence the ſtaff H may be viewed; as alſo another ſtaff at D: And proceed in every reſpect as before.

When a proper ſtation for the level has been pitched upon between the two points, the two heights obſerved at that ſtation muſt be written down in two columns, namely, under the firſt column thoſe obſerved when the eye was from the ſpring, or towards the point, which may be called back-ſights; and under the ſecond column thoſe obſerved when the eye was next the ſpring, or the fore-ſights.

Having ſummed up the height of each column ſeparately, ſubtract the leſſer from the greater, and the remainder will be the difference of level between A and B.

If the diſtance of the two points be required, add all the diſtances meaſured together, and, dividing the difference of height by the yards of the diſtances, for each 200 yards you will have a deſcent of about two inches nine lines.

Dr. Halley ſuggeſts a new method of levelling; which is performed wholly by the barometer, in which the mercury is found to be ſuſpended to ſo much the leſs height, as the place is farther remote from the center of the earth. Hence it follows, that the different height of the mercury in two places gives the difference of level.

Mr. Derham, from ſome obſervations at the top and bottom of the Monument in London, found that the mercury fell one tenth of an inch at every eighty two feet of perpendicular aſcent, when the mercury was at thirty inches: Dr. Halley allows of one tenth of an inch for every thirty yards; which, conſidering how accurately barometers are now made, he thinks this method ſufficiently exact to take levels for the conveyance of water, and leſs liable to errors than the common levels.

He alſo found a difference of three inches eight tenths between the height of the mercury at the top and bottom of Snowdon hill, in Wales.

the common occaſions of levelling, ſet a pole upright in a ſpring, pond, &c. and mark how many feet and inches are above water: Then ſet up another pole of

equal length with the other, in the place to which the water is to come. Place the center of a quadrant on the top of this laſt pole, the plummet hanging free; ſpy through the ſights the top of the pole in the water, and if the thread cuts any degree of the quadrant, the water may be conveyed by a pipe laid in the earth. If you cannot ſee from one extreme to the other, the operation may be repeated.

LEVER, in mechanics, is any inflexible line, rod, or beam, moveable about or upon a fixed point, called the prop or fulcrum, upon one end of which is the weight to be raiſed; at the other end is the power applied to raiſe it, at the hand, &c.

Since the momentum of the weight and power are as the quantities of matter in each multiplied by their reſpective celerities: and the celerities are as the diſtances from the center of motion, and alſo as the ſpaces paſſed through in a perpendicular direction in the ſame time; it muſt follow, that there will be an equilibrium between the weight and power, when they are to each other reciprocally as the diſtances from the center, or as the celerities of the motions, or as the perpendicular aſcent or deſcent in the ſame time; and this univerſally in all mechanical powers whatſoever, which is therefore the fundamental principle of all mechanics.

The general properties of the lever may be eaſily obtained by the ſolution of the following problem.

To determine the poſition in which the bended lever BDC, (plate LXXX. *fig.* 1.) whoſe center of motion is the point D, will be ſuſtained in equilibrio by means of two weights P, Q, appended to the ends P and Q of the ſtrings BKP, CIQ, faſtened to the extremities B and C of the lever, and paſſing freely over two ſmall pullies fixed in the points K, I.

Solution. Through any convenient point M, draw a horizontal line SMR, and let BDC repreſent the required poſition. Produce PK, QI, to the line SMR, and draw BT, DM, CN, parallel to PS, or QR; draw alſo BEW and CH parallel to SMR; join the points B, C, with a right line BC, and from D, draw DA perpendicular to BC. Put KS $=a$, DM $=b$, SM $=d$, BD $=m$, DC $=n$, BC $=h$, IR $=c$, MR $=e$, p and q for the ſine and coſine of the angle DBC, radius $=1$. Let L and l repreſent the lengths of the ſtrings BKP, CIQ, put TB $=x$; then will DE $=b-x$, BE $=\sqrt{m^2-b-x^2}$, and FB $=d-\sqrt{m^2-b-x^2}$; whence BK $=\sqrt{d-\sqrt{m^2-b-x^2}^2+\overline{a-x}^2}$, and conſequently PS $=L-\sqrt{d-\sqrt{m^2-b-x^2}^2+\overline{a-x}^2}+a$. Again, $\frac{b-s}{m}$ $=$ ſin. $\angle$DBE, and its coſine $=\frac{\sqrt{m^2-b-x^2}}{m}$; therefore $q\times\frac{b-x}{m}-\frac{p}{m}\times\sqrt{m^2-b-x^2}$, $=$ ſin. $\angle$WBC; whence NC $=qb\times\frac{b-x}{m}+x-\frac{pb}{m}\times\sqrt{m^2-b-x^2}$, and HI $=c-qb\times\frac{b-x}{m}+\frac{bp}{m}\times\sqrt{m^2-b-x^2}-x$. But by the elements of plane trigonometry, the product of the ſines of any two angles, added to that of their coſines, is equal to the coſine of their difference multiplied by radius; therefore $p\times\frac{b-s}{m}+q\times\frac{\sqrt{m^2-b-x^2}}{m}$ is the ſine of the angle BCW; hence EW $=pb\times\frac{b-s}{m}+qb\times\frac{\sqrt{m^2-b-x^2}}{m}-\sqrt{m^2-b-x^2}$, and CI $=$

$$\sqrt{c-qb\times\frac{b-x}{m}+bp\times\frac{\sqrt{m^2-b-x^2}}{m}-x}^2+\overline{e-pb\times\frac{b-s}{m}-qb\times\frac{\sqrt{m^2-b-x^2}}{m}\times\sqrt{m^2-b-x^2}}^2$$

Hence, by lemma 1. Clark's Introduction to Mechanics, the perpendicular diſtance of the common center of gravity of the two weights P, Q, from the horizontal line SR, will be expreſſed by

$$\frac{P\times L-P\times\sqrt{d-\sqrt{m^2-b-x^2}^2+\overline{a-x}^2}+P\times a+l\times Q-Q\times CI+Q\times c}{P+Q};$$ which, being put into fluxions, made $=0$, and the equation thence ariſing properly reduced, by firſt ſubſtituting therein for the values of $\frac{qb}{m}$ and $\frac{pb}{m}$, their reſpective equals, viz. $\frac{BA\times BC}{BD^2}$, and $\frac{AD\times BC}{BD^2}$, there will at length be produced the following equation: $\frac{P\times FB\times DE+P\times BE\times KF}{BE\times BK}+\frac{Q\times HI}{CI}+\frac{Q\times CH\times DE\times AB\times BC}{BD^2\times BE\times CI}-\frac{Q\times HI\times BA\times BC}{BD^2\times CI}=\frac{Q\times HI\times AD\times BC\times DE}{BD^2\times BE\times CI}$.

Corol 1. If FB and HC are each equal to 0, we ſhall have $P+Q=Q\times\frac{BA\times BC}{BD^2}+\frac{Q\times AD\times BC\times DE}{BD^2\times BE}$.

Corol 2. If FB, CH, and AD, are each equal 0, the general equation will contract into $AB\times P=AC\times Q$, or P : Q :: AC : AB, A in this caſe being the center of motion.

Corol 3. If, from the center of motion D, we let fall DL perpendicular upon BK, and DN perpendicular upon IC produced, then will $P\times DL=Q\times DN$; whence P : Q :: DN : DL.

The lever is of five kinds. The common ſort where the prop is between the weight and the power, but nearer the former. When the prop is at one end, the power applied at the other, and the weight between both. When the prop is at one end, the weight at the other, and the power applied between both. The bended lever which differs only in form from the firſt ſort. When the prop is placed at an equal diſtance between the weight and the power, and this is commonly called the balance. See BALANCE.

LEVERET, among ſportſmen, denotes a hare in the firſt year of her age.

LEVIGATION, in pharmacy and chemiſtry, the reducing hard bodies to an impalpable powder, by grinding them with water on a porphyry, or marble.

LEVITE, in a general ſenſe, means all the deſcendants of Levi, among whom were the Jewiſh prieſts themſelves, who, being deſcended from Aaron, were likewiſe of the race of Levi: but it is more particularly uſed for an order of officers in that church, who were employed in performing the manual ſervice of the temple, ſuch as in fetching wood, water, and other things neceſſary for the ſacrifices; and in ſinging and playing upon inſtruments of muſic.

LEVITICUS, a canonical book of the Old Teſtament, ſo called from its containing the laws and regulations relating to the prieſts, Levites, and ſacrifices.

The ſeven firſt chapters of this book preſcribe the ceremonies to be obſerved in offering burnt-ſacrifices, meat-offerings, peace-offerings, &c. then Moſes relates in what manner the prieſts were to be conſecrated, and the misfortune of Nadab and Abihu, who offered incenſe to the Lord with ſtrange fire. Upon this occaſion, he preſcribes ſome laws concerning the mourning of the prieſts, and forbids their drinking wine, while they were employed in the ſervice of the tabernacle. In the eleventh, twelfth, thirteenth, and fourteenth chapters, he lays down rules for diſtinguiſhing clean and unclean beaſts, and concerning the leproſy, purifications, &c. appoints the ceremonies to be obſerved upon the great day of expiation: regulates the degrees of kindred within which perſons were allowed or forbidden to marry: prohibits alliances with the Canaanites, and alſo idolatry, theft, perjury, calumny, &c. In the twenty-third chapter, he takes notice of the principal annual feſtivals, the paſſover, pentecoſt, &c. preſcribes what was to be obſerved in the ſabbatical and jubilee-years, and concludes with regulations concerning vows and tythes.

LEVITY,

PLATE LXXX.

Facing Liver.

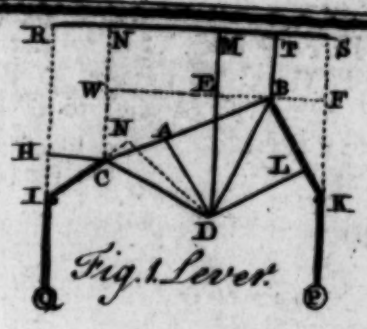


Fig. 1. Lever.

Fig. 6. Liver.

Fig. 4. Liver.

Fig. 3. Light.

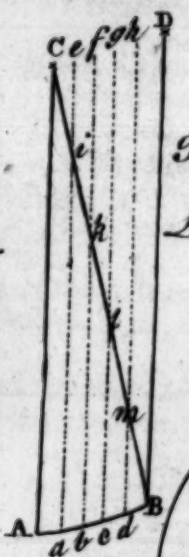


Fig. 2. Light.

Fig. 5. Liver.

5 JA 59

LEVITY, in phyſiology, the privation or want of weight in any body, when compared with another that is heavier than it, in which ſenſe it ſtands oppoſed to gravity. See the articles GRAVITATION and GRAVITY.

LEVY, in law, ſignifies to gather or collect, as to levy money; and to levy a fine of lands, is the paſſing a fine.

LEX, LAW. See the article LAW.

LEXICON, the ſame with dictionary. It is generally uſed in ſpeaking of Greek dictionaries.

The word is Greek, λεξικον, and derived from λεξις, a word.

LIBATION, a religious ceremony among the ancient pagans, which conſiſted in an effuſion of liquors poured on the head of the victims prepared for ſacrifice.

Libations were alſo in uſe among the Hebrews, who poured a tun of wine on the victim after it was killed, and the ſeveral pieces of the ſacrifice were laid on the altar, ready to be conſumed in the flames.

LIBEL, injurious reproaches or accuſations againſt a perſon, written and publiſhed in order to expoſe him to public contempt, hatred, or ridicule.

LIBEL, in the law of Scotland, implies an indictment. See INDICTMENT.

LIBELLA, or LIBELLULA, in the hiſtory of inſects, a genus of four-winged flies, called in Engliſh dragon-flies, or adder-flies; the characters of which are, that they are furniſhed with jaws, the antennæ are ſhort, and the tail terminated by a kind of forceps.

LIBERATE, in law, a writ that lies for the payment of a penſion, or annual ſum, granted under the great ſeal, being directed to the treaſurer and chamberlains of the exchequer.

LIBERIA, in Roman antiquity, a feſtival obſerved on the ſixteenth of the calends of April, at which time the youth laid aſide their juvenile habit for the toga virilis, or habit peculiar to grown men. See the article TOGA.

LIBERTUS, in Roman antiquity, a perſon who from being a ſlave had obtained his freedom. See MANUMISSION.

LIBERTY, *Libertas*, in general, denotes a ſtate of freedom, in contradiſtinction to ſlavery. See the article FREEDOM.

According to Cicero, liberty is the power of living as a man pleaſes, or without being controlled by another.

In a legal ſenſe, liberty ſignifies ſome privilege that is held by charter or preſcription.

LIBRA, the ballance, in aſtronomy, one of the twelve ſigns of the zodiac, the ſixth in order; ſo called becauſe, when the ſun enters it, the days and nights are equal, as if weighed in a ballance.

LIBRA, in Roman antiquity, a pound weight; alſo a coin, equal in value to twenty denarii.

LIBRARY, an edifice, or apartment, deſtined for the placing of books; or the books themſelves lodged therein.

The word is formed from the Latin *libraria*, which is derived from *liber*, a book.

LIBRATION, in aſtronomy, an apparent inequality in the motion of the moon, by which ſhe ſeems to librate or waver about her own axis, ſometimes from the eaſt to the weſt, and ſometimes from the weſt to the eaſt. See the article MOON.

LIBRATION *of the Earth* is that motion whereby the earth is ſo retained in its orbit, that its axis continues conſtantly parallel to the axis of the world.

LICENCE, in law, an authority given to a perſon to do ſome lawful act.

LICENTIATE, one who has obtained the degree of licence.

LICHEN, *Cinereus Terreſtris*, aſh-coloured ground liver-wort, in botany, a ſpecies of moſs, conſiſting of roundiſh, pretty thick leaves, divided about the edges into obtuſe ſegments, flat above, of a reticular texture underneath, faſtened to the earth by ſmall fibres; when in perfection, of an aſh-grey colour; by age, turning darker-coloured or reddiſh. It grows on commons and open paths, ſpreads quickly on the ground, and is to be met with at all times of the year, but is ſuppoſed to be in its greateſt vigour about the end of autumn.

This herb is ſaid to be a warm diuretic. It is particularly celebrated as a preſervative againſt the terrible conſequences of the bite of a mad dog: an account of the remarkable efficacy, in this intention, of a powder compoſed of the dry leaves and black pepper, was communicated to the Royal Society by Mr. Dampier, and publiſhed in N°. 237 of the Philoſophical Tranſactions. This powder was afterwards inſerted, in the year 1721, into the London Pharmacopœia, at the deſire of Dr. Mead, who had large experience of its good effects, and who declares, that he had never known it to fail, where it had been uſed, with the aſſiſtance of cold bathing, before the hydrophobia began.

LICTORS, *Lictores*, in Roman antiquity, the ſerjeants or beadles who carried the faſces before the ſupreme magiſtrates: it was alſo a part of their office to be the public executioners in beheading, ſcourging, &c.

LIEGE, in law, a term ſometimes uſed for liege-lord, or one who owns no ſuperior; and ſometimes for liege-man, or one who owes allegiance to the liege-lord. In our ſtatutes, the king's ſubjects are ſometimes called lieges, or liege-people.

LIEN, the ſpleen, in anatomy. See SPLEEN.

LIENTERY, in medicine, a diſorder proceeding from a preternatural ſmoothneſs of the inteſtines, in conſequence of which what is diſcharged by ſtool, greatly reſembles the aliments, both in colour and ſubſtance.

The cauſe of this diſorder, according to Fernelius, is not an obſtructed or hindered diſtribution of the aliments, but a weakneſs of the firſt concoction, in conſequence of which the aliments paſs through the inteſtines unchanged.

The principal intention of cure in a lientery, according to Etmuller, is to ſtrengthen and corroborate the ſtomach; which end is moſt effectually obtained by rhubarb, preparations of coral, and quinces. All the medicines recommended againſt vomiting, are alſo proper in this diſorder. Waldſchmidius informs us, that the moſt ſimple and eaſily prepared ſtomachics are more beneficial in a lientery, than thoſe of the compound kind. The moſt proper ſtomachics, according to that author, are preſerved nutmeg, preſerved ginger, the white of an egg boiled with vinegar, and wormwood-wine prepared with maſtich.

LIEUTENANT, an officer who ſupplies the place, and diſcharges the office of a ſuperior in his abſence. Of theſe, ſome are civil, as the lords-lieutenants of kingdoms, and the lords lieutenants of counties; and others are military, as the lieutenant-general, lieutenant-general of the artillery, lieutenant-colonel, lieutenant of the artillery of the tower, lieutenant of horſe, foot, ſhips of war, &c.

Lord LIEUTENANT *of Ireland* is properly a viceroy, and has all the ſtate and grandeur of a king of England, except being ſerved upon the knee. He has the power of making war and peace, of beſtowing all the offices under the government, of dubbing knights, and of pardoning all crimes except high treaſon; he alſo calls and prorogues the parliament, but no bill can paſs without the royal aſſent. He is aſſiſted in his government by a privy-council; and on his leaving the kingdom, he appoints the lords of the regency, who govern in his abſence.

Lords LIEUTENANTS *of Counties* are officers who, upon any invaſion or rebellion, have power to raiſe the militia, and to give commiſſions to colonels and other officers, to arm and form them into regiments, troops, and companies. Under the lords-lieutenants are deputy-lieutenants, who have the ſame power; theſe are choſen by the lords-lieutenants, out of the principal gentlemen of each county, and preſented to the king for his approbation.

LIEUTENANT-GENERAL is an officer next in rank to the general; in battle, he commands one of the wings; in a march, a detachment, or a flying camp; alſo a quarter, at a ſiege, or one of the attacks, when it is his day of duty.

LIEUTENANT *of a Ship of War*, the officer next in command to the captain, and who governs the ſhip in his abſence.

In the Britiſh navy an officer muſt have ſerved ſix years at ſea, two of which he muſt have been mate or midſhipman in ſome of the king's ſhips, before he can be appointed a lieutenant; he muſt alſo paſs an examination.

The number of lieutenants appointed to a ſhip is always in proportion to her rate, a firſt rate having ſix, and a ſixth rate only one.

In an engagement the ſtation of the lieutenants is to ſuperintend the manoeuvre of the great guns, and obſerve that they are properly ſupplied with powder and ſhot, &c. The lieutenant ranks with captains of horſe and foot.

LIFE, *Vita*, in general, a kind of active operative exiſtence, and conceived to conſiſt in motion.

LIFE is uſed in a more particular ſenſe to ſignify the duration of an animal's being; or the ſpace of time which paſſes between its birth and death.

LIFE-ANNUITIES. See the article INTEREST.

LIFTS, in the ſea-language, certain ropes which reach from the maſt-heads to the yard-arms of a ſhip, to keep the ſail-yards parallel to the deck, or as ſeamen term it, ſquare by the lifts, i. e. parallel to the horizon, when the ſhip is upright, or at right angles with the maſt.

The lifts are alſo employed to top the yards, i. e. to lift one yard-arm higher than the other, by drawing in one lift, and ſlackening the other.

Topping-LIFT. See TOPPING-*Lift*.

LIGAMENT, in anatomy, a ſtrong compact ſubſtance, ſerving to join two bones together.

A ligament is more flexible than a cartilage, not eaſily ruptured or torn, and does not yield, or at leaſt very little, when pulled.

Some ligaments are deſigned to ſtrengthen the joints, and to ſecure the bones in their ſeveral motions from parting from each other, as happens in luxations; other ligaments ſerve to connect cartilages with bones; and ſome there are which ſtrengthen other parts, beſides the bones and cartilages: of this laſt kind are the annular ligaments, ſo called, not ſo much from their figure as from their uſe, ſerving, like a ring, to bridle the tendons of many muſcles. Some ligaments again are fixed to one or more bones, with different degrees of tenſion, and ſerve on each ſide for the inſertion of muſcles. To theſe may be added, the ligaments commonly termed aponeuroſes; ſuch as thoſe of the temples, ſcapula, or humeri, ulna, palm of the hand, thigh, leg, and ſole of the foot. Other differences of ligaments may be deduced from their conſiſtence, ſolidity, ſituation, and figure; ſome are almoſt cartilaginous, and others have a particular elaſticity, by which they are capable of being drawn out by a ſufficient force, and of contracting again when left to themſelves.

LIGATURE, in ſurgery, is a cord, band, or ſtring; or the binding any part of the body with a cord, band, fillet, &c. whether of leather, linen, &c.

Ligatures are uſed to extend and replace bones that are broken or diſlocated; to tie the patients down in lithotomy and amputations; to tie upon the veins in phlebotomy, or the arteries in amputations, or in large wounds; to ſecure the ſplints that are applied to fractures; to tie up the proceſſes of the peritonæum, with the ſpermatic veſſels in caſtration; and laſtly, in taking off warts or other excreſcences by ligature. For the manner of uſing them, ſee LITHOTOMY, PHLEBOTOMY, FRACTURE, &c.

LIGHT, *Lux*, in philoſophy, certain inconceivable ſmall particles of matter of different magnitudes, which are emitted or reflected from every point in the ſurface of a luminous body in right lines, and in all directions, with an unparalleled velocity, and whoſe power and intenſity decreaſe as the ſquares of the diſtances increaſe.

The Greeks, and after them all the barbarous nations, who learned of them to reaſon and to err, have ſaid from age to age through a long ſeries of time, "Light is an accident, which accident is the act of tranſparent as tranſparent; colours are what move tranſparent bodies. Luminous and coloured bodies have qualities like thoſe they excite in us, according to the maxim that nothing can give what it has not. In fine, light and colours are a mixture of the hot, cold, dry, and humid; for the humid, dry, cold, and hot, being the principles of all things, colours muſt neceſſarily be compoſed of them." See the article COLOUR.

This is the abſurd jargon which the profeſſors of ignorance, paid by the public, have made human credulity revere ſo many eges; which manner of reaſoning prevailed almoſt in all things down to the time of Galileo and Deſcartes. Even long after them, the ſame traſh, the diſgrace of human underſtanding, ſubſiſted in many ſchools.

All the pretended philoſophers therefore having gueſſed of nature at a venture through the veil under which ſhe lay concealed, Deſcartes at length came, and diſcovered a corner of this great veil. He ſaid, "Light is a fine and ſubtile matter, diffuſed univerſally, that ſtrikes our eyes. Colours are ſenſations excited in us by God, according to the motions which tranſmit that matter to our organs." Thus far Deſcartes was in the right, and ought either to have ſtopped there, or, in advancing, to have taken experiment for his guide. But he was poſſeſſed with the deſire of eſtabliſhing a ſyſtem. That paſſion had the ſame effect on this great man, as paſſions have on all men; they hurry them beyond their principles.

According to Deſcartes, the light does not proceed to our eyes from the ſun, but is a globulous matter diffuſed univerſally, which the ſun impels, and which preſſes upon our eyes as a ſtaff puſhed at one end preſſes the ſame inſtant at the other. This appeared plauſible, but is not therefore the leſs falſe. Deſcartes, however, was ſo fully convinced of this principle, that, in his ſeventeenth letter of the third volume, he poſitively ſays and repeats it, "I confeſs that I know nothing of philoſophy, if the light of the ſun is not tranſmitted to our eyes in an inſtant." And indeed we muſt own, that, as great a genius as he was, he knew very little of true philoſophy, and wanted the experiments of the preceding age. That age is as much ſuperior to Deſcartes, as Deſcartes was to antiquity.

If light were always diffuſed, and always exiſting in the air, we ſhould ſee as clearly in the night as we do in the day; becauſe the ſun below the horizon would continually impel the globules on all ſides, and the impreſſion equally affect our eyes.

That light is a material ſubſtance, and what we properly call body, is not to be doubted; becauſe we find it ſomething that has motion, or is propagated in time; ſomething that acts upon our bodies, and produces great alterations and changes in their natures and forms. It is ſomething that bodies act upon, by reflecting, inflecting, and refracting it on their ſurfaces, and in their pores: and it would appear to have weight, and all other ſenſible qualities of common matter, were it not that the ſmallneſs of its quantity renders them entirely imperceptible to us. Nor are we to conſider light only as a body, but as the moſt active principle or moſt general agent in nature; and it is, perhaps, the true primum mobile, or the ſpring of motion and action in all other bodies. Were the particles of light to be annihilated, we ſhould ſee no marks or foot-ſteps of fire or heat remaining, and therefore no power of motion in bodies; but all things would put on the appearance of lifeleſs inert matter, rigid and inflexible, as it would be abſolutely cold and dark.

The divine wiſdom and providence appear, perhaps, in nothing ſo remarkably as in the extreme ſubtility of the particles of light: without this qualification it could not have pervaded the pores of bodies, and ſo we could have had none of thoſe which we call diaphanous or tranſparent ſubſtances, and every thing but the ſurface of a body would have been concealed from the ſight of mankind. Again, the velocity of a body is always as the quantity of matter inverſely; and therefore, the ſmaller the body, the greater velocity it is ſuſceptible of from the ſame force; whence it comes to paſs that light is the qualified to be tranſmitted through immenſe diſtances in a ſmall and inſenſible part of time; which thing was quite neceſſary, according to the preſent frame and ſtate of nature.

But laſtly, it was abſolutely neceſſary that the particles of light ſhould be ſo exceeding ſmall, that, when compounded with its velocity, it ſhould produce no ſenſible force, as it muſt otherwiſe have done, and which, therefore, could not have been borne by the tender and delicate texture of the ſeveral parts of vegetable and animal bodies. To give an example: the velocity of a particle of light is found to be at the rate of 897600000 feet in a ſecond; ſuppoſe its matter to be but one millionth part of a grain, then its force to ſtrike an object would

as $\frac{2.7.6.8.8.8.}{1.0.0.0.0.0.} = 897,6$ feet per ſecond for one grain; or it would ſtrike with the ſame force that one grain weight would do falling from half the height, viz. through 448,8 feet; which we ſhould find to be very great, was the experiment to be made on the ſenſible coats of the eye.

Since the weight of bodies is proportional to the quantity of matter, it follows, that, where the latter is diminiſhed indefinitely, the former will be ſo too; therefore, the weight of light muſt be inſenſible to ever ſo great a quantity of it. Dr. Boerhaave cauſed a globe of iron, twelve inches in diameter, to be heated red-hot, and ſuſpended at the end of a very exact ballance, and counterpoiſed by weights at the other end very nicely, and thus let it hang till all the particles of heat or light were eſcaped, when he found the equilibre of the ballance no ways altered; which plainly proves the above theſis. See the article FIRE.

That the particles of light have not only magnitude, but that in different degrees alſo, is another, and perhaps the moſt ſubtile, diſcovery of the Newtonian philoſophy. The comparative terms of greater and leſſer are now as applicable to the particles of light, as to any other bodies. This is abſolutely proved by the different refrangibility they are found to have in paſſing through a priſmatic figure of glaſs or water; for the power of the priſm detains the iſſuing particle, and draws it a little towards the ſurface; and, ſince this power is the ſame, it would have the ſame effect on all the particles of light, if they were all of an equal magnitude, becauſe they have all an equal velocity. But ſince this effect is different among the particles, ſome being detained and drawn aſide to a greater diſtance than others, it follows, they muſt be leſs in magnitude, to become more ſubject to the influence of the attracting ſurface; in like manner as the electric effluvia will act upon and agitate very ſmall and light bodies, much ſooner and more eaſily than they can move thoſe which are larger. But of this more when we come to ſpeak of the manner in which this power acts in refracting the rays of light. See REFRACTION.

If light were not reflected from every point in the ſurface of a body in all directions every way, there might be aſſigned a point of ſpace where a ray of light, from ſuch a point in the ſurface, does not come; and there the ſaid point of the ſurface could not be viſible: but becauſe the eye can find no point of ſpace in all the viſible hemiſphere reſpecting that point, but where it is viſible; therefore a ray of light is reflected from that point to every part of ſpace, from whence a right line to that point can be drawn.

That the rays of light proceed in a right-lined direction, is evident from hence, that whatever the figure of the body be, if it be held perpendicular to the rays of light, it will always caſt a ſhadow of the ſame figure againſt a parallel plane. Thus a circle will produce a circular ſhadow, a triangle a triangular one, and ſo on. Which plainly ſhews that the rays of light paſs by the extremities of theſe bodies in right-lined directions, excepting theſe only which paſs contiguous to the edges of the body; for they will be a little inflected, which will cauſe the extremity of the ſhadow to be not ſo diſtinct and well defined as it otherwiſe would be; of which we ſhall take farther notice hereafter.

As all the other affections of light, ſo that of its velocity was utterly unknown to all the ancient, and moſt of the modern philoſophers, who, before the time of Mr. Romer, were of opinion that the motion of light was inſtantaneous, or that it was propagated through immenſe ſpaces in an inſtant. But Mr. Romer, and other philoſophers, about this time, making frequent obſervations on the eclipſes of Jupiter's moons, found that the time of theſe eclipſes did not correſpond to the calculations founded upon the aſtronomical tables; where the times are all calculated for the diſtance of the center of the ſun, and conſequently where the eye of the ſpectator muſt be ſuppoſed to be in viewing the ſaid eclipſes, occultations, &c. of Jupiter's moons.

To illuſtrate this matter, let S (plate LXXX. *fig.* 2.) be the center of the ſun, A B the orbit of Mercury, C D the orbit of Venus, E F that of the earth, and G H a part of the orbit of Jupiter. Let I be the body of Jupiter, and K L its ſhadow; O M N the orbit of one of Jupiter's moons, M juſt entering the ſhadow of Jupiter. Now a ſpectator at S would obſerve the moon M to enter the ſhadow, juſt at the time which is calculated from the tables: but a ſpectator on the earth, at T, always obſerves it to happen ſooner; and, when the earth is in the oppoſite part of its orbit R, he will always obſerve it to happen later, by the ſpace of about ſeven minutes, in both caſes. This obſervation gave the firſt proof that light was progreſſive, and took up about fourteen minutes to paſs over the diameter of the earth's orbit from T to R, or ſeven minutes to paſs from the ſun S to the earth T.

But this, though a ſufficient diſcovery or proof of the progreſſive motion of light, was yet but an experiment in the groſs, and not accurate to determine or define the true rate of velocity which properly belonged to light: the ſolution of this noble problem was reſerved for Dr. Bradley, who by reiterated and certain experiments, obſerved, that the bright ſtar in the head of Draco appeared 39″ more northerly in September than in March, juſt the contrary way to what it ought to appear by the annual parallax of the ſtars, which muſt ariſe from the velocity of light bearing ſome proportion to that of the annual motion of the earth. See the article ABERRATION *of the Stars*.

To illuſtrate this, and from thence to determine the velocity of light: let A B (*fig.* 3.) repreſent a part of the earth's annual orbit, and let C be a ſtar obſerved by a ſpectator at the earth at A; when the earth arrives at B, the ſtar will not be obſerved at C, as before, but at D in the line B D parallel to A C; for let A B be divided into equal parts A *a*, *ab*, *bc*, *cd*, and *d* B; then through theſe points draw the lines *ae*, *bf*, *cg*, *dh*, parallel to A C and D B. Now let the velocity of the earth be to that of the light as A B to C B. When the earth ſets out from the point A, ſuppoſe the ray of light commences its motion from the ſtar at C in the direction C B perpendicular to A B; then it is plain, when the earth is arrived at *a*, the particle of light will be got to *i*, the point where *a e* cuts B C, and the ſtar will be ſeen in the direction *a i*, and appear at *e*. In like manner, when the earth is at *b*, the particle of light will be come to *k*, and will appear at *f*; and ſo on; when the earth is at *c*, *d*, B, the particle will be at *l*, *m*, and B, and the ſtar will appear at *g*, *h*, and D. If therefore the line C A repreſents the axis of a teleſcope, making the angle B A C with the direction of the earth's motion A B; when the ſpectator comes to B, he will ſee the ſtar at D, which he could not do, if the teleſcope was directed in the perpendicular line B C; but the difference of the poſitions of the lines D B and B C, or the angle D B C, is ſo very ſmall as to amount to no more than 20″ 15‴, which gives the proportion of the ſides B C to C D or A B, as 10210 to 1; which ſhews that the velocity of light is 10210 times greater than the velocity of the earth in her orbit. But the velocity of the earth is known, which is about 500,000,000 miles in 365 days, or about 56,000 miles per hour; whence the velocity of light will be found to be ſuch as carries it through the ſpace of 170,000 miles, or 897,600,000 feet in one ſecond; and, therefore, it will paſs from the ſun to us in 8′ and 13″.

If a cannon will throw a ball one mile perpendicular height, or 5280 feet, the velocity with which it goes from the cannon's mouth is the uniform velocity of 10,560 feet per 18 ¼″, which is the time of the perpendicular aſcent or deſcent, and therefore the velocity of the cannon-ball is 578 feet per ſecond. Whence the velocity of light is, to that of the cannon-ball, as 897,600,000 to 578, or as 1,550,000 to 1, nearly.

The doctor found that the parallax of the fixed ſtars, inſtead of amounting to many ſeconds, as ſome have deduced from their obſervations, does not make one ſecond; and from thence it follows that the abovementioned ſtar, in draco, is about 400,000 times farther from us than the ſun; and, conſequently, that the light takes up above 493″ × 400,000 = 197,200,000 ſeconds, which is more than ſix years, in coming from that ſtar to us.

For the properties of reflected and refracted light, ſee the articles REFLECTION and REFRACTION.

LIGHT is alſo uſed to denote the diſpoſition of objects,

with regard to the receiving of light: thus, the doors, windows, &c. of houſes, are called lights.

For the lights and ſhades of paintings, &c. ſee CLARO-OBSCURO.

LIGHTER, a ſort of veſſel or large boat employed in harbours or rivers, particularly the Thames, to bring goods to and from a ſhip in the act of lading and delivering the cargo. See CARGO.

LIGHT-HOUSE, among ſailors, a little houſe erected on a cape, hill, or promontory, near the ſea-coaſt, for the direction of ſhips which are paſſing that way: for this purpoſe it is furniſhed with great lights at the top, and has always ſomebody to watch them. As the lights may be ſeen at a great diſtance, they are very ſerviceable in guiding ſhips which are at a loſs to know where they are.

LIGHTNESS, or *Levity of* BODIES. See the article LEVITY.

LIGHTNING, in phyſiology, the burſting of fire from a cloud.

From Mr. Franklin's experiments, it appears, that lightning is only electrical fire drawn off from the clouds; and, in effect, this electricity has been collected during thunder in iron bars, or on tin-tubes, in many parts of Europe. See ELECTRICITY.

Thunder then, or lightning, is in the hand of nature, what electricity is in ours; the wonders which we now exhibit at pleaſure, are only little imitations of thoſe great effects which frighten us. A cloud prepared by the action of winds, by heat, by a mixture of exhalations, &c. is the electrified body; and watery clouds, or terreſtrial matter, the non-electrics which excite it. See the article THUNDER.

LIGULATED, among botaniſts, an appellation given to ſuch floſcules as have a ſtraight end turned downwards, with three indentures, but not divided into ſegments.

LIGUSTICUM, lovage, in botany, a genus of plants, the general corolla of which is uniform, and the ſingle flowers conſiſt each of five lanceolated petals, bent inwards at the points: the fruit is naked, oblong, angulated, ſulcated, and ſeparable into two parts; and containing two oblong, ſmooth ſeeds, plain on one ſide, and ſtriated on the other.

LIGUSTRUM, privet, in botany, a genus of trees, with a funnel-faſhioned flower, quadrifid or quinquifid at the limb: the fruit is a globoſe, ſmooth berry, with only one cell, containing four ſeeds, convex on one ſide, and angulated on the other.

LILAC, in botany, a genus of trees, otherwiſe called ſyringa. See SYRINGA.

LILIACEOUS, an appellation given to ſuch flowers as reſemble that of the lily. See LILY.

LILIO-FRITILLARIA, a ſpecies of fritillary. See FRITILLARY.

LILIO-HYACINTHUS, a ſpecies of ſcilla or quill. See SCILLA.

LILIO-NARCISSUS, or AMARYLLIS, in botany, a genus of plants, with a liliaceous flower, compoſed of ſix petals. Its fruit is a ſuboval capſule, with three cells, containing a great many ſeeds.

LILIUM, the lily. See LILY.

LILIUM *Convallium*, lily of the valley. See CONVALLIUM *Lilium*.

LILY, *lilium*, in botany, the name of a large genus of plants, with a kind of bell-faſhioned flower, and is compoſed of ſix leaves, which are more or leſs expanded and bent back. The piſtil ſtands in the center of the flower, and finally becomes an oblong and trigonal fruit, which is divided into three cells, and contains a number of marginated ſeeds, arranged in a double order one on another. To this muſt be added, that the root is of a bulbous form, and is compoſed of a number of fleſhy ſcales affixed to an axis.

All ſorts of lilies and martagons are propagated by ſowing their ſeeds; and if the ſeeds are carefully ſaved from good flowers, the martagons very frequently afford very beautiful varieties.

The manner of ſowing them is this: ſome ſquare boxes ſhould be provided of about ſix inches deep, with holes bored in the bottoms to let out the wet; theſe muſt be filled with freſh light ſandy earth, and the ſeeds muſt be ſown on them pretty thick in the beginning of Auguſt, ſoon after they are ripe, and covered over about half an inch deep with light ſifted earth of the ſame kind. They ſhould be then placed where they may have the morning ſun; and if the weather prove dry, they muſt be watered at times, and the weeds carefully picked out. In the month of October, the boxes are to be removed to a place where they may have as much ſun as poſſible, and be ſecured from the north and north-eaſt winds. In ſpring the young plants will appear, and the boxes are then to be removed into their former ſituation; they ſhould be watered at times during the ſummer, and in Auguſt the ſmalleſt roots are to be emptied out of theſe boxes, and ſtrewed over a bed of light earth, and covered with about half an inch depth of light earth ſifted over them; they muſt here be watered and ſhaded at times, and defended from the ſeverity of the winter, by a light covering of ſtraw, or peaſe-haulm, in the hardeſt weather. In February the ſurface of the bed ſhould be cleared, and a little light earth ſifted over it. When the leaves are decayed, the earth ſhould be a little ſtirred over the roots, and in the month of September following a little earth ſifted on. In the September of the following year, the roots muſt be tranſplanted to the places where they are to remain, and ſet at eight inches diſtance, the roots being placed four inches below the ſurface: this ſhould be done in moiſt weather. They will now require the ſame care as in the preceding winters; and the ſecond after they are tranſplanted, the ſtrongeſt roots will begin to flower. The fine ones ſhould then be removed at the proper ſeaſon into flower-beds, and planted at great diſtances from one another, that they may flower ſtrong. *Miller's Gard. Dict.*

The roots of the white lily are emollient, maturating, and greatly ſuppurative. They are uſed externally in cataplaſms for theſe purpoſes with ſucceſs. The common form of applying them is boiled and bruiſed; but ſome prefer the roaſting them till tender, and then beating them to a paſte with oil, in which form they are ſaid to be excellent againſt burns. Gerard recommends them internally in dropſies.

LIMB, in a general ſenſe, denotes the border or edge of a thing: thus we ſay, the limb of a quadrant, of the ſun, of a leaf, &c.

LIMB, in anatomy, an appellation given to the extremities of the body, as the arms and legs. See ARM and LEG.

LIMBERS, or LIMBER-HOLES, in ſhip-building, ſmall holes in the lower part of the timbers of a ſhip cloſe to the keel; the purpoſe of which is to let the water, which may have come in by a leak, have a free paſſage to the well, where the pumps are fixed to draw it out: for this purpoſe every floor-timber is fitted with two of theſe, viz. one on each ſide of the kelſon.

LIMBER-BOARDS, ſhort pieces of plank which form a part of the ceiling of a ſhip's floor cloſe to the kelſon, and immediately above the timber-holes: they can be occaſionally removed to clear the limbers, when they are filled or clogged with any filth, ſand, gravel, &c.

LIME, *Calx*, a ſoft, friable ſubſtance, obtained by calcining or burning ſtones, ſhells, and the like.

There are ſo many ſpecies of ſtone capable of being burnt into lime, and ſo many that in the different parts of the world are really put to that uſe, that it would be difficult to affix any particular idea to the term lime-ſtone; but we are to underſtand by it in general, any ſtone, that upon a proper degree of heat, continued a ſufficient time, becomes a white calx, which will make a great ebullition and noiſe on being thrown into water, and will, in fine, fall into a looſe white powder at the bottom of that liquor; after having very ſtrongly impregnated it with its ſoluble particles. The moſt common kind of lime-ſtone is a greyiſh or bluiſh ſtone, found in looſe maſſes, and often veined with red: marble, alabaſter, and all the ſtones that have ſpar for their baſis, may alſo come under the general denomination of lime ſtone, ſince they all burn into lime. In general, every ſtone, of whatever kind or colour, that will ferment with aqua-fortis, will alſo burn into lime; and it is of no conſequence to the medicinal uſe of that calx, whether it be made of the one or the other of theſe ſtones. What lime we have in London is

is made of chalk, which is weaker than that made of ſtone; but it is otherwiſe the ſame.

The kilns uſed for making lime, are commonly built in a large pit; they are wide at the top, and grow narrow by degrees, as they approach nearer to the bottom: on the outſide, near the bottom of the kiln, there is a door, at which the aſhes are taken out, and juſt above that an iron-grate: upon this is placed a layer of ſtone, or whatever elſe is to be burnt for making lime, and upon that a layer of wood or coals, which is repeated till the kiln is full, only obſerving, that the outermoſt layer muſt be wood or coals. Chalk is commonly burnt in twenty-four hours, but ſtone often takes up ſixty hours: ten buſhels of ſea-coal, or a hundred of faggots three feet long, will burn forty buſhels of chalk, and forty buſhels of chalk will yield thirty buſhels of unſlacked lime.

The beſt lime is that made of the hardeſt ſtone; it is not only uſed by architects, builders, plaſterers, dyers, ſugar-refiners, tanners, and many other mechanics, but is an excellent manure for land, where it is ſandy, or a mixed gravel or clay ſoil. In many places it is carried out and laid in heaps, allowing a buſhel to a pole ſquare, or 160 buſhels to an acre.

The beſt method of ordering it, is to mix it with dung, or with mud drawn from the bottom of rivers: this makes an excellent mixture, eſpecially where the ſoil is ſandy; and in Weſtmoreland they produce fine crops of barley from their ſandy lands, by manuring them with lime and cow dung mixed together. The nature of lime on land is like that of chalk, it works downwards as the farmers expreſs it; and therefore it is beſt to treat it in the ſame manner, laying it fallow the year before it is to be ploughed up. It is obſerved that if the lime be carried hot out of the kiln, and laid upon the land to cool, it does much better than in any other way.

The improvement it makes upon land is owing chiefly to its heat, and the ſalt it contains. It is in much the ſame manner that coal aſhes and the ſoot of coal become uſeful upon the like kind of lands; but the farmers always find that a mixture of good earth and lime, that has laid a conſiderable time together, is better for this purpoſe than freſh lime alone.

Lime is alſo of great utility in medicine, for which uſe it is to be choſen in clean, light, and hard pieces, but not ſtony, ſuch as will not eaſily crumble to pieces between the fingers, and yet will readily break when thrown into water. The beſt lime in the world, on being long expoſed to a damp air, will moulder into a powder, and loſe all its medicinal virtues. Lime in its perfect and unaltered ſtate, as newly taken from the kiln, is called calx viva, or quick-lime: that which has lain in the air till it has fallen into powder, is called calx extincta; and that which has been thrown into water, and the powder it has fallen into afterwards waſhed with ſeveral freſh waters, is called calx lota.

Quick lime is burning and corroſive, and is never given internally; but it is ſometimes uſed in external applications, as made into a paſte with orpiment, ſoap, &c. and uſed as a depillatory. The calx lota is no longer a corroſive, but a powerful deſiccative; and lime-water is of great ſervice internally in all cutaneous eruptions, in the cure of obſtinate ulcers, and for diſeaſes of the lungs: for this purpoſe it is generally to be continued a conſiderable time.

The preparations of lime in uſe in the ſhops are, the ſimple lime-water; the leſs compound lime-water; the more compound lime-water; and ſeveral kinds of cauſtics, which ſee under the article CAUSTIC.

Simple lime-water is made in the following manner: Put a pound of quick-lime into a large earthen pan; pour upon it, by a little at a time, a gallon and a half of water; after the ebullition is thoroughly over, let the liquor ſtand to ſettle, and then pour it clear off, and filter it for uſe. This is principally intended for waſhing old ulcers, and other external purpoſes; when it is to be taken internally, the following additions are made to it, to take off its flavour, or to add to its virtues. Take of liquorice-root, an ounce; of ſaſſafras-bark, half an ounce; ſimple lime-water, three quarts; let the whole infuſe together for two days without heat, then filter it for uſe: this laſt preparation is called the leſs compound lime-water. The more compound lime-water is made thus: Take raſpings of guaiacum, half a pound; liquorice-root, an ounce; ſaſſafras-bark, half an ounce; of coriander-ſeed, three drams; of lime-water, three quarts; let the whole ſtand together two days without heat, and then filter it off for uſe.

It has been found by ſeveral late experiments, made by Dr. Alſton, that lime-water is an excellent remedy for the ſtone; and that it has alſo been given with extraordinary ſucceſs in acute fevers.

Sponius ſays, that when drank with milk or whey, it performs wonderful effects in internal ulcers, diarrhœas, and the dyſentery.

Lime-water on being mixed with linſeed oil, or the oil of olives, and well ſhaken, acquires the conſiſtence of a balſam, which is of ſingular ſervice when applied externally in freſh burns, and alſo conduces to ſtop inflammations. It may alſo be impregnated with copper, by ſtanding in a brazen baſon: by which means it aſſumes a beautiful ſaphire colour, and proves an excellent remedy againſt puſtules, ulcers, ſcabies, and itching of the eyes; and this laſt prepartion mixed with a little ſal ammoniac, is recommended againſt all humours, films, and other blemiſhes of the eyes, and is ſaid to be very efficacious when the eyes are hurt by the ſmall-pox; and there is no remedy more effectual for cancerous ulcers.

LIME-TREE, the Engliſh name of the tilia. See TILIA.

LIMITS *of Equations*, in algebra, a method of diſcovering the limits of the root of equations, by which their ſolutions is much facilitated.

Let any equation be propoſed, and having put p, q, r, s, t, v, &c. for the known quantities of the terms thereof, under their ſigns changed, viz. that of the ſecond p, that of the third q, of the fourth r, of the fifth s, and ſo on. And the ſigns of the terms being rightly obſerved, make $p=a$, $pa+2q=b$, $pb+qa+3r=c$, $pc+qb+ra+4s=d$, $pd+qc+rb+sa+5t=e$, $pe+qd+rc+sb+ta+6v=f$, and ſo on, obſerving the ſame law in the continuation of the ſeries; and a will be the ſum of the roots, b the ſum of the ſquares of each of the roots, c the ſum of the cubes, d the ſum of the biquadrates, e the ſum of the quadrato-cubes, f the ſum of the cubo-cubes, and ſo on. As in the equation $x^4-x^3-19xx+49x-30=0$, where the known quantity or co-efficient of the ſecond term is -1, of the third -19, of the fourth $+49$, of the fifth -30: you muſt make $1=p$, $19=q$, $-49=r$, $30=s$. And there will thence ariſe $a=(p=)\ 1$, $b=(pa+2q=1+38=)\ 39$, $c=(pb+qa+3r=39+19-147=)\ -89$, $d=(pc+qb+ra+4s=-89+741-49+120=)\ 723$: wherefore the ſum of the roots will be 1, the ſum of the ſquares of the roots 39, the ſum of the cubes -89, and the ſum of the biquadrates 723; hence the roots of that equation are 1, 2, 3, & -5, and the ſum of theſe $1+2+3-5=1$; the ſum of the ſquares, $1+4+9+25$, is 39; the ſum of the cubes, $1+8+27-125$, is -89; and the ſum of the biquadrates, $1+16+81+625$ is 723.

Now to collect the limits between which the roots of the equation ſhall conſiſt, if none is impoſſible, it will be neceſſary to obſerve, that when the ſquares of all the roots are affirmative, the ſum of the ſquares will be affirmative; and therefore greater than the ſquare of the greateſt root; and alſo that the ſum of the biquadrates of all the roots will be greater than the biquadrate of the greateſt root, and the ſum of the cubo-cubes greater than the cubo-cube of the greateſt root. Wherefore, to obtain that limit which no roots can paſs, find the ſum of the ſquare of the roots, and extract the ſquare root of that ſum, this root will be greater than the greateſt root of the equation; but to approach the greateſt root ſtill nearer, find the ſum of the biquadrates, and extract its biquadrate root; and for a third approximation, extract the cubo-cubical root of the ſum of the cubo-cubes of the roots.

Thus in the precedent equation, the ſquare-root of the ſum of the ſquares of the roots, or $\sqrt{39}$, is $6\frac{1}{2}$ nearly, and $6\frac{1}{2}$ is farther diſtant from 0 than any of the roots 1, 2, 3, -5. But the biquadrate root of the ſum of the biquadrates of the roots, viz. $\sqrt[4]{723}$, which is $5\frac{1}{4}$ nearly, comes nearer to the root that is moſt remote from nothing, viz. -5.

Another

Another method of finding the limits of an equation is this: Multiply every term of the propoſed equation by the number of its dimenſions, and divide the product by the root of the equation.

Then again, multiply every one of the terms that come out by a number leſs by unity than before, and divide the product by the root of the equation; proceed in this manner, by conſtantly multiplying by numbers leſs by unity than before, and dividing the product by the root, till at length all the terms are deſtroyed, whoſe ſigns are different from the ſign of the firſt or higheſt term, except the laſt: and that number will be greater than any affirmative root, which being writ in the terms that come out for the root, makes the aggregate of thoſe which were each time produced by multiplication, to have always the ſame ſign with the firſt or higheſt term of the equation.

Let the equation $x^5-2x^4-10x^3+30x^2+63x-120=0$, be propoſed; firſt multiply it thus; $x^{5}-2x^{4}-10x^{3}+30x^{2}+63x^{1}-120^{0}$. Then again, multiply the terms that come out, divided by x, thus; $5x^{4}-8x^{3}-30x^{2}+60x^{1}+63^{0}$, and dividing the terms that come out again by x, there comes out $20x^3-24x^2-60x+60$; which, to leſſen them, I divide by the greateſt common diviſor 4, and you have $5x^3-6x^2-15x+15$. Theſe being again multiplied by the progreſſion 3, 2, 1, 0, and divided by x, become $15xx-12x-15$, and again divided by 3, becomes $5xx-4x-5$: and theſe multiplied by the progreſſion 2, 1, 0, and divided by $2x$, gives $5x-2$. Now ſince the higheſt term of the equation x^5 is affirmative, I try what number writ in theſe products for x will cauſe them all to be affirmative. And by carrying 1, you have $5x-2=3$ affirmative; but $5xx-4x-5$, you have -4 negative: wherefore the limit will be greater than 1. I therefore try ſome greater number, as 2, and ſubſtituting 2 in each for x, they become

$5x-2=8$
$5x^2-4x=-5=7$
$5x^3-6x^2-15x+15=1$
$5x^4-8x^3-30x^2+60x+63=79$
$x^5-2x^4-10x^3+30x^2+63x-120=46$.

Wherefore, ſince the numbers that come out 8, 7. 1. 79. 46. are all affirmative, the number 2 will be greater than the greateſt of the affirmative roots. In like manner, if we would find the limit of the negative roots, we muſt try negative numbers, or, which is the ſame thing, change the ſigns of every other term, and try affirmative ones. But having changed the ſigns of every other term, the quantities in which the numbers are to be ſubſtituted, will become

$5x+2$
$5x^2+4x-5$
$5x^3+6xx-15x-15$
$5x^4+8x^3-30x^2-60x+63$
$x^5+2x^4-10x^3-30x^2+63x+120$.

From theſe, let ſome quantity be taken wherein the negative terms ſeem moſt prevalent; ſuppoſe $5x^4+8x^3-30x^2-60x+63$; and here ſubſtituting for x the numbers 1 and 2, there come out the negative numbers -14 and -33; whence the limit will be greater than -2. But ſubſtituting the number 3, there comes out the affirmative number 234. And in like manner in the other quantities, by ſubſtituting 3 for x, there comes out always an affirmative number, which may be ſeen by bare inſpection. Wherefore the number -3 is greater than all the negative roots. And ſo you have the limits 2 and -3, between which are all the roots.

Theſe limits are of uſe both in the reduction of equations by rational roots, and in the extraction of ſurd roots out of them; for it is certain, that if after trying all the diviſors of the laſt term of the equation, which here is 120, none of them writ in the equation for x would make all the terms vaniſh, the equation will admit of no root but what is ſurd. But there are many diviſors of that term, namely, $1,-1,2,-2,3,-3,4,-4,5,-5,6,-6,8,-8,10,-10,12,-12,15,-15,20,-20,24,-24,30,-30,40,-40,60,-60,120$, and -120. To try all theſe diviſors would be tedious. But it being known that the roots are between 2 and -3, it will be ſufficient to try thoſe only that are within theſe limits, viz. the diviſors 1, and -1, and -2. For if none of theſe are the root, it is certain that the equation admits of no root but what is ſurd.

LIMITS *of a Planet*, its excurſion from the ecliptic, or; which is the ſame thing, the points of its greateſt latitude.

LIMITATION, in law, ſignifies a certain ſpace of time allowed for bringing actions in.

LIMITATION *of Eſtate* is the length of time an eſtate is to continue in the poſſeſſion of a perſon or family.

LIMITED PROBLEM, a problem that admits but of one ſolution, as to make a circle paſs through three given points, not lying in the ſame right line.

LIMNING, the art of painting in water-colours, in contradiſtinction to painting, which is done in oil colours. See PAINTING.

LIMON, the lemon-tree. See LEMON.

LIMPET, the Engliſh name of a ſhell-fiſh, called by authors patella. See PATELLA.

LINE, *Linea*, in geometry, a quantity extended in length only, without any breadth or thickneſs. It is formed by the flux or motion of a point. See the article FLUXION.

There are two kinds of lines, viz. right lines and curve lines. If the point A, (plate LXXXI. *fig.* 1.) move towards B; by its motion, it deſcribes a line, and this, if the point go the neareſt way towards B, will be a right or ſtraight line, whoſe diſtinction therefore is the neareſt or ſhorteſt diſtance between any two points; or a line, all whoſe points tend the ſame way. If the point go any way about, as in one of the lines A B C, or A c B, it will trace out either a crooked line as the upper A c B, or elſe two more ſtraight ones as in the lower A C B. Right lines are all of the ſame ſpecies, but curves are of an infinite number of different ſpecies. We may conceive as many as there may be different ratios between their ordinates and abſciſſes. See the articles ABSCISS and ORDINATE.

Curve lines are uſually divided into geometrical and mechanical; the former are thoſe which may be found exactly in all their points; the latter are thoſe, ſome or all of whoſe points are not to be found preciſely, but only tentatively, or nearly.

Curve lines are alſo divided into the firſt order, ſecond order, third order, &c. See the article CURVE.

Lines conſidered as to their poſitions, are either parallel, perpendicular, or oblique, the conſtruction and properties whereof ſee under PARALLEL, &c.

Euclid's ſecond book treats moſtly of lines, and of the effects of their being divided and again multiplied into one another.

LINE, in geography, the ſame with equator. See the article EQUATOR.

LINES, in aſtronomy, are, 1. Fiducial line, the line or ruler which paſſes through the middle of an aſtrolabe, or the like inſtrument, and on which the ſights are fitted, otherwiſe called alhidade, index, dioptra, and mediclinium. See the article ASTROLABE. 2. The horizontal line. 3. Iſochronal line. 4. Meridian line. 5. Line of the nodes. See the articles HORIZONTAL, ISOCHRONAL, MERIDIAN and NODES.

LINES, in perſpective, are, 1. Geometrical line, which is a right line drawn in any manner on the geometrical plane. 2. Terreſtrial line, or fundamental line, is a right line wherein the geometrical plane, and that of the picture or draught interſect one another, ſuch is the line N I, (plate LXXXI *fig.* 2.) formed by the interſection of the geometrical plane L M, and the perſpective plane H K. 3. Line of the front, is any right line parallel to the terreſtrial line. 4. Vertical line, the common ſection of the vertical and of the draught. 5. Viſual line, the line or ray imagined to paſs from the object to the eye. 6. Line of ſtation, according to ſome writers, is the common ſection of the vertical and geometrical planes. Others, as Lamy, mean by it the perpendicular height of the eye above the geometrical plane. Others a line on that plane, and perpendicular to the line expreſſing the height of the eye. 7. Objective line, the line of an object from whence the appearance is ſought for in the draught or picture.

LINES, in dialling, are, 1. Horizontal line, the common ſection of the horizon and the dial-plane. See DIAL. 2. Horary lines, or hour-lines, the common interſections of the hour-circles of the ſphere, with the plane of the dial. 3. Subſtylar line, that line on which the ſtyle or cock of a dial is duly erected, and the repreſentation of ſuch an hour-circle as is perpendicular to the plane of that dial. 4. Equinoctial line, the common interſection of the equinoctial and plane of the dial.

Contingent LINE. See CONTINGENT.

LINE *of Meaſures* is uſed by Oughtred, to denote the diameter of the primitive circle in the projection of the ſphere in plano, or that line in which the diameter of any circle to be projected falls. In the ſtereographic projection of the ſphere in plano, the line of meaſures is that line in which the plane of a great circle perpendicular to the plane of the projection, and that oblique circle which is to be projected, interſects the plane of the projection; or it is the common ſection of a plane paſſing through the eye-point and the center of the primitive at right angles to any oblique circle which is to be projected, and in which the center and pole of ſuch circle will be found.

LINE *of Direction of the Earth's Axis*, in the Pythagorean ſyſtem of aſtronomy, the line connecting the two poles of the ecliptic and of the equator when they are projected on the plane of the former.

LINE *of Direction*, in mechanics, that wherein a body actually moves, or would move, if it were not hindered. It alſo denotes the line that paſſes through the center of gravity of the heavy body to the center of the earth, which muſt alſo paſs through the fulcrum, or ſupport of the heavy body, without which it would fall.

LINE *of Gravitation*, of any heavy body, a line drawn through its center of gravity, and according to which it tends downwards.

LINE *of the ſwifteſt Deſcent*, of a heavy body, is the cycloid. See CYCLOID.

LINE *of a Projectile*. See PROJECTILE.

LINES *on the Plain Scale*, are the line of chords, line of ſines, line of tangents, line of ſecants, line of ſemitangents, line of leagues, the conſtruction and application of which ſee under the words SCALE, SAILING, &c.

LINES *on Gunter's Scale* are the line of numbers, line of artificial ſines, line of artificial tangents, line of artificial verſed ſines of rhumbs, line of artificial tangents of the meridian line, and line of equal parts; for the conſtruction and application of which, ſee GUNTER'S SCALE.

LINES *of the Sector* are the line of equal parts, or line of lines, line of tangents, line of ſecants, line of polygons, line of numbers, line of hours, line of latitudes, line of meridians, line of metals, line of ſolids, line of planes; for the conſtruction and uſe of which, ſee the article SECTOR.

LINES, in fortification, are thoſe of approach, capital, defence, circumvallation, contravallation, of the baſe, &c. See the articles APPROACH, CAPITAL, &c.

To LINE *a Work*, ſignifies to ſtrengthen a rampart with a firm wall; or to encompaſs a parapet or moat with good turf, &c.

LINE, in the art of war, is underſtood of the diſpoſition of an army, ranged in order of battle, with the front extended as far as may be, that it may not be flanked. See ARMY.

LINE *of Battle*, in the marine, the array in which a fleet or ſquadron of ſhips of war is formed to engage with an enemy.

In this manoeuvre the ſhips are drawn up about one hundred fathoms diſtant, a-head of each other, the admiral being in the center, whoſe chief judgment is to form it in a proper diſpoſition and ſtrength throughout, from the van to the rear; in doing which, particular care muſt be had to make the center ſtrong; for if that is forced or broke through, the battle is looked upon as loſt. Here it is to be obſerved, that in a ſea-action the center is made the ſtrongeſt; whereas in a land-fight it is the weakeſt; and the wings of an army are the ſtrongeſt, leſt the enemy, by forcing a wing, ſhould have the advantage of flanking, and conſequently putting the line in confuſion; for the ſame reaſon alſo, the van and rear of a fleet is not put into diſorder, becauſe care is taken to make them proportionally ſtrong to reſiſt the enemy; therefore the weakeſt part of the line will be in the quarters, as ſupported each way from the center throughout.

The line being thus formed, there ought to be a corps-de-reſerve, as many as may be thought neceſſary, if they can be diſpenſed with. But firſt, the line muſt ſtretch out the length of the enemy's, if poſſible, or elſe they will have the advantage, and by tacking and doubling upon your line, put the van and rear into confuſion.

It is a maxim in naval diſcipline that a commanding flag-ſhip ſhould never go out of her way for any ſhip whatever, unleſs that ſhip ſhould be diſabled, or that a ſudden ſhift of wind takes her unexpectedly. The reaſon is ſelf-evident: if the admiral gives way for one, or backs and fills for another's fancy or miſconduct, there would be no end to ſuch negligence or over-ſight; therefore the commanding flag-ſhip expects that every ſhip in his fleet will obſerve and take her motions from him and his ſeconds, whoſe diſtance from the admiral ſhould be a ſtandard for every other ſhip to follow in that from each other, as near as poſſible, except when her ſignal is made to back or fill, or make more or leſs ſail.

The ſeconds to the commanding flag-ſhip are particularly to regard her, to move as ſhe does, whether the other ſhips do or not, or cannot do; for they are called ſeconds to guard and attend the admiral's ſhip.

It is the duty of every officer, as ſoon as the ſignal is diſplayed for the line, to crowd, if poſſible, into his ſtation, and not lie, through indolence or negligence, braced to or a-back, but make ſail to windward, or bear away to leeward, in order to form the line immediately, and then each leading ſhip to mind her tack as the wind is, to lead and give room.

The commanding flag-officer, when his ſhips are arranged into a line, obſerves the ſtrength of the enemy's line throughout, and acts accordingly, making more or leſs ſail, or what motion he might think moſt to his advantage. He is not to take his motion from his leading ſhip, but upon ſome particular occaſion, ſignal, notice, or meſſage ſent to him.

In a line of battle the weathermoſt fleet, or that which has the weather-gage, in the ſea language, is generally allowed to have the advantage, although there are ſeveral arguments on the other hand in favour of the lee-ſide. We ſhall endeavour to ſtate the mutual advantages.

1. The weather-gage is ſooneſt clear of ſmoke; and of courſe that line can better obſerve the ſignals which are ſpread than the ſhips to leeward can, which muſt have the continuance of both its own and of the enemy longer.

2. If the weather-ſhips are more in number than the enemy's fleet, they can detach ſome from their ſquadron, which, bearing down upon the rear of the enemy, muſt infallibly throw them into diſorder.

3. The fire-ſhips of the weather-line can, when they are ordered, more eaſily bear down upon the enemy, than thoſe of the lee can ply to windward, which can never be done againſt a line in action; but the weather fire-ſhips can bear down againſt all the reſiſtance that can be made by the enemy.

Advantages of the lee-line. — 1. If one, two, or more of the ſhips to windward ſhould be diſabled, they muſt inevitably drive to leeward, and become a prey to the enemy.

2. The ſhips of the lee line can more readily bear away before the wind, and have their places ſupplied by ſhips from the corps de-reſerve, in caſe of being diſabled or meeting with any diſaſter.

3. The line to leeward can keep their ports longer open in a ſtrong wind with a high ſea, when thoſe to windward, in all probability, may be obliged to ſhut the ports of their lower tier of guns, to prevent the water from ruſhing in between decks, which may be attended with the moſt fatal conſequences.

4. The lee-line can more eaſily obſerve the men on the decks of the ſhips to windward, as they heel, and when the ſmoke does not intercept their ſight: at which time the marines and top-men may eaſily take aim at, and deſtroy them with muſkets or carabines.

LINE A-BREAST, an arrangement in which the whole ſquadron advances uniformly with all the ſhips parallel to

each other; ſo that the length of each ſhip forms a right line with the line a-breaſt. See DIVISION, SQUADRON, and NAVAL *Engagement*.

LINE, in fencing, that part of the body oppoſite to the enemy, wherein the ſhoulders, the right arm, and the ſword, ought always to be found; and wherein are alſo to be placed the two feet at the diſtance of eighteen inches from each other. In which ſenſe a man is ſaid to be in his line, or to got out of his line, &c.

LINE *of Demarcation*, or *Alexandrian* LINE, a meridian paſſing over the mouth of the river Moragnon, and by the capes Houmas and Mallabrigo, ſo called from pope Alexander VI. who, to end the diſpute between the crowns of Caſtile and Portugal, about their boundaries, drew an imaginary line on the globe, which was to terminate the pretenſions of each. By this partition, the Eaſt Indies fell to the ſhare of the Portugueſe, and the Weſt Indies to the Caſtilians.

LINE *of the Synodical*, in reference to ſome theories of the moon; is a right line ſuppoſed to be drawn through the centers of the earth and ſun: and, if it be produced, quite through the orbits: it is called the line of the true ſyzygies: but a right line imagined to paſs through the earth's center, and the mean place of the ſun, is called the line of the mean ſyzygies.

LINE, in genealogy, a ſeries or ſucceſſion of relations in various degrees, all deſcending from the ſame common father.

Direct line, is that which goes from father to ſon; being the order of aſcendants and deſcendants.

Collateral line is the order of thoſe who deſcend from ſome common father, related to the former, but out of the line of aſcendants and deſcendants: in this are placed uncles, aunts, couſins, nephews, &c. See DIRECT and COLLATERAL.

LINE alſo denotes a French meaſure, containing the twelfth part of an inch, or the hundred and forty-fourth part of a foot.

LINES, in muſic, the name of thoſe ſtrokes drawn horizontally on a piece of paper, on and between which the characters and notes of muſic are diſpoſed: their number is commonly five; when another is added, for one, two, or more notes, it is called a ledger-line.

LINES, in heraldry, the figures uſed in armories, to divide the ſhield into different parts, and to compoſe different figures. Theſe lines, according to their different forms and names, give denomination to the pieces or figures which they form, except the ſtraight or plain lines.

LINEA *Alba*, in anatomy, a white line which runs from the cartilago enſiformis to the os pubis, dividing the abdomen exactly in the middle; and is formed out of the tendons of the oblique and tranſverſe muſcles.

It receives a twig of a nerve from the intercoſtals in each of its digeſtations or indentings.

LINEAMENT, among painters, implies the out-lines of a face.

LINEAR PROBLEM, in mathematics, ſuch a problem as may be ſolved geometrically, by the interſection of two right lines: as meaſuring an inacceſſible height by means of two unequal ſticks, &c. It is alſo called a ſimple problem, and is capable but of one ſolution.

LINEN, in commerce, a well-known kind of cloth, chiefly made of flax. See FLAX.

LINIMENT, *Linimentum*, in pharmacy, a compoſition ſomewhat thinner than an unguent, and thicker than an oil, uſed for anointing the body in various intentions.

LINNET, *Linaria*, in ornithology, a bird of the ſize of the goldfinch; the head is ſmall and flatted; the eyes are ſmall, and hazel; the beak is conic, very ſmall, and ſharp at the point; the head, neck, and back are variegated with a bright brown and white; the breaſt and belly are pale, but in the male, eſpecially in the ſummer, there is a redneſs on the top of the head and all over the breaſt. This is a ſinging bird, and ſometimes has young ones four times a year, eſpecially if they are taken from the dam before they are able to fly, which may be done four days after they are hatched.

LINSEED, the ſeed of the plant linum. See the article LINUM.

Linſeed bruiſed and ſteeped in water, gives it very ſoon a thick mucilaginous nature, and communicates much of its emollient virtues to it. It is anodyne, attemperating, and of great ſervice in ſuppreſſions of urine from inflammation and heat; it envelops the acid ſalts of the urine, and prevents their vellicating and wounding the tender parts; and in ſome meaſure ſupplies the mucus of the bladder, when abraded and worn off. It is to be given in decoction, or infuſion, on theſe occaſions: the infuſion is not to be made too thick or mucilaginous, becauſe in that caſe it loads the ſtomach, and breeds flatulences in the inteſtines. A ſlight infuſion of linſeed, by way of tea, is recommended by many as an excellent pectoral; and the ſeed is a common and very good ingredient in clyſters. Externally, this ſeed, ground to powder, is an excellent emollient; as is alſo the ſtrong mucilage, made by boiling the ſeeds a long time: the oil drawn from it by expreſſion is of great ſervice in coughs, pleuriſies, and many other caſes.

LINSPINS, in the military art, ſmall pins of iron, which keep the wheel of a cannon, or waggon, on the axle-tree; for when the end of the axle-tree is put thro' the nave, the linſpin is put in, to keep the wheel from falling off.

LINSTOCK, in the military art, a wooden ſtaff, about three feet long, upon one end of which is a piece of iron, which divides in two, turning from one another, having each a place to receive the match, and a ſcrew to keep it faſt: the other end is pointed, and ſhod with iron, to ſtick in the ground. It is uſed, by gunners, to fire the guns.

LINT, *Linum*, the flax of which linen is made. See FLAX and LINEN.

In ſurgery, the term lint denotes the ſcrapings of linen which is uſed in dreſſing wounds, and is made up in various forms, as tents, doſſils, pledgets, &c. See the articles TENT, DOSSIL, &c.

LINTEL, in architecture, a piece of timber that lies horizontally over door-poſts and window-jambs, as well to bear the thickneſs of the wall over it, as to bind the ſides of the wall together.

LINUM, flax, in botany, a genus of plants, the flower of which is infundibuliform, conſiſting of five oblong petals; its fruit is a globoſe capſule, divided into ten cells, in each of which is a ſingle acuminated ſeed. See FLAX and LINSEED.

LION, *Leo*, in zoology, the ſtrongeſt and fierceſt of all quadrupeds.

The head of the lion appears very large in proportion to its body, and is the moſt fleſhy of the heads of all the known animals. Its jaw-bones alſo are remarkably large. The breaſt alſo appears very large, but this is only owing to the great quantity of long hair that covers it, for the ſternum is ſmaller than that of moſt animals of the ſame ſize. The tail, which is very long, appears alſo of the ſame thickneſs all the way, but this is wholly owing to the growth of the hair. The tail itſelf is largeſt at the baſe, and thence goes taper to the point; but the hair, being very ſhort near its baſe, and continuing to grow longer all the way, as that decreaſes in thickneſs, is ſo exactly proportioned in this growth, that it always gives the whole tail this regular appearance.

The long hair that grows about the neck and breaſt, and makes what is called the mane of the lion, only differs from the hair of the reſt of the body in length, having no greater thickneſs, or rigidity, like that of the manes of other animals. The claws of the lion have no caſes, as Pliny pretends that they have, for the animal to withdraw them into in walking; but Plutarch, Solinus, and ſome others, are much more in the right, in ſaying that the lion draws them up backwards when he walks, and places them cloſely among the articulations of the toes.

It is certain that the laſt joint but one of every toe in this creature has a peculiarly eaſy joint for motion, and by means of this the laſt joint, with the claw that is affixed to it, are very readily drawn up, and hid upon the foot, and placed wholly out of the way of being hurt in walking. This creature, therefore, does not put the extremities of its toes to the ground in walking, but the termination of each toe, as to its touching the earth, is the joint of the laſt piece with the laſt but one. This drawing up of the laſt joint of every toe, by means of which

which each claw is hid between the toe it belongs to and the next, is the effect of a ligament, which in its natural ſtate is ſo ſhortened, as to keep them in this poſition: and it is only by the action of a very ſtrong muſcle, that this joint can be pulled downward, when the claws are to be uſed, the ligament beforementioned always drawing them naturally into their firſt poſition again, as ſoon as the force of the muſcle is over.

The lion has fourteen teeth in each jaw, four inciſores, four canine, and ſix molares. The inciſores are ſmall; the canine are unequal in ſize, two being very large, and two very ſmall; the large ones are an inch and half long, and are the only ones the ancients allowed to be canine teeth. The molares alſo are irregular in ſize, the anterior ones being very ſmall, the others large, and terminated by three or four points, forming a ſort of flower-de-luce.

Ariſtotle, Ælian, and others ſay, that the neck of the lion is all compoſed of one unjointed bone. It appears indeed very rigid in this creature, but it does not proceed from ſo ſtrange a cauſe, but is found owing to this, that the ſpinoſe apophyſes of the vertebræ of the neck are long, and faſtened together by extremely ſtrong and rigid ligaments.

The tongue of the lion is very rough and rigid, being covered with a great number of prominences of a hard matter, reſembling that of a cat's claws, and nearly of the ſame ſize, the baſe of each being a round fleſhy prominence on the ſurface of the tongue.

The eyes of the lion are clear and bright, even after the creature is dead. The common obſervation that this creature ſleeps with its eyes open, is founded on this, that it has a very thick membrane lodged in the greater canthus of the eyes, which it can extend over the whole eye upon occaſion, as birds do their membrana nictitans, and thus will have no occaſion to ſhut its eye-lids, in order to exclude the light. It is very remarkable that the common cat has all the ſingular ſtructure of the ſeveral parts as the lion has, its claws, feet, tongue and eyes, being of the ſame kind, and its internal parts bearing as ſtrong a reſemblance.

The heart of the lion is greatly larger than that of any other creature of the ſame ſize, being ſix inches long, and four in diameter, in the largeſt part, and terminating in a very ſharp point. The brain is as remarkably ſmall; and upon the compariſon of this with the great quantity of brain in a calf, and purſuing the obſervation through ſeveral other creatures, as to the proportion of brain they have, it does not appear that a ſmall quantity of brain is a mark of folly, but uſually of great ſubtlety, and of a cruel diſpoſition. *Mem. pour l'Hiſtoire des Anim.*

LIONCELLES, in heraldry, a term uſed for ſeveral lions borne in the ſame coat of arms.

LIP, *Labium*, or *Labrum*, in anatomy, the exterior fleſhy covering of the mouth. See MOUTH.

The cheeks and lips form the ſides and entry of the cavity of the mouth. They are formed in general by the connection of ſeveral fleſhy portions, of different breadths, fixed round the two jaws, covered on the outſide with the ſkin and fat, and lined on the inſide by a glandulous membrane. Beſides this, the lips have a ſoft ſpongy ſubſtance, which ſwells and ſubſides on certain occaſions, independently of the action of the muſcles; and is mixed with fat.

The ſubſtance that forms the red border of the lips is a collection of very fine, long, villous papillæ, cloſely connected together, and covered by a fine membrane; which ſeems to be both a continuation of the epidermis, and of that pellicle which covers the glandulous membrane of the cavity of the mouth. This ſubſtance is extremely ſenſible. The internal membrane of the upper-lip forms a ſmall middle frænum above the firſt dentes inciſorii.

The arteries which go to the lips are ramifications of the external carotid, and principally of the external and internal maxillary branches. See ARTERY.

The veins are ramifications of the external anterior jugular. See VEIN.

The nerves of theſe parts come from the maxillaris ſuperior and inferior, which are branches of the fifth pair; and alſo from the portio dura of the auditory nerve, or ſympatheticus minimus, the ramifications of which are ſpread in great numbers on all theſe parts, and communicate very ſingularly with the nerves of the fifth pair in ſeveral places.

There is ſo much variety in the muſcles of the lips, in different objects, that it is not at all ſurpriſing to find anatomiſts diſagree in the deſcription of them.

The muſcles of the lips are uſually divided into common and proper; the common are thoſe which end at the angles of the two lips; and thoſe are proper which are fixed in one lip only, which are again ſubdivided into proper muſcles of the upper-lip, and proper muſcles of the under-lip.

The common muſcles are the ſemi-orbiculares, ſupra-ſemi-orbiculares, buccinatores, and zygomatici majores.

The proper muſcles of the upper-lip are the zygomatici minores, canini, inciſorii laterales, and inciſorii medii.

Thoſe of the under-lip, the triangulares, triangularium collaterales, quadratus, inciſorii inferiores, and cutanei.

The upper-lip is ſometimes moved by the action of the muſcles of the noſe, eſpecially the pyramidales; and both lips, either jointly or ſeparately, are moved by ſuction, without the aſſiſtance of their proper muſcles.

The common muſcles of the lips either draw both corners of the mouth at once, or only one at a time, according to the different direction of their fibres. The proper muſcles pull the different parts of the lips in which they are inſerted.

The buccinators, in particular, may ſerve to move the food in maſtication.

Hare-LIPS, in ſurgery, a diſorder in ſome perſons wherein the upper-lip is ſo divided, as to reſemble a hare's lip. This diviſion is ſometimes ſmall, at other times it is double, like the letter M, and then termed the double hare-lip. Beſides the deformity cauſed by this diſorder, it hinders infants from ſucking, and adults from ſpeaking diſtinctly. Sometimes this accident happens to the lower lip from the ill treatment of a wound, and this is called the ſpurious hare-lip; the true kind is born with the infant. The leſs and more equal the fiſſure of the hare-lip is, it is generally ſo much the more eaſily cured. In ſome infants, the diviſion of the lip is ſo large and irregular, that there can be but little hopes of a cure, which may, however, be eaſily performed on the very ſame lip, when adult. Sometimes too we meet with a tooth projecting forward into the fiſſure; in this caſe it cannot be cured without firſt taking out the tooth. In a recent hare-lip, or one made by a wound, the cure is to be performed by the knotted ſuture. See the articles SUTURE and WOUND.

In curing the hare lip, where part of the lip is wanting, no attempt can be made to ſupply what is deficient, but only to unite thoſe parts which are divided, by taking off the ſkin from the edges of the fiſſure, and then cauſing them to unite and grow together, by paſſing through them two or three needles, made of gold or ſilver, pointed with ſteel, from the right to the left, beginning with the upper-part of the fiſſure, and inſerting them at about a ſtraw's breadth from each other: the ſurgeon having thus entered the needles, and cleanſed the bleeding lips with a ſpunge, he takes a piece of ſtrong waxed thread or ſilk, and faſtening it about one end of the needle, he winds it over the other end, and back again. Having done this, he afterwards ſecures it by a knot; by this means the edges of the lips are brought cloſe together, and the upper-part or ſurface kept ſmooth and even. To heal the wound internally, it is dreſſed with ſoft lint dipped in honey of roſes, and put between the gums and lip; but this practice can only be followed with adults: the external part of the wound is at the ſame time dreſſed with balſam of Peru, or ſome other vulnerary unguent, covered with lint and compreſs, and over that a ſticking plaſter with four heads, two of which are faſtened on the left ſide of the lip, and two upon the right, and the whole ſecured by a ſling or fillet, whoſe extremities may be faſtened about the head, either by a knot or pins. But it muſt here be obſerved, that when the fiſſure appears large and deep, ſo that the two parts of the lip cannot be eaſily joined, it will be neceſſary, before the above operation, to divide the frænulum of the upper-lip from the gum, with a pair

of

of ſciſſars, but without wounding the gum, or uncovering the jaw. Though the hæmorrhage is often very plentiful in performing theſe operations on young infants, yet it is not dangerous, ſince it prevents an inflammation, and generally ceaſes after tying the bandages.

The dreſſings ought not to be moved before the third day, unleſs ſome accident makes it neceſſary; and then it muſt be done with great caution, to avoid ſeparating the parts in contact. If the lips of the wound appear conjoined, three or four days after the operation, you may then venture to draw out the middle needle, when there are three, or the upper one, when there are only two; and two or three days after draw out the other: the cure muſt be completed by dreſſing every day, as at firſt.

LIPOTHYMIA, in medicine, the name of a diſeaſe uſually confounded with the ſyncope, but really different from it in many particulars.

The lipothymia is a very conſiderable abolition of the vital and animal faculties, at leaſt to appearance: and the ſyncope is a plenary or total abolition of them, as far as appears to us at the time. It is eaſy to ſee, however, that theſe are only two different ſtages of the ſame diſtemperature. The lipothymy is ſometimes an idiopathic, ſometimes a ſymptomatic diſeaſe, and moſt frequently attends the ſcurvy, malignant fevers, and other diſorders; the ſyncope is idiopathic, and attacks perſons in health as well as thoſe that are diſeaſed. The lipothymy is always eaſily diſtinguiſhed from a convulſed ſtate of the body, by this, that the limbs are all flaccid in it. The ſyncope differs from death only in degree; and the body being flaccid in this, and growing rigid under the laſt convulſions in death, is the only diſtinction of them in extreme caſes.

LIQUOR MINERALIS ANODYNUS, is a name given by Hoffman to a liquor of his invention, famous at this time in Germany, and ſuppoſed by Burggrave to be made in this manner: take oil of vitriol, and Indian nitre, of each four ounces; diſtil the ſpirit gradually from this, by a retort: pour two ounces of the ſpirit cautiouſly and ſucceſſively, into fifteen ounces of ſpirit of wine, highly rectified; diſtil this, and there comes over a very fragrant ſpirit: this is to be again diſtilled, to render it perfectly pure, adding firſt to it a ſmall quantity of oil of cloves, and a quantity of water, equal to that of the ſpirit; after this, as ſoon as the watery vapours begin to riſe, the whole proceſs is to be ſtopped, and the ſpirit kept alone in a bottle, well corked. This has great virtues as an anodyne, diaphoretic, antiſeptic, and carminative. It is not certain that this is the ſame with Hoffman's, that author never having publiſhed his manner of making it; but it appears the ſame to the ſmell and taſte, and has the ſame virtues.

LIQUORICE, *liquoritia glycyrrhiza*, and *radix dulcis*, a ſweet root of conſiderable uſe in medicine.

This plant, deſcribed by all the botanical authors under the name of glycyrrhiza vulgaris, grows to four or five feet high, its ſtalks are hard and woody, its leaves are ſmall and roundiſh; and they ſtand many together on the two ſides of a rib, making what authors call a winged leaf. They are viſcous to the touch; the flowers are of the papilionaceous kind, ſmall, and bluiſh.

The plant is of the diadelphia decandria of Linnæus, and of the herbæ flore papilionaceo ſeu leguminoſæ of Mr. Ray. Liquorice grows wild in many parts of France, Italy, Spain, and Germany. It is cultivated in great abundance in Yorkſhire, and in many other parts of England; and by the good order we keep the ſoil in, produce better roots, longer, evener, and more ſucculent than are to be had from any other part of the world. The reſt of Europe is in great meaſure furniſhed by what grows about Bayonne and Saragoſſa in Spain.

The ground deſigned for liquorice muſt be well dug, and dunged the year before, that the dung may be thoroughly rotted in it; and juſt before it is planted, the earth is to be dug three ſpades deep, and laid very light. The plants to be ſet ſhould be taken from the ſides or heads of the old roots, and each muſt have a very good bud, or eye, or otherwiſe they are ſubject to miſcarry; they ſhould alſo be about ten inches long, and perfectly ſound. The beſt ſeaſon for planting them is the end of February, or the beginning of March, and this muſt be done in the following manner: the rows muſt be marked by a line drawn a-croſs the bed, at two feet diſtance; and the plants muſt be ſet in theſe by making a hole of their full depth, and ſomething more, that the eye of the root may be an inch below the ſurface: they muſt alſo be ſet two feet diſtance from each other in the rows. When this is done, the ground may be ſowed over with onions, which, not rooting deep, will do the liquorice roots no injury for the firſt year. In October, when the ſtalks of the liquorice are dead, a little very rotten dung ſhould be ſpread over the ſurface of the ground. Three years after the time of planting, the liquorice will be fit to take up for uſe; and this ſhould be done juſt when the ſtalks are dead off; for, if taken up ſooner, the roots are very apt to ſhrink greatly in their weight. The roots about London look browner than thoſe which have been propagated in a leſs rich ſoil, but then they are much larger, and grow quicker to their ſize. *Miller's Gard. Dict.*

Liquorice is an excellent medicine in coughs, and all diſorders of the breaſt and lungs. It obtunds the ſharpneſs of acrid and ſalt humours. It is alſo recommended againſt diſorders of the kidneys and bladder, and is ſaid to take off the ſenſe of pain in many terrible complaints. It is an ingredient in almoſt all decoctions and ptiſans, in which it is eſteemed for obtunding acrimony, and for giving the whole a very pleaſant taſte, and drowning the worſt flavour of the other ingredients.

LIQUORICE *Juice*, the inſpiſſated juice of the common liquorice root, and is brought to us in rolls or cakes, covered uſually with bay leaves from Spain and Holland, from the firſt of which places it obtained the name of Spaniſh juice. It is to be choſen firm, but not tough, hard, and when broken, of a fine ſhining ſurface; ſuch as perfectly melts in the mouth, and does not taſte of burning, nor leaves any harſh or gritty particles between the teeth.

The manner of preparing it in Spain is this: they take up the roots in the month of July; they clean them perfectly as ſoon as taken out of the earth, and then hang them up in the air till nearly dry; after this they cut them into thin ſlices, and boil them in water till the decoction is extremely ſtrong; they then preſs it hard out to obtain all the juice they can from the root. They ſet this decoction by to ſettle a little, and when it has depoſited its coarſeſt parts, they pour it off into veſſels, in which they evaporate it over a fire, ſtrong at firſt, but milder afterwards, till it becomes of the conſiſtence of a thick extract; they then let the fire go out, and when the extract is ſo cool that they can handle it, they take out large parcels of it at a time; and working them well in the hands, they roll them out into long cylindric maſſes, which they cut out into ſuch lengths as they pleaſe, and rolling them over a parcel of half dried bay leaves, they pick up enough of them for a covering, which are in that condition laid in the ſun till perfectly dried; there is great nicety required at the end of the evaporation, to get the extract to a proper conſiſtence, without letting it burn. It is this the Spaniards are famous for: a great deal of liquorice juice is made in other places, but it is in a great meaſure either under-boiled, and conſequently ſoft, or is burnt.

Liquorice juice has the ſame virtues with the root it is produced from. It is a very famous remedy among the common people for coughs and all diſorders of the breaſt and lungs. It is commonly taken alone, holding a ſmall piece of it in the mouth till it gradually melts there; but the more agreeable way of taking it is in form of lozenges, of which there are many kinds, which it is the baſis of; in theſe it is mixed with other pectoral ingredients, and has the advantage of melting more eaſily in the mouth than in its own form. It is alſo an ingredient in the theriaca and ſome other of the compoſitions of the ſhops.

LIST, in commerce, the border of cloth, or of a ſtuff; ſerving not only to ſhew their quality, but to preſerve them from being torn in the operations of fulling, dyeing, and the like. See CLOTH, &c.

Liſt is uſed on various occaſions; but chiefly by gardeners, for ſecuring their wall trees.

LIST, in architecture, a little ſquare moulding, other-wiſe

wiſe called a fillet, liſtel, &c. See FILLET and MOULDING.

LISTING, the ſame as heeling, or inclining to one ſide. See HEEL and CAREEN.

LITANY, a ſolemn form of ſupplication to God, in which the prieſt utters ſome things fit to be prayed for, and the people join in their interceſſion.

LITERATI, in general, denotes men of learning; but is more particularly uſed by the Chineſe, for ſuch perſons as are able to read and write their language, which is remarkably difficult.

LITHARGE, a metalline ſubſtance, formed of the ſpume of lead.

The word is Greek, λιθαργυρος, which is formed of λιθος, a ſtone, and αργυρος, ſilver, becauſe it is found in furnaces where ſilver is refined.

This preparation, or, as it may be more properly called, recrement of lead, is of two kinds, differing in colour, though in no other quality: the ancients, as well as moderns, obſerved this difference, and called the one litharge of gold, and the other litharge of ſilver. This recrement of lead is not prepared by a formal proceſs on purpoſe; it is collected from the furnaces where ſilver is ſeparated from lead, or from thoſe where gold and ſilver are purified by means of that metal; but in the furnaces uſed for either of theſe purpoſes, it is generally run into lead again to ſerve for the ſame or other uſes. The litharge ſold in the ſhops is produced in the copper works, where lead has been uſed to purify that metal, or to ſeparate ſilver from it. Of all the various metalline and mineral ſubſtances, which are ſeparated from gold or ſilver, by means of lead, there is none but copper which remains embodied in and intimately joined with that metal after ſcorification; the others being either not at all received into the body of it, or, if they are, being either deſtroyed before ſcorification; or finally, if they remain mixed with it longer, they ſplit and deſtroy the veſſels. The recrement produced from this combination of lead with copper, is our common litharge. It is of a yellower or redder colour, as the fire has been more or leſs ſtrong; and is always compoſed of a multitude of thin flakes, reſembling the ſpangles of talc, in thoſe foſſils called micæ or glimmors.

The greateſt quantities of litharge are brought from Sweden, Germany, and Denmark. Poland furniſhes ſome, as does alſo England, but the Dantzic kind is eſteemed the moſt valuable. The beſt litharge is that which is moſt calcined, and of the livelieſt colour. Litharge on the whole is properly lead vitrified, either alone or with a mixture of copper.

Litharge is ſoluble in oil and all other unctuous ſubſtances, and thus diſſolved, it makes the baſis of a great part of the ointments and plaſters of the ſhops. It is drying, abſtergent, and ſlightly aſtrictive; and hence it is of great uſe in cleanſing ulcers, and diſpoſing them to incarnate.

LITHOCOLLA, a cement uſed by lapidaries for faſtening precious ſtones together. See the article CEMENT.

LITHONTRIPTICS, medicines which either break, or are ſuppoſed to have the virtue of breaking ſtones in the urinary paſſages.

The word is derived from the Greek λιθος, a ſtone, and θρυπτω, to break.

LITHOPHYTA, in botany, a ſubdiviſion of plants, ſo called from their approaching to a ſtony hardneſs, comprehending the iſis, ſpongia, millepora, tubipora, &c.

LITHOSPERMUM, gromwell, in botany, a genus of plants, the corolla of which conſiſts of a ſingle petal of the length of the cup: the tube is cylindric, the limb ſemiquinquifid, obtuſe, and erect: there is no pericarpium, but the cup becomes patulous and long, containing four broad, oval, acuminated, and hard ſeeds.

The ſeeds of this plant, being the only parts uſed in medicine, are accounted diuretic. Emulſions are made of them, with dog's graſs water.

LITHOTOMY, in ſurgery, cutting for the ſtone. See the article STONE.

Mr. Sharp lays down the following method of ſearching for the ſtone. The patient being laid on an horizontal table with his thighs elevated, and a little extended, paſs the ſound, or catheter, with the concave part towards you, till it meets with ſome reſiſtance in the perinæum, a little above the anus; then turning it without much force, puſh it gently on into the bladder, and if it meets with an obſtruction at the neck, raiſe its extremity upwards, by inclining the handle of it towards you; and if it does not then ſlip in, withdraw it a quarter of an inch, and introducing your fore finger into the rectum, lift it up, and it will ſeldom fail to enter. Though, upon ſearching, the ſurgeon may be aſſured of a ſtone in the bladder, yet he is not without farther inquiry to operate immediately; ſince there are ſome obſtacles that forbid the operation, either abſolutely, or only for a certain time. Among theſe, that of the greateſt conſequence is the gravel or ſtone in the kidneys, which is known by the pain in the loins, vomiting, retraction of the teſticles, numbneſs of the thighs, and often by matter which the inflammation produces in the kidneys. Difference of age makes an extreme difference in danger, infants and young people almoſt always recovering; but ſtill the operation is adviſeable in thoſe advanced in years, though it is not attended with near the ſame ſucceſs. Before the operation is performed it is proper to prepare the patient with a gentle purge the preceding day, and a clyſter early in the morning, which will be of great ſervice in cooling the body and making the operation leſs dangerous, where the rectum is liable to be wounded when full.

The moſt convenient time for the operation of lithotomy is ſpring or autumn, though when the patient is in exquiſite torment, or his life in danger, the preſent opportunity ſhould be embraced. Lithotomy is of two kinds: that made into the bladder is termed cyſtotomy; but when the ſtone is in the kidneys, which very rarely happens, the operation is termed nephrotomy.

With reſpect to the ſeveral methods of performing lithotomy for the ſtone in the bladder, they, according to Heiſter, are four: the firſt, and moſt ancient, is the apparatus minor, called likewiſe the Celſian or Guidonian method: the ſecond the apparatus magnus, or Marianus's method; the latter being termed the new, and the former the old method: the third is the apparatus altus, or hypogaſtric ſection, wherein the inciſion is made at the lower part of the abdomen in the anterior ſide of the bladder, immediately above the os pubis; whereas in the reſt it is made in the perinæum, between the anus and the ſcrotum: the fourth, and moſt modern method, was invented towards the end of the laſt century, and is termed the lateral operation.

1. The firſt method is now entirely laid aſide, though Heiſter thinks it practicable on boys under fourteen: the wound of the bladder in this operation, ſays Sharp, is made in the ſame place as is now practiſed in the lateral method; but its being impracticable on ſome ſubjects, and uncertain in all others, has made it to be univerſally exploded.

2. In performing lithotomy by the apparatus major, Mr. Sharp's directions for the ſituation of the patient are thus. Having laid the patient on a ſquare horizontal table, three feet four inches high, with a pillow under his head, let his legs and thighs be bent, and his heels made to approach his buttocks by tying his hands to the ſoles of his feet with a couple of ſtrong ligatures; and to ſecure him more effectually from ſtruggling, paſs a double ligature under one of his hams, and carry the four ſtrings round his neck to the other ham: then paſſing the loop underneath, make a knot by threading one of the ſingle ends through the loop; and thus the thighs are to be widened from each other, and firmly ſupported by proper perſons.

The patient thus ſituated, Heiſter directs the operation as follows: the operator, dipping the beak of a ſizeable and grooved ſteel catheter in oil, conveys it through the urethra into the bladder, and being aſſured there is a ſtone, turns the crooked part of the catheter in the bladder and urethra towards the left ſide of the perinæum, but the handle and penis which contains it, towards the right inguen, then delivers it to the aſſiſtant, who holds up the ſcrotum in the other hand; for the crooked convex part of the catheter thus elevated in the perinæum, renders that part of the urethra which is to be divided, ſufficiently

ficiently perceptible both to the ſight and touch. He next lays hold of the integuments of the perinæum with the fingers of his left hand, holding in his right the inciſion-knife, wrapped in linnen, as he would do a pen for writing: with this he makes a longitudinal incision downwards, about the middle of the left ſide of the perinæum near the ſuture, through the fat; then he again feels for the catheter, and afterwards divides the urethra in a direct line downwards, ſo that the end of the knife may paſs into the groove of the catheter. After a proper inciſion, the ſurgeon parts with his knife, inſerting in the groove of the catheter, if an aſſiſtant holds it, the nail of his finger or thumb: then he takes a male conductor, dips it in warm oil, and having paſſed it through the groove of the catheter and neck of the bladder into the bladder itſelf, extracts the catheter.

The male conductor being thus paſſed, a female conductor is introduced upon it, in ſuch a manner as the latter receives the prominent back of the former in its groove, and conveys it ſafely into the bladder through its neck. After this the two conductors are gently ſeparated by their handles, and then a ſtraight forceps, dipt in oil and ſhut very cloſe, is carefully conveyed into the bladder between the conductors. The forceps, after it is introduced, and the conductors withdrawn, muſt be opened ſeveral times to dilate the wound, and then ſhut to ſearch for the ſtone: when the ſtone is found, they muſt be opened with both hands, in ſuch a manner that one jaw, if poſſible, may lay hold under the ſtone, and the other above it. When the ſtone is thus intercepted, the forceps, by a gentle motion from ſide to ſide, muſt be brought towards the rectum, and the ſtone extracted downwards, becauſe the parts dilate and yield more eaſily that way, while upwards they meet with a reſiſtence from the os pubis: but if it lies concealed in any part of the bladder, and cannot be laid hold of by the forceps, the operator muſt paſs the two firſt fingers of his left hand into the anus, elevate the ſtone, and force it into them. If it is ſituated in the upper part of the bladder, behind the oſſa pubis, the inferior part of the abdomen muſt be preſſed downwards by the hand, that it may commodiouſly be taken hold of, and drawn out by the ſtraight or a crooked forceps; and if it is lodged on either ſide, the crooked inſtrument is moſt convenient.

When the ſtone is too large to be extracted whole, it muſt be broken by a forceps with teeth, and the fragments to be drawn out one after another. Laſtly, if the ſtone is too large and too hard to be either extracted or broken, a prudent ſurgeon will deſiſt, and heal the wound, or leave a fiſtula for the diſcharge of the urine. The ſtone being thus extracted, and the bladder cleared, the wound is cleanſed with a ſponge, the ligatures untied, the patient put to bed, and the wound now dreſſed with doſſils of ſcraped lint: if the hæmorrhage be too profuſe, it may be ſtopped by pledgets of lint dipt in a proper ſtyptic, and the arteries compreſſed with the fingers till it ſtops.

Theſe muſt be covered with a linnen-bolſter, and a large ſquare compreſs without a plaſter, ſecuring the whole with the T bandage, or that with four heads; and if they are ineffectual, the artery muſt be tied up with a crooked needle and thread. See the article HÆMORRHAGE.

After dreſſing, the patient muſt be ſupplied with plenty of ptiſan, barley-water, or a ſtrengthening and compoſing emulſion; his diet ſhould be the ſame as for people in fevers, or after great wounds. See the articles FEVER and WOUND.

3. The apparatus altus, or high operation, is performed as follows. The patient being duly prepared, and laid in a proper ſituation, a hollow ſilver catheter, with a flexible leathern tube at the end of it, is to be introduced into the bladder: to the tube muſt be fitted a large ſyringe, for the injecting of ſuch warm water, barley-water, or milk, as the patient can bear. When this is done, the catheter is extracted: then while an aſſiſtant introduces his two fore-fingers into the anus to elevate the ſtone and bladder, the operator makes an inciſion in a right line through the ſkin, fat, and abdominal muſcles, immediately above the oſſa pubis. The external wound ſhould be three fingers-breadth long in children, and four in adults; then introducing the left index, the ſurgeon feels for the liquor that diſtends the bladder, and then makes an inciſion into the bladder immediately above the junCture of the oſſa pubis: after which he paſſes a ſmall knife into the body of the bladder, ſo as to make a ſmall wound with the point only; through this aperture he paſſes a crooked or ſtraight knife, armed with a button, whereby he enlarges the wound upwards the breadth of one or two fingers. He then introduces his left index to draw the upper part of the bladder towards the navel, and then enlarges the wound downwards. Immediately after, he introduces the fore-finger of the other hand, and examines the ſize and ſituation of the ſtone, and accordingly he enlarges the wound either upwards or downwards, in order to extract it. And when the ſtone is extracted, and nothing left, the wound is dreſſed, and the patient treated much in the ſame manner as in the former caſe.

4. The fourth method, which is called the lateral operation, was performed by Cheſelden thus: every thing being properly prepared, he introduces a catheter, and afterwards makes an inciſion of a proper length, beginning where they end in the apparatus major, and continuing it downwards between the accelerator urinæ, and erector penis, on the left ſide of the inteſtinum rectum; and directing his knife to the poſterior part of the catheter, through the inferior and lateral part of the bladder, behind the proſtate gland, and above the ſeminal veſicles, he then continues it forwards through the ſphincter of the bladder, and left ſide of the proſtate glands into the membranous part of the urethra even to its bulb, which preſerves the rectum better than the lateral method.

Among Cheſelden's emendations, Douglas enumerates theſe. 1. If he finds the patient's pulſe low after the operation, he applies bliſters to the arms, which effectually raiſe his ſpirits. 2. If the wound grows callous, he lays on a piece of bliſter plaſter to erode it, by which new fleſh pullulates, and the wound unites. 3. If the wound be putrid, he mixes a little verdigreaſe with ſome digeſtive ointment.

Women are leſs ſubject to the ſtone in the bladder than men, and their urinary paſſages are more ſhort and lax, ſo that in general the ſtone being but ſmall, diſcharges itſelf with the urine, and when it happens to increaſe in the bladder, we have inſtances of its coming away ſpontaneouſly. Douglas propoſes to extract a ſmall ſtone in a woman, by dilating the urethra with a tent of gentian-root, or prepared ſponge; but when the ſtone is large, he approves of the high operation, diſtending the bladder with warm water, and compreſſing the urethra by an aſſiſtant's finger in the vagina, and then making an inciſion into the bladder immediately above the os pubis. This, Heiſter ſays, is a very proper method, when the ſtone is very large, and the patient young and healthy; but Morand, when the ſtone is ſmall, prefers the apparatus major.

Upon the whole, lithotomy appears to be a dangerous and precarious operation, nor can one method alone be depended on; but the ſurgeon muſt be determined in the choice, by the particular circumſtances of the caſe.

Nephrotomy, the ſecond ſpecies of lithotomy, is by moſt writers on the ſubject thought impracticable, who therefore abſolutely reject it; though we have many inſtances of perſons, who have been cured of wounds of the back penetrating to the kidneys. Heiſter mentions one cure of this kind performed by himſelf. Wounds, therefore, of the kidneys, eſpecially thoſe inflicted on the back, without penetrating into the cavity of the abdomen, he ſays, are often curable. And though Hippocrates prohibits his pupils from practiſing lithotomy, yet treating of diſorders in the kidneys, in his work, *De Intern. Affect.* he directs to make an inciſion near the kidney when it is tumified and elevated, and after extracting the pus, to diſcharge the gravel by diuretics; for this opening may preſerve the patient, who muſt otherwiſe die: and again, he ſays, when the kidney, being ſuppurated, tumifies near the ſpine, a deep inciſion ſhould be made upon the tumor near the kidney, or into the kidney itſelf. Hence it is manifeſt, that a wound in theſe parts did not appear ſo formidable to him. Rouſet, Rioſanus, and others, think nephrotomy may be practiſed with

with ſucceſs, if the opening is made where the ſtone is perceptible, and neither the emulgent artery, vein, nor ureter, wounded, nor the cavity of the abdomen penetrated. But beyond all diſpute it muſt be reaſonable, when nature points out the place by a tumor or abſceſs in the loins, preceding from a ſtone in the kidneys.

LITURGY, λειτυργια, a name given to thoſe ſet forms of prayer which have been generally uſed in the Chriſtian church. Of theſe there are not a few aſcribed to the Apoſtles and fathers, but they are almoſt univerſally allowed to be ſpurious.

The liturgy of the church of England was compoſed in the year 1547, ſince which time it has undergone ſeveral alterations, the laſt of which was in the year 1661, and of this liturgy Dr. Comber gives the following character. "No church was ever bleſſed with ſo comprehenſive, ſo exact, and ſo inoffenſive a liturgy as ours; which is ſo judiciouſly contrived, that the whole may exerciſe at once their knowledge and devotion; and yet ſo plain, that the moſt ignorant may pray with underſtanding; ſo full, that nothing is omitted, which ought to be aſked in public; and ſo particular, that it compriſeth moſt things which we would aſk in private; and yet ſo ſhort, as not to tire any that have true devotion. Its doctrine is pure and primitive; its ceremonies ſo few and innocent, that moſt of the Chriſtian world agree in them: its method is exact and natural, its language ſignificant and perſpicuous, moſt of the words and phraſes being taken out of the holy Scripture, and the reſt are the expreſſions of the firſt and pureſt ages."—And in the opinion of the moſt impartial and excellent Grotius, (who was no member of, nor had any obligation to, this church) "the Engliſh liturgy comes ſo near the primitive pattern, that none of the reformed churches can compare with it." Again, he ſays, "In the prayers, a ſcholar can diſcern cloſe logic, pleaſing rhetoric, pure divinity, and the very marrow of the ancient doctrine and diſcipline; and yet all made ſo familiar, that the unlearned may ſafely ſay, Amen."

LITUUS, in Roman antiquity, a ſhort ſtraight rod, only bending a little at one end, uſed by the augurs. See AUGUR.

LIVER, *Hepar*, in anatomy, a large and pretty ſolid maſs of a dark red colour, a little inclined to yellow, ſituated immediately under the arch of the diaphragm, partly in the right hypochondrium, which it fills almoſt entirely, and partly in the epigaſtrium, between the appendix enſiformis and ſpina dorſi, and terminating commonly in the left hypochondrium, into which it ſometimes runs a conſiderable way. The figure of the liver is irregular, it being arched or convex on the upper part, unequally concave on the lower, and very thick on the right and back-ſides. Towards the left and anterior ſides, its thickneſs decreaſes very much, and terminates then by a kind of edge; and its breadth is more extended from right to left, than from before backwards. The liver may be divided into two extremities, one great, the other ſmall; two edges, one anterior, the other poſterior; two ſides, one ſuperior and convex, which is ſmooth and poliſhed, and proportioned to the arch of the diaphragm; and one inferior, concave and uneven, with ſeveral eminences and depreſſions. It may likewiſe be divided into two lateral parts called lobes; one of which is termed the great or right lobe, the other the ſmall or left lobe. Theſe two lobes are diſtinguiſhed above by a membranous ligament, and below very plainly by a conſiderable ſciſſure lying in the ſame direction with the ſuperior ligament. The eminences on the concave ſide of the liver belong to the great lobe. The principal eminence is a ſort of triangular or pyramidal apophyſis ſituated backward, near the great ſciſſure, which diſtinguiſhes the two lobes. This triangular eminence is termed lobulus Spigelii, or, ſimply, the ſmall lobe of the liver. One of its angles advances a conſiderable way toward the middle of the lower ſide of the great lobe, and is loſt there. This angle is called the root of the lobulus. Toward the fore-ſide there is another eminence leſs prominent but broader; and to this eminence and the former the ancients gave the name of portæ. The depreſſions on the concave or lower ſide of the liver, which deſerve our attention, are four in number. The firſt is the ſciſſure which ſeparates the two lobes, which run acroſs the concave ſide, from the eminences already mentioned, to the anterior edge, where it terminates by a notch of different depths, in different ſubjects. This is termed the great ſciſſure of the liver; and in ſome ſubjects, part of it is an entire tube. The ſecond depreſſion is ſituated tranſverſely between the two eminences of the great lobe, and filled by the ſinus of the vena portæ, ſo called by the ancients, becauſe it lies between the eminences of the ſame name. The third depreſſion is backward, between the great lobe and lobulus Spigelii; and the vena cava paſſes through it. The fourth is a kind of ſulcus, between the lobulus and ſmall lobe of the liver; which, in the fœtus, ſerves to receive a venous canal loſt in adults, in which it appears only as a kind of ligament. This ſulcus is in ſome meaſure a continuation of the great ſciſſure, and joins the vena cava by an acute angle. Beſides theſe four depreſſions, there is one on the fore-part of the great lobe, in which the gall-bladder is lodged, and it ſometimes runs as far as the edge, where it forms a ſmall notch. We may likewiſe reckon, among theſe depreſſions, a ſmall cavity in the poſterior and lateral part of the lower-ſide of the great lobe, by which it reſts on the right kidney; and likewiſe a ſuperficial cavity in the left lobe, where it runs over the ſtomach. Laſtly, on the poſterior edge of the liver, there is a great ſinus common to both lobes, which gives paſſage to the ſpina dorſi and œſophagus, near the place where the vena cava deſcends; and we ſometimes meet with ſciſſures on both ſides of the liver, which are not ordinary.

The convex ſide of the liver is commonly connected to the diaphragm by three ligaments, which are only continuations of the membranous lamina of the peritonæum. One lies near the edge of the extremity of each lobe, and one in the middle; and they are accordingly termed right, middle, and left ligaments. There is a cellular ſubſtance in the duplicature of each, in which the blood-veſſels and lymphatics run, and which ſends off a kind of lamina into the ſubſtance of the liver. The right ligament ſometimes connects the great lobe to the cartilages of the falſe ribs; and the left ligament or that of the ſmall lobe is often double, and advances toward the middle ligament. This middle ligament begins below the great ſciſſure of the liver, near the eminences called portæ; and from thence paſſes through the anterior notch, and over the convex ſide of the liver, as the union of the two lobes, and is fixed obliquely in the diaphragm. It is likewiſe fixed along the upper and inner part of the vagina of the right muſculus rectus of the abdomen, in ſuch an oblique manner, as to be nearer the linea alba below than above. Beſides theſe ligaments, the great lobe of the liver is likewiſe connected to the right ala of the tendinous portion of the diaphragm, not by a ligament, but by a broad and immediate adheſion, without the intervention of the membrane of the peritonæum, which is only folded quite round this adheſion, and to form this external membrane of all the reſt of the body of the liver. This broad adheſion is commonly, though improperly called ligamentum coronarium; but in the firſt place it is not a ligament, as has been already obſerved; and ſecondly, it is not circular, but oval and very oblong: it is not in the upper part of the convex ſide of the liver, but along the poſterior part of the great lobe; the broad extremity of the adheſion lying near the notch, and the pointed extremity towards the right hypochondrium. The middle ligament, called improperly ligamentum hepatis ſuſpenſorum, contains in its duplicature a thick white rope, like a round ligament, which was the umbilical vein in the fœtus. Thus the lower part repreſents a flag, the convex edge of which is ſharp, and the other rounded: all theſe ligaments ſerve to keep the liver in its proper ſituation, and to hinder it from inclining too much towards either ſide: but we muſt not imagine that any of them ſerve to ſuſpend it, becauſe it is ſufficiently ſupported by the ſtomach and inteſtines, eſpecially when they are filled. When the ſtomach is empty, or when we faſt longer than ordinary, it is a common expreſſion to ſay, the ſtomach pinches us. As the liver is not then ſuſtained by the ſtomach and inteſtines, it deſcends by its own weight, and, principally by means of the middle ligament, pulls the diaphragm along with it. It is in that place therefore, that we have this uneaſy ſenſation, and not at the ſuper-

rior orifice of the ſtomach, as is commonly believed. The right or great lobe of the liver, which lies in the right hypochondrium, reſts on the right kidney, by a ſmall ſuperficial depreſſion above mentioned; and it likewiſe covers a portion of the colon, and the pylorus. About $\frac{2}{3}$ of the ſmall or left lobe lie in the middle of the epigaſtrium, and the remaining third part advances over the ſtomach, towards the left hypochondrium: this ſmall lobe is ſituated almoſt horizontally; the great lobe is very much inclined, and its thick extremity runs down almoſt in a perpendicular direction to the right kidney, on which it lies in the manner already ſaid. This obſervation is of uſe to diſtinguiſh the different parts of the liver, in wounds and chirurgical operations. It may likewiſe ſerve to direct us in examining a liver taken out of the body; the ſituation of which may be otherwiſe very eaſily miſtaken, eſpecially that of the parts of the concave ſide. The paſſage of the vena cava, between the body of the great lobe and the lobulus Spigelii, may likewiſe ſerve for a rule, in placing a detached liver in its true ſituation.

The liver is compoſed of ſeveral kinds of veſſels, the ramifications of which are multiplied in an aſtoniſhing manner and form, by the intertexture of their capillary extremities, an innumerable collection of ſmall, pulpy, friable corpuſcles, which are looked upon to be ſo many organs deſigned to ſeparate from the maſs of blood a particular fluid termed the bile. See the article BILE.

The greateſt part of theſe veſſels, from one end to the other, is included in a membranous vagina called capſula venæ portæ, or capſula Gliſſoni, from an Engliſh author who has deſcribed it particularly. The veſſel which carries the blood to the liver, is called the vena portæ, for the reaſon already given. In the deſcription of the veins it is obſerved, that the vena portæ might be conſidered as two large veins, the trunks of which are joined endwiſe, and ſend out branches and ramifications in oppoſite directions to each other; that one of theſe veins is ramified in the liver, the other lying without the liver, and ſending its branches and ramifications to the viſcera of the abdomen; and laſtly, that the firſt of theſe large veins may be termed vena portæ hepatica, the other vena portæ ventralis.

The particular trunk of the vena portæ hepatica is ſituated tranſverſely between the broad anterior eminence of the great lobe of the liver, and the root of the lobulus, in a particular ſciſſure, and forms what is called the ſinus of the vena portæ. From this ſinus five principal branches go out, which are afterwards divided into millions of ramifications, though the whole ſubſtance of the liver. At this place the vena portæ lays down the common office of a vein, and becomes a kind of artery, as it enters, and is again ramified in the liver. The extremities of all theſe ramifications of the trunk of the vena portæ hepatica end in the pulpy friable corpuſcles, which ſeen to be thick, villous folliculi, when examined through a microſcope in clear water.

It is in theſe folliculi that the bile is ſecreted, and it is immediately collected in the ſame number of extremities of another kind of veſſels, which unite by numerous ramifications into one common trunk. Theſe ramifications are termed pori biliarii, and the trunk ductus hepaticus; and the ramifications of theſe two kinds of veſſels are inveſted together by the capſula of the vena portæ.

The blood, deprived of this bilious fluid, is reconveyed to the heart, by a great number of venous ramifications, which afterwards unite into three principal branches, beſides others which are leſs conſiderable, that terminate in the vena cava, and are called by the name of venæ hepaticæ: the capillary extremities of the ramifications of the vena cava join thoſe of the vena portæ, and accompany them through the liver; and yet the great branches of both veins interſect each other in ſeveral places. When we cut the liver in ſlices, it is eaſy to diſtinguiſh, in each ſlice, the ramifications of the vena cava from thoſe of the vena portæ, the firſt being thinneſt and largeſt, and adhering cloſeſt to the ſubſtance of the liver; whereas thoſe of the vena portæ, which are inveſted by the cellular capſula, appear to be a little rumpled, when empty, becauſe the cellular capſula ſubſides, when it is cut; but the other veins remain uniformly open, their ſides adhering to the ſubſtance of the liver.

The liver receives from the cœliac artery a particular branch termed arteria hepatica, which being very ſmall, when compared with the bulk of that bowel, ſeems deſigned only for the nouriſhment thereof, and not for the ſecretion of the bile. The plexus hepaticus, formed by the nervi ſympathetici maximi and medii, furniſhes a great number of nerves to the ſubſtance of the liver. The ramifications of the artery, and nervous plexus, are included in the cellular capſula, together with thoſe of the vena portæ and pori biliarii: the pulſation of this artery has been, by ſome anatomiſts, taken for that of the capſula; and by this, they have endeavoured to explain the arterial function of the vena portæ: but they have not conſidered that the blood in this vein does not require to be pumped forward; becauſe ſo ſwift a motion would have been prejudicial to the ſecretion of the fine oil of the bile; for which a ſlow and almoſt an inſenſible motion is neceſſary. The liver is covered exteriorly by a particular membrane or coat, which is a continuation of the peritonæum: there is likewiſe a membranous or filamentary ſubſtance, which runs through the whole bowel, and connects the ramifications and extremities of all its veſſels to each other: this ſubſtance ſeems to be a complicated production of the capſula of the vena portæ, and of the external membrane of the liver. The outer ſurface of this coat is very ſmooth; but its inner ſurface is uneven, being made up of a great number of thin membranous laminæ, between which we obſerve, very diſtinctly, numerous lymphatic veſſels on both the convex and concave ſides of the liver; but it is more difficult to trace thoſe which accompany the filamentary ſubſtance through the bowel. We have already obſerved that the ſubſtance of the liver is principally made up of pulpy friable corpuſcles, each of which is bounded, and in a manner ſurrounded, by a particular expanſion of the capſula Gliſſoni; and all theſe expanſions are connected by common ſepta, in ſome meaſure reſembling a honey-comb: theſe corpuſcles have ſeveral angles eſpecially in the inner ſurface of the liver; but near the ſurface they are raiſed in the form of ſmall tubercles: their pulpy texture ſeems like radiated tufts, a ſmall void ſpace being left in the middle of each. If we blow through a pipe into the vena portæ, vena cava, arteria hepatica, or trunk of the pori biliarii, but eſpecially through the two veins, we obſerve the liver to ſwell, and the corpuſcles, near the ſurface, are raiſed and become more ſenſible: if blown with much force, theſe corpuſcles will burſt, and the air getting between them and the external membrane, raiſes it from the ſubſtance of the liver, in bliſters.

The ductus hepaticus or trunk of the pori biliarii, having run a little way, joins another canal, called ductus cyſticus or veſicularis, becauſe it comes from the veſicula felli: theſe two united trunks form a common trunk, named ductus communis choledochus, becauſe it conveys the bile: this duct, having reached the incurvation of the duodenum, inſinuates itſelf through the coats of that inteſtine, and opens into the cavity thereof, not by a round papilla, but by an oblong orifice, rounded at the upper part and contracted at the lower like the ſpout of an ewer, or like a common tooth-picker: the edges of this orifice are raiſed, broad, and plaited; as may be ſeen by making this portion of the duodenum ſwim in clear water: at the entry of this orifice, we may ſee another ſmaller opening, diſtinct from it, which is the orifice of the ductus pancreaticus.

Plate LXXX. *fig.* 4. exhibits the liver freed from its parenchyma.

Fig. 5. repreſents the flat part of the liver, together with the moſt conſpicuous veſſels in it, A being that part of the liver which lies next to the back; B, its right ſide; C, its anterior edge. D, its left ſide; E, the vena cava, where it paſſes through the diaphragm; E E 2, E 3, its three principal branches diſtributed almoſt through the whole liver; F, the vena portæ turned upwards, that other veſſels may be more eaſily ſeen; F F 2, F 3, F 4, four branches of the vena portæ diſtributed to ſeveral quarters of the flat part of the liver, but the fifth branch is not obſerved on this ſide; G, the gall bladder; H, H, the vena umbilicalis become a ligament; I, the ductus communis choledochus; K, the canalis venoſus, now performing the office of a ligament;

the trunk of the vena cava deſcendens; *a*, a ſmall portion of the membrane inveſting the liver; *b*, that part of the diaphragm which ſurrounds the vena cava; *c*, the biliary duct; *d*, the cyſtic duct; *e*, the place where theſe veſſels meet; *f*, the hepatic artery; *o*, *o*, the hepatic nerves, *p*, *p*, *p*, *p*, the common capſula laid open; *q*, *q*, the lymphæducts; *m*, *m*, *m*, &c. the ſmaller branches of the vena portæ; *n*, *n*, *n*, &c. the ſmall branches of the vena cava.

Fig. 6. repreſents the convex part of the liver, together with the veſſels ſituated in it. A, the ſuperior part of the liver which lies next to the back. B, its right part. C, its lower interior part. D, the left part of the liver. E, the trunk of the vena cava above the diaphragm. F, the ſinus of the vena portæ. F 1, F 2, F 3, F 4, four branches of the venæ diſtributed in four different directions through the liver. F 5, the fifth branch of the vena portæ, which could not be deſcribed in the preceding figure. G, the gall-bladder. H, H. the umbilical vein. I, the ductus communis choledochus. *a*, *a*, *a*, *a*, the ſmall ramifications of the fifth branch of the vena portæ cut off, that the other veſſels may be the more diſtinctly ſeen. *b*, that portion of the diaphragm where it is joined to the vena cava. *c*, the biliary duct. *d*, *d*, the cyſtic duct. *e*, the angle where thoſe veſſels are joined. *m*, *m*, *m*, &c. the ſmaller branches of the vena portæ. *n*, *n*, *n*, &c. the ſmaller branches of the vena cava.

Fig. 7. A, the convex part of the liver. B, its right part. C, the concave part of the liver. D, its left part. E, the trunk of the vena portæ turned upwards, that the other veſſels may be the more eaſily ſeen. 1, 2, 3, 4, 5, the five larger branches of the vena portæ. F, the ductus communis choledochus. G, the biliary duct and its firſt diviſion. H, the cyſtic duct. I, the gall-bladder. *a*, *a*, *a*, *a*, &c. the common capſula laid open. *b*, *b*, *b*, *b*, *b*, the ſubdiviſions of the biliary duct.

LIVERY *of Seiſin*, in law, ſignifies delivering the poſſeſſion of lands, &c. to him who has a right to them.

LIVERYMEN, of London, are a number of men choſen from among the freemen of each company. Out of this body the common council, ſheriff, and other ſuperior officers for the government of the city are elected, and they alone have the privilege of giving their votes for members of parliament; from which the reſt of the citizens are excluded.

LIVES, or *Inſurance of* LIVES. See the article INSURANCE and INTEREST.

LIVRE, a French money of account, containing twenty ſols.

LIXIVIOUS, *Lixiviate*, in chemiſtry, ſuch ſalts as are extracted from the aſhes of burnt vegetables by means of lotion.

LIXIVIUM, a ley, or water impregnated with the ſalts of burnt vegetables.

What is left after the evaporation of ſuch a liquor is called a lixivious ſalt.

Lixiviums are of great uſe in medicine, bleaching, ſugar-works, &c.

LIZARD, *Lacerta*, in zoology, a genus of amphibious animals, the body of which is oblong and rounded, the legs four, and the hinder part terminated by a tapering tail.

LOACH, the Engliſh name of a fiſh, called by Artedi, the ſmooth ſpotted cobitis, with a cylindrical body.

LOAD, among miners, denotes a vein of ore. See MINE.

It is alſo uſed for nine diſhes of ore. See the article DISH.

LOADSTONE, the ſame with magnet. See MAGNET.

LOAMS, in natural hiſtory, are defined to be earths, compoſed of diſſimilar particles, hard, ſtiff, denſe, and hard and rough to the touch; not eaſily ductile while moiſt, readily diffuſible in water, and compoſed of ſand, and a tough viſcid clay. Of theſe loams, ſome are whitiſh, and others brown or yellow.

LOBE, in anatomy, denotes each of the two parts of which the lungs conſiſt. See LUNGS.

It is alſo applied to the diviſions of the liver. The word is derived from the Greek λοβὸς, the extremity of a thing.

LOCAL, in law, ſomething fixed to the freehold, or tied to a certain place: thus real actions are local, ſince they muſt be brought in the country where they lie; and local cuſtoms are thoſe peculiar to certain countries and places.

LOCAL PROBLEM, among mathematicians, ſuch a one as is capable of an infinite number of different ſolutions, by reaſon that the point which is to reſolve the problem may be indifferently taken within a certain extent, as ſuppoſe any where, within ſuch a line, within ſuch a plane figure, &c. which is called a geometric locus, and the problem is ſaid to be a local or indetermined one. See LOCUS.

LOCHIA, in phyſic, the purgations of the uterus after child-birth. Theſe conſiſt, generally, for the two firſt days, of a kind of bloody ſerolity, and gradually become more white, viſcous, and leſs in quantity; which, during the whole time, cannot be determined, ſome women having more, others leſs: nor can the duration of the flux be limited to any particular time.

The lochia ſometimes flow in too large quantities, either on account of ſomething retained in the uterus, which prevents it from contracting duly; or a too great fluidity or agitation of the blood. If it proceed from a retention of ſomething in the uterus, this muſt, if poſſible, be taken away by the hand. But if it proceed from a too great fluidity or agitation of the blood, temperating decoctions of barley, jellies, emulſions, opiates, and aſtringents, are to be adminiſtered.

But when a deficiency in the lochia, or their utter ſuppreſſion, happens, all poſſible means ſhould be uſed to procure this ſalutary diſcharge. For this purpoſe mild anti-acids, diluters, and aperients, are to be exhibited. But great ſtreſs is to be laid on aperient and relaxing topics, clyſters, fomentations, plaſters, liniments, cupping on the inferior parts, peſſaries and ſuppoſitories.

Boerhaave adviſes not to let blood in the above-mentioned diſorders, without the utmoſt neceſſity.

LOCK, a well known inſtrument for ſecuring doors, cheſts, &c. and only to be opened by a key. See the article KEY.

LOCUS GEOMETRICUS, in geometry, denotes a line, by any point of which a local or indeterminate problem is ſolved.

If a right line ſuffice for the conſtruction of the equation, it is called locus ad rectam; if a circle, locus ad circulum; and theſe were called plain loci: if a parabola, hyperbola, locus ad parabolam, hyperbolam, &c. And thoſe were called ſolid loci.

Wolfius and the moderns more commodiouſly divide loci into orders, according to the number of dimenſions to which the indeterminate quantities riſe.

When in an equation there are two undetermined quantities *x* and *y*, then for each particular value of *x* there may be as many valves of *y* as it has dimenſions in that equation. So that if A P, a part of the indefinite line A E, repreſent *x*, and the perpendiculars P M (plate LXXXI. *fig.* 3.) repreſent the correſponding values of *y*, then there will be as many points M, the extremities of theſe perpendiculars or ordinates, as there are dimenſions of *y* in the equation. And the values of P M will be the roots of the equation ariſing by ſubſtituting for *x* its particular value A P in any caſe.

From whence it appears, how when an equation is given you may determine as many of the points M as you pleaſe, and draw the line that ſhall paſs through all theſe points; which is called the locus of the equation.

When any equation involving two unknown quantities, *x* and *y*, is propoſed, then ſubſtituting for *x* any particular value A P, if the equation that ariſes has all its roots poſitive, the points M will lie on one ſide of A E; but if any of them are found negative, then theſe are to be ſet off on the other ſide of A E towards *m*.

If for *x*, which is ſuppoſed undetermined, you ſubſtitute a negative quantity, as A *p*, then you will find the points M, *m*, are taken in, that it may ſhew all the values of *y* correſponding to all the poſſible values of *x*.

If, in any caſe, one of the values of *y* vaniſh, then the

point M coincides with P, and the locus meets with A E in that point.

If one of the values of y becomes infinite, then it ſhews that the curve has an infinite arch: and in that caſe the line P M becomes an aſymptote to the curve, or touches it at an infinite diſtance, if A P is itſelf finite.

If, when x is ſuppoſed infinitely great, a value of y vaniſh, then the curve approaches to A E produced as an aſymptote. If any values of y become impoſſible, then ſo many points M vaniſh.

From what has been ſaid it appears, that when an equation is propoſed involving two undetermined quantities, x and y, there may be as many interſections of the curve, that is the locus of the equation, and of the line P M, as there are dimenſions of y in the equation; and as many interſections of the curve and the line A E as there are dimenſions of x in the equation.

LOCUST, *Locuſta*, a genus of inſects, comprehending the locuſt, ſimply ſo called, the ſeveral ſpecies of other locuſts and graſhoppers, with the crickets of the houſe and field.

Willughby obſerves, that in theſe animals there are always more males than females, which is contrary to the order of nature in other inſects, where the females are much the moſt numerous; and Swammerdam obſerves, that it is only the males that make a noiſe, which he ſays they do by a ſwift vibration of their wings, either againſt one another, or againſt their legs.

The nympha, or worm of the locuſt, ſcarce at all differs from the creature in its perfect ſtate. It moves and eats in the nymph ſtate, and all the viſible difference is, that the wings are not expanded as in the perfect locuſt, but are gathered up in a ſmall compaſs, and form four little buttons on the ſhoulders. Swammerdam obſerves, that the want of attention to this particular, in former writers, had been the occaſion of a very unneceſſary multiplication of names; as Aldrovand, Johnſon, Mouffet, and others, have deſcribed theſe locuſts in the nymph ſtate under the names of bruchi, attebali, and aſelli, ſuppoſing them to be ſo many diſtinct ſpecies of animals. It is obſerved, that towards the end of ſummer the males are very tender of the females, three or four of them being frequently ſeen gathered about one of that ſex, and ſeeming to do her all the kind offices in their power, fluttering about with their wings, and rubbing her with their fore legs. The males are always more briſk and nimble than the females; and, amongſt all the kinds of locuſts, there are a great many naturally imperfect; particularly, many have only one hinder leg, yet theſe hop almoſt as well as the reſt.

The country of the Coſſacks or Ukrain is, in dry ſummers, much infeſted with ſwarms of locuſts driven thither by an eaſt or ſouth-eaſt wind. The number of theſe inſects is ſo great, that they darken the air, and devour all the corn of the country. They lay their eggs in autumn, and then die. It is ſaid that each of theſe creatures lays two or three hundred eggs, which hatching the enſuing ſpring, produce ſuch a number of locuſts, that they do far more miſchief than before, unleſs the rains fall, which kill both the eggs and the inſects, or unleſs a ſtrong north or north-weſt wind ariſes, which drives all into the Euxine ſea. The hogs of the country are fond of theſe eggs, and devour great quantities of them. In the night, when theſe inſects reſt on the ground, they cover it to the height of three or four inches. If a wheel paſſes over them, they emit an intolerable ſtench. *Phil. Tranſ.* N°. 8.

Water LOCUST, *Locuſta Aquatica*, the name given by authors to a ſpecies of water inſect, ſomewhat reſembling the locuſt kind in ſhape. It is about three inches long, its tail an inch and a quarter, and its legs are of different lengths; the anterior pair being ſhorteſt of all. Its body is ſlender, and its fore legs are always carried ſtraight forward, ſo as to reach beyond the head in the form of antennæ. Theſe, as well as the other legs, end each in two claws. The eyes are ſmall and not very prominent, and the upper wings are cruſtaceous, the under ones membranaceous, thin, and tranſparent. The middle joint of the leg is ſuch, that the creature can only move them upwards, not downwards; and there runs an acute tongue or proboſcis under the belly, as is the caſe of the water ſcorpion and notonecta. *Ray's Hiſt. Inſects.*

LOCUSTÆ, in botany, the tender extremities of the branches of trees, ſuch as, it is ſuppoſed, St. John Baptiſt fed on in the wilderneſs.

LODGMENT, in military affairs, is a work raiſed with earth, gabions, faſcines, wool-packs, or mantelets, to cover the beſiegers from the enemy's fire, and to prevent their loſing a place which they have gained, and are reſolved, if poſſible, to keep. For this purpoſe, when a lodgment is to be made on the glacis, covert-way, or in a breach, there muſt be great proviſion made of faſcines, ſand-bags, &c. in the trenches; and during the action, the pioneers with faſcines, ſand-bags, &c. ſhould be making the lodgment, in order to form a covering in as advantageous a manner as poſſible from the oppoſite baſtion, or the place moſt to be feared.

LOG, in naval affairs, a ſmall triangular piece of board uſed on board a ſhip; into one end of which a convenient quantity of lead is caſt, to make it ſwim upright, the other end being faſtened to the log-line.

LOG-LINE, a line faſtened to one end of the log, and wound upon a reel.

This line is generally divided into certain ſpaces, which are, or ought at leaſt to be, ſuch a proportional part of a nautical mile, ſixty of which make a degree of a great circle, as half a minute, the time allowed for the experiment, is of an hour. Now a common nautical or ſea mile, according to an experiment made by Mr. Richard Norwood, and with which the French nearly agree, is=6120 Engliſh feet, which being divided by 120, the half minutes in an hour, gives fifty-one feet for the diſtance between each diviſion on the log-line.

Theſe diviſions or ſpaces are called knots, becauſe at the end of each diviſion there is a piece of twine with knots in it reeſed between the ſtands of the line: whereby the number of diviſions or knots run off the reel, during the half minute, are readily counted.

And becauſe it is requiſite that the log be out of the eddy of the ſhip's wake before they begin to count, therefore theſe knots or ſpaces begin at the diſtance of ten fathoms or ſixty feet from the log, at which point, for the more ready diſcovering it, there is faſtened a piece of red rag.

The log-line being thus prepared and wound upon a reel, heave the log over-board from the poop, and as ſoon as the log is out of the ſhip's eddy, or the red rag at your hand, let your aſſiſtant turn the half minute glaſs; then veer the line from off the reel, which eaſily turns, as the ſhip ſails from the log, till the half minute glaſs is run out, at which time ſtop the line, and the number of knots intercepted between your hand and the red rag, will ſhew how far the ſhip has run in that time, and, conſequently, her rate of ſailing. For ſince the diſtance, comprehended between each knot, bears the ſame proportion to a nautical mile as half a minute does to an hour; therefore as many knots as are run out in half a minute, ſo many miles will the ſhip ſail in an hour; ſuppoſing her to move with the ſame velocity, during that time.

But as many accidents attend a ſhip during a day's ſailing, ſuch as the variableneſs of winds, the different quantity of ſail carried, &c. it will be neceſſary to heave the log at every alteration; but if none of theſe alterations be perceptible, yet it ought to be conſtantly heaved, at leaſt every hour. As the log-line is apt to ſtretch and ſhrink, and the half minute glaſs to alter, they ought to be often examined, and when found amiſs, rectified.

The generality of our ſeamen, upon a ſuppoſition that ſixty Engliſh miles are equal to a degree of a great circle, make the diſtance between knot and knot but forty feet; but as this ſuppoſition is evidently falſe, it were greatly to be wiſhed that they woud conſtantly uſe the former limitation, being in every reſpect as eaſy, and much more ſure and certain; and the rather, as they are at the ſame time obliged by experience to ſhorten the half minute glaſs nearly four ſeconds, which is nothing leſs than correcting one blunder by another.

LOG-

Log-Board, a table generally divided into five columns, in the firſt of which is entered the hour of the day; in the ſecond, the courſe ſteered; in the third, the number of knots ran off the reel each time of heaving the log; in the fourth, from what point the wind blows; and in the fifth, obſervations on the weather, variation of the compaſs, &c.

Log-Book, a book ruled in columns like the log-board, into which the account on the log-board is tranſcribed every day at noon; from whence, after it is corrected, &c. it is entered into the journal.

Log-Wood, or Campeachy wood, is the wood of a low prickly tree, which grows plentifully about Campeachy on the bay of Honduras. See Campeachy-Wood.

Log-wood gives out its colour both to watery and ſpirituous menſtrua, but not readily to either: it requires to be raſped and ground into fine powder, and boiled in ſeveral freſh parcels of the liquors. Rectified ſpirit extracts the colour more eaſily, and from a larger proportion of the wood than water does.

The tinctures both in water and in ſpirit are of a fine red, with an admixture, particularly in the watery one, of a violet or purple. Volatile alkaline ſalts or ſpirits incline the colour more to purple: the vegetable and nitrous acids render it pale; the vitriolic and marine acids deepen it.

The watery decoction, wrote with on paper, loſes its redneſs in a few days, and becomes wholly violet. This colour communicates alſo to woollen cloth previouſly prepared by boiling with a ſolution of alum and tartar: the dye is beautiful, but very periſhable. It is often uſed by the dyers, as an ingredient in compound colours, for procuring certain ſhades which are not eaſily hit by other materials.

With chalybeate ſolutions, it ſtrikes a black. Hence it is employed in conjunction with thoſe liquors, for ſtaining wood black for picture frames, &c. and with the addition of galls, for dyeing cloth and hats black. The black dyes, in which this wood is an ingredient, have a particular luſtre and ſoftneſs, far beyond thoſe made with galls and vitriol alone: the beauty, however, which it here imparts, is not permanent, any more than its own natural violet dye.

On the ſame principle, it improves alſo the luſtre and blackneſs of writing ink. Ink made with vitriol and galls, does not attain to its full blackneſs till after it has lain ſome time upon the paper: a due addition of log-wood renders it of a deep black as it flows from the pen, eſpecially when vinegar or white wine is uſed for the menſtruum.

LOGARITHMIC *Curve*, a curve which explains the nature and properties of logarithms, and is delineated in the following manner:

Upon the line A G (plate LXXXI. *fig.* 4.) infinitely extended each way, let there be taken A B, B C, C D, D E, E F, &c. towards the right hand; alſo A O, O P, &c towards the left, all equal among themſelves; and from the ſeveral points P, O, A, B, C, D, E, F, &c. let there be drawn the lines R P, O Q, A H, B I, C K, D L, E M, F N, &c. equal in length to the ſeveral lines, in the geometrical ſcale of proportional lines, infinite in number; theſe therefore will repreſent ſo many terms in the progreſſional of proportionals, of which the line A H repreſents unity. Now if the extremities R, Q, H, I, K, L, M, N, &c. of the geometrical ſcale of mean proportionals be connected together by right-lines, the figure P R N F will be a polygon, conſiſting of more or fewer ſides, according as the terms in the ſcales of mean proportionals are more or fewer in number.

If the diſtances A B, B C, D E, E F, &c. are biſſected in the points *b*, *c*, *d*, *e*, *f*, &c. and from theſe points be drawn lines, as *b i*, *c k*, *d l*, *e m*, *f n*, &c. perpendicular to A G, which will be ſo many proportionals between A H, B I, C K, D L, E M, F N, &c. there will ariſe a new ſcale for a ſeries of proportionals between A H, B I, C K, D L, E M, F N, &c. double in number to thoſe of the former ſcale. And if the extremities H, *i*, I, *k*, K, *l*, L, &c. be connected together by right-lines, we ſhall have a new polygon, conſiſting of a greater number of ſides; but each ſide leſs in magnitude.

After the ſame manner, if the diſtance between every two terms be continually biſſected, and to each of the points, ſo found, there be applied a ſeries of mean proportionals, the number of terms in this new ſcale, as alſo the ſides of the polygon, will by this means become infinite; and each ſide of the polygon will be leſs than any given right-line, and conſequently the polygon will be changed into a curve-lined figure; ſince every curvilinear figure may be conſidered as a polygon of an infinite number of ſides. The curve thus deſcribed is called the logarithmic curve, in which, if the right-lines A H, B I, &c. which ſtand at right-angles to the axis A G, repreſent ſo many terms in a ſeries of numbers in geometrical progreſſion, the portions of the axis A B, B G, &c. between the place of unity and any given term, will ſhew the place or order that each number in the ſcale of geometrical proportionals obtains from the place of unity in the ſame ſeries.

The diſtance therefore between any two numbers, in this continued ſcale of geometrical proportionals, is the logarithm of the ratio of theſe two numbers the one to the other. See Logarithms.

Logarithmic *Spiral*. If the quadrant of a circle A N B (plate LXXXI. *fig.* 5.) be divided into any number of equal parts, in the points N, *n*, *n*, &c. and from the radii C N, C *n*, C *n*, &c. be cut off C M, C *m*, C *m*, &c. continual proportionals, the points M, *m*, *m*, *m*, &c. will be in the logarithmic ſpiral. And there may be imagined an infinite number of different curves of this kind.

LOGARITHMS, a ſet of artificial numbers, whereby the common operations in multiplication and diviſion are performed by addition and ſubtraction; raiſing powers and extracting roots, are by the help of theſe numbers eaſily performed by multiplication and diviſion.

The word is formed from the Greek, λογος, ratio, and αριθμος, number.

Logarithms, juſtly eſteemed one of the greateſt and moſt uſeful diſcoveries that the laſt century has produced, were firſt invented by John Neper, baron of Marchiſton in Scotland, and by him firſt publiſhed at Edinburgh in the year 1614, and ſoon after by himſelf, and Mr. Briggs, (then Savilian profeſſor of geometry in the univerſity of Oxford) reduced into a better form, and publiſhed in London in the year 1624, in the ſame form and manner as they are uſed at this day.

Logarithms may be conſidered as, and are uſually defined to be, a ſeries or rank of numbers in an arithmetical progreſſion, fitted or adapted to the exponents of a ſeries of numbers in a geometrical progreſſion.

If between 1 and x be inſerted a mean proportional, which is $\sqrt{x}$ or $x^{\frac{1}{2}}$, its index $\frac{1}{2}$ ſhews that its diſtance from unity will be but one half of the diſtance of x from unity. In like manner, if between x and x^2 we inſert a mean proportional, its index will be 1 and $\frac{1}{2}$ or $\frac{3}{2}$, inaſmuch as its diſtance from unity is once and a half the diſtance of x from the ſame place of unity.

Again, if between 1 and x be inſerted two mean proportionals, the firſt of theſe will be the cube-root of x or $\sqrt[3]{x}$, and its index will be $\frac{1}{3}$, inaſmuch as its diſtance from the units place is but $\frac{1}{3}$ of the diſtance of x, from the ſame place of unity; and conſequently $\sqrt[3]{x}$ is expreſſed by $x^{\frac{1}{3}}$, whence it follows that the index of unity is 0, inaſmuch as unity cannot be removed at any diſtance from itſelf.

And the ſame ſeries of geometrical proportionals may be continued on the contrary ſide of unity, or towards the left hand, and which therefore will decreaſe in the ſame manner, or in the ſame ratio, as the terms placed on the right hand increaſe.

For the terms $\frac{1}{x^5}$, $\frac{1}{x^4}$, $\frac{1}{x^3}$, $\frac{1}{x^2}$, $\frac{1}{x}$, 1, x, x^2, x^3, x^4, x^5, &c. are in the ſame geometrical progreſſion continued, and have all the ſame common ratio; wherefore, inaſmuch as the diſtance of x from unity towards the right hand is poſitive, or $+1$, the diſtance of $\frac{1}{x}$ from unity towards the left hand, which is equal to the former, is

is negative or -1, which is therefore the index of $\frac{1}{x}$, and consequently for $\frac{1}{x}$ may be written x^{-1}.

Again, inasmuch as x^2 is on the right side of unity, and positive, and its index $+2$, the index of $\frac{1}{x^2}$, which is as far distant from unity on the contrary side, or towards the left hand, will be negative, and -2, and consequently $\frac{1}{x^2}$ is the same with x^{-2}: In like manner x^{-3} is the same with $\frac{1}{x^3}$, and x^{-4} same with $\frac{1}{x^4}$; whence it comes to pass that the negative indices shew that the terms to which they belong, are as far distant from unity toward the left hand, as the terms whose indices are the same and positive, are removed from unity on the contrary side, or towards the right hand.

Again, as between 1 and x, in the series increasing from or on the right hand of unity, may be inserted a mean proportional as $\sqrt{x}$, and between this mean proportional and unity be inserted another mean proportional as $\sqrt[4]{x}$, and between the last mean proportional and unity be inserted another mean proportional as $\sqrt[8]{x}$, &c. whose respective indices will be $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, &c. so between unity and the next term $\frac{1}{x}$ in the series decreasing from unity, or on the left hand of unity, may be inserted a mean proportional as $\frac{1}{\sqrt{x}}$, whose correspondent index will be $-\frac{1}{2}$: and, again, between this mean proportional and unity, may another mean proportional, as $\frac{1}{\sqrt[4]{x}}$, be inserted, whose correspondent index will be $-\frac{1}{4}$, and between this and unity may another mean proportional be inserted; the index will be $-\frac{1}{8}$, &c. and as this may be done between any other two terms of the progression, it follows, that between any two terms may an infinite number of mean proportionals be inserted, whose respective indices will become the logarithms of the respective terms to which they belong: and these mean proportionals, the greater they are in number between the two terms of any ratio, the nearer do they approach to a ratio of equality, with their correspondent indices or exponents.

Hence we are let into the reason of the ancient way of making logarithms, and which was made use of by their first inventors, and that was by a continual extraction of the square-root. In order to this, they first extracted the square of 10, and having continued that root to a very great number of places, they extracted the square-root again, and so on continually until they at last, after 54 such extractions, obtained the number 1,000000000000000127819149320032344 2. Now if this number be first squared, then cubed, then raised to the fourth, fifth, &c. power, it is very certain that, as their increase in the several products arise but by slow degrees, there will among them be found such as are extremely near in value to the natural numbers 2, 3, 4, 5, &c. and consequently, by what has been already said concerning the nature of logarithms, those of the natural numbers 2, 3, 4, 5, &c. will be expounded by the exponents, or number of multiplications, which formed the products respectively equal (or nearly so) to the natural numbers 2, 3, 4, 5, 6, &c. Here we see the reason why the logarithm of 1 is 0, or rather, that 1 has no logarithm, because the quantity to be continually involved must be a small matter greater than 1; for if it be less, the powers will decrease it.

If logarithms are to be made only to seven places of figures, which are sufficient for common use, twenty-five successive extractions will do for that purpose; that is, we need only extract the 33554432 (or 2 raised to the 25th power) root of 10; because in that root there will be found seven cyphers before the first significant figure after the unit; and in the course of these extractions, the denominators of the fractions expounding those roots which are nearest in value to any of the natural numbers 2, 3, 4, 5, &c. will point out their respective logarithms.

Some have considered the logarithm of a number as the logarithm of the ratio of unity to that number itself, or as the distance between unity and that number in a geometrical scale of proportionals, and consequently measured by the number of proportionals contained between them: logarithms therefore expound the place or order that every number obtains from the unit's place in a continued series or scale of proportionals indefinite in number.

Thus, if between unity, and the number 10, there be supposed 10000000, &c. mean proportionals, that is, if the number 10 be placed in the 10000000th place from unity, between 1 and 2, there will be found 3010300 of such proportionals; that is, the number 2 will be placed in the 3010300th place from unity; between 1 and 3 there will be found 4771213 of the same proportionals, or the number 3 will stand in the 4771213th place in the indefinite scale of proportionals; their numbers 10000000, 3010300, and 4771213, are therefore the logarithms of 10, 2, and 3; or, more properly, the logarithms of the ratio's of those numbers one to the other.

Again, if between unity and the number 10, there be supposed an indefinite scale of mean proportionals, whose number is 23025851; that is, if the number 10 be placed in the 23025851st place from unity, in the indefinite scale of proportionals, between 1 and 2, there will be found to be 6931471 such mean proportionals; and between 1 and 3, there will be found 10986122 of the same proportionals: so that if the first term of the series be called x, the second term will be x^2, the third x^3, &c. and if the number 10 be supposed to be the 10000000th term in the series, the number 2 will be the 3010300th term, and the number 3 will be the 4771213th term in the same series; and consequently $x^{10000000} = 10$, $x^{3010300} = 2$, and $x^{4771213} = 3$, &c. and again, if the number 10 be supposed the 23025851st term in the series, the number 2 will be the 6931471st term, and the number 3 the 10986122d term in the same series; and consequently, in this case, $x^{23025851} = 10$, $x^{6931471} = 2$, and $x^{10986122} = 3$, &c.

And as the indefinite number of mean proportionals between any two numbers may be assumed at pleasure, hence logarithms may be of as many different forms (that is, there may be as many different scales of logarithms) as there can be assumed different scales of mean proportionals between any two numbers. Every number therefore is some certain power of that number which is placed next to unity in the indefinite scale of proportionals between unity and the given number, and the index of that power is the logarithm of the number.

Logarithms therefore may be of as many sorts as you can assume different indices of the power of that number whose logarithm is required.

But since fluxions and the higher geometry have been so well understood, mathematicians have directed their views towards facilitating those laborious and operose calculations formerly made use of for constructing tables of logarithms, by help of converging series, and other means, whereby the logarithms of any proposed numbers may now be obtained with very little trouble: an example of this kind may be seen in Mac Laurin's Fluxions, p. 678, vol. ii. where that celebrated mathematician shews that, the logarithm of m being given, the logarithm of $\overline{m+z}$ — log. m is equal to $\frac{2z}{2m+z}$ multiplied by the series $1 - \frac{z}{12} \times \frac{1}{m+z} - \frac{1}{m} + \frac{z^3}{360} \times \frac{1}{\overline{m+z}^3} - \frac{1}{m^3} - \frac{z^5}{1260} \times \frac{1}{\overline{m+z}^5} - \frac{1}{m^5}$ + &c. This series converges so very swift, that two or three terms are sufficient in almost any case whatsoever.

The indices, or characteristics of logarithms, correspond to the denominative part of the natural numbers, as the other member of the logarithm does to the denominative part of the number: that is, the index shews the denomination, or place of the last (or left hand) figure of the number, and consequently of all the rest. — Thus 0 affixed to a logarithm, denotes the last figure of the number, to which the logarithm answers, to be nothing distant

diſtant from (i. e. in) the place of units. The index 1 ſhews the laſt figure of its number to be diſtant 1 place from the place of units, i. e. to be in the place of tens, and conſequently the number itſelf to be either 10, or ſome number between that and 100, and ſo of the other indices.—Hence all numbers, which have the ſame denomination, but not the ſame numerative parts, are all numbers from 1 to 10, from 10 to 1000, &c. and will have logarithms whoſe indices are the ſame, but the other members different. Again, all numbers, which have the ſame numerative, but not the ſame denominative part, will have different indices, but the reſt of the logarithms the ſame. If a number be purely decimal, to its logarithm is affixed a negative index, ſhewing the diſtance of its firſt real figure, from the place of units. Thus the logarithm of the decimal ,256 is $\bar{1}$,43824; of the decimal ,0256 is $\bar{2}$ 30824, &c.

To find the logarithm for a number greater than any in the common tables, but leſs than 10000000.—Cut off four figures on the left hand of the given number, and ſeek the logarithm in the table; add as many units to the index, as there are figures remaining on the right; ſubtract the logarithm found from the next following it, in the table; then, as the difference of numbers in the canon is to the tabular difference of the logarithms anſwering to them, ſo are the remaining figures of the given number to the logarithmic difference; which if it be added to the logarithm before found, the ſum will be the logarithm required. Suppoſe the logarithm of the number 92375 were required. Cut off the four figures 9237, and to the characteriſtic of the logarithm correſponding to them, add an unit; then

From the logarith. of the numb. 9238 =	3,9655780
Subtract logarith. numb. — — 9237 =	3,9655309
Remains tabular difference — — — —	471

10—471=5
5) 2 — — 1
235

Now to the logarithm — — —	4,9655309
Add the difference found — — —	235
The ſum is the logarithm required —	4,9655544

To find the logarithm of a proper fraction.—Subtract the logarithm of the numerator from that of the denominator, and to the remainder prefix the ſign of ſubtraction.—Thus ſuppoſe it were required to find the logarithm of $\frac{3}{7}$,

Logarithm of 7 =	0,8450980
Logarithm of 3 =	0,4771213
Logarithm of $\frac{3}{7}$ =	$\bar{0}$,3679767

To find the number correſponding to a logarithm greater than any in the table.—Firſt, from the given logarithm, ſubtract the logarithm of 10, or 100, or 1000, or 10000, till you have a logarithm that will come within the compaſs of the table; find the number correſponding to this, and multiply it by 10, or 100, or 1000, or 10000, the product is the number required. Suppoſe, for inſtance, the number correſponding to the logarithm 7,7589982 be required; ſubtract the logarithm of the number 10000, which is 4,0000000, from 7,589982; the remainder is 3,7589982, the number correſponding to which is 5741,1, which multiplied by 10000, gives 57411000, the number required.

To find the number correſponding to a negative logarithm.—To the given negative logarithm, add the laſt logarithm of the table, or that of the number 10000, i. e. ſubtract the firſt from the ſecond, and find the number correſponding to the remainder; this will be the numerator of the fraction, whoſe denominator will be 10000. Suppoſe it be required to find the fraction correſponding to the negative logarithm 0,3679767, ſubtract this from

4,0000000

the remainder is — — 3,6320233, the number correſponding to which is 4285 $\frac{71}{100}$; the fraction ſought therefore is $\frac{4285\frac{71}{100}}{10000}$.—The reaſon of the rule is, that as a fraction is the quotient, ariſing from the diviſion of the numerator by the denominator, unity will be to the fraction, as the denominator to the numerator; but as unity is to the fraction correſponding to the given negative logarithm, ſo is 10000 to the number correſponding to the remainder: therefore if 10000 be taken for the denominator, the number will be the numerator of the fraction required.

To find a fourth proportional to three given numbers, add the logarithm of the ſecond to that of the third, and from the ſum ſubtract the logarithm of the firſt; the remainder is the logarithm of the fourth required. Let the given numbers be 4, 68, and 3.

Logarithm 68 =	1,8325089
Logarithm 3 =	0,4771213
Sum — — =	2,3096302
Logarithm 4 =	0,6020600
Logarithm requir'd	1,7075732

The number in the tables correſponding to which is 51.

LOGIC, λογικὴ, the art of thinking and reaſoning juſtly; or, it may be defined the ſcience or hiſtory of the human mind, inaſmuch as it traces the progreſs of our knowledge from our firſt and moſt ſimple ideas thro' all their different combinations, conceptions, and all thoſe numerous deductions that reſult from variouſly comparing them one with another. See the articles IDEA and KNOWLEDGE.

The preciſe buſineſs of logic, therefore, is to explain the nature of the human mind, and the proper manner of conducting its ſeveral powers, in order to the attainment of truth and knowledge. It lays open thoſe errors and miſtakes we are apt, through inattention, to run into; and teaches us how to diſtinguiſh between truth, and what only carries the appearance of it. By this means we grow acquainted with the nature and force of the underſtanding; ſee what things lie within its reach; where we may attain certainty and demonſtration; and when we muſt be contented with probability.

Theſe conſiderations ſufficiently evince the uſefulneſs of this ſcience, which is divided into four parts, according to the number of the operations of the mind in its ſearch after knowledge, viz. perception, judgment, reaſoning, and method. See the articles PERCEPTION, &c.

This valuable art of ranging our ideas, connecting them cloſely together, and conſequently of facilitating the tranſition from one to another, ſupplies us with a means of rendering all men's abilities nearly equal. In fact, all our knowledge is reducible to primitive ſenſations, which is nearly alike in all men. The art of combining and connecting our direct ideas only gives them a more or leſs exact arrangement and denomination; whence they become more or leſs ſenſible to others. A man who readily combines his ideas, differs but little from him who combines them ſlowly; as he who judges of a picture at ſight, differs but little from him who requires to be made ſenſible of all its parts: both at the firſt glance have the ſame ſenſations, though they ſink not ſo deep in the ſecond, who therefore dwells longer upon each, to render them ſtrong and diſtinct; and by this means, the reflex ideas of the firſt obſerver become as eaſy to the ſecond as direct ones. And hence, perhaps, there is ſcarce an art or ſcience that may not, by means of a well adapted logic, be taught to a ſlow underſtanding; becauſe there are few arts or ſciences, whoſe precepts or rules may not be reduced to ſimple notions, and diſpoſed in ſo connected an order, that the chain need never be broken. As the mind is more or leſs ſlow in its operations, it requires more or leſs of this connected order. The advantage of a genius is that of having leſs occaſion for it; or rather, of being able to form it quick and almoſt imperceptibly. See DEMONSTRATION.

LOGISTIC CURVE, the ſame with that otherwiſe called logarithmic. See the article LOGARITHMIC.

LOGISTIC SPIRAL. See LOGARITHMIC and SPIRAL.

LOGISTICA NUMERALIS, the ſame with algorithm. See ALGORITHM.

LOGISTICAL ARITHMETIC, the doctrine of ſexageſimal fractions. See the article SEXAGESIMAL.

LOHOCH, or LOCH, in pharmacy, a compoſition of a middle conſiſtence between a ſoft electuary and a ſyrup, principally uſed in diſorders of the lungs. See LINCTUS.

LOINS, *Lumbi*, in anatomy, the two lateral parts of the

the umbilical region of the abdomen. See the article ABDOMEN.

LOLIUM, darnel, in botany, a genus of plants, the corolla whereof conſiſts of two valves; the lower is narrow, lanceolated, convoluted, acuminated, and of the length of the cup; the other is ſhort, linear, obtuſe, and hollowed upwards; there is no pericarpium, the corolla incloſes the ſeed, which is ſingle, oblong, compreſſed, convex on one ſide, and plane and ſulcated in the middle on the other.

The ſeed of this plant is reckoned attenuant, abſtergent, drying and heating.

LOMBARDY, a kingdom which comprehended almoſt all Italy. It was erected by the Longobards, or Lombards, a German nation, about the year 598, and laſted till Charlemain put an end to it, about the year 760.

LONCHITIS, ſpleenwort, in botany, a genus of plants, the fructifications of which are arranged into lunulated ſeries, and diſpoſed ſeparately under the ſinuſes of the leaves.

The leaves of this plant are of uſe in healing wounds, and in preventing inflammations of them; they are alſo uſed againſt the ſpleen; the root is aperient and diuretic.

LONDON, the metropolis of Great Britain, where the firſt meridian is fixed on the Britiſh maps, lies in 51° 32′ north latitude, on the river Thames, and the greateſt part on the north-ſide of that river. The form of London, including Weſtminſter and Southwark, comes pretty near an oblong ſquare, five miles in length, if meaſured in a direct line from Hyde-Park to the end of Limehouſe, and ſix miles, if we follow the windings of the ſtreets; the greateſt breadth is two miles and a half; and the circumference of the whole ſixteen or ſeventeen miles, but it is not eaſy to meaſure it exactly, on account of its irregular form. The principal ſtreets are generally level, exceeding well built, and extended to a very great length; theſe are inhabited by tradeſmen, whoſe houſes and ſhops make a much better figure than thoſe of any tradeſmen in Europe. People of diſtinction uſually reſide in elegant ſquares, of which there are great numbers at the weſt end of the town near the court. What moſtly contributes to the riches and glory of this city, is the port, whither ſeveral thouſand ſhips of burden annually reſort from all countries, and where the greateſt fleets never fail to meet with wealthy merchants ready to take off the richeſt cargoes. The number of people in the whole city are computed to be about one million.

LONGÆVITY, from *longus*, long, and *vita*, life, length of life.

We have ſeveral inſtances of longævity, as Parr, who lived one hundred and thirty-two years and nine months; Henry Jenkins of Yorkſhire, who lived one hundred and ſixty-nine; the counteſs of Deſmond and Mr. Eccleſtone, both of Ireland, each of whom exceeded one hundred and forty years.

LONG-BOAT, in the marine, the largeſt and ſtrongeſt boat in the ſhip.

The uſe of the long-boat is to carry great bins, ſuch as water, proviſions, anchors, and cables, and often part of the cargo: ſhe is occaſionally equipped with a maſt, ſails, and rigging, ſometimes armed with ſwivels, muſketoons, and carabines, and can be decked as neceſſity requires.

LONGIMETRY, the art of meaſuring lengths, acceſſible and inacceſſible.

LONGISSIMUS DORSI, in anatomy, a very complex, long and narrow muſcle ſituated between the ſpinal apophyſes and the ſacro-lumbaris, from which it is divided by a fatty or cellular line; but, at the lower part, they are confounded together. It covers the ſemiſpinalis or tranſverſo-ſpinalis dorſi, and ſemiſpinalis lumborum. Its upper part lies between the ſacro-lumbaris and tranſverſalis colli. This muſcle and the ſacro-lumbaris are common to the back and loins. The longiſſimus dorſi is an aſſiſtant to the ſacro-lumbaris, eſpecially its vertebral portion, which it helps very powerfully both by the multiplicity and inſertions of its fibres, in ſuſtaining the vertebræ of the back and loins, while extended, whether in ſitting or ſtanding, and in preventing their ſinking under the weight of the body, or any additional burden. It aſſiſts in performing, or counterballancing all the motions and inflections which theſe vertebræ, eſpecially thoſe of the loins, are capable of in all poſtures of the body. And in this, it alſo bears ſome reſemblance to the inferior or vertebral portion of the ſplenius: and theſe two muſcles on each ſide, and the ſacro-lumbaris, are of the number of thoſe called vertebrales obliquæ divergentes. *Winſlow's Anat.*

LONGITUDE *of the Earth*, denotes its extent from weſt to eaſt, according to the direction of the equator.

LONGITUDE *of a Star*, &c. in aſtronomy, an arch of the ecliptic, counted from the beginning of aries, to the place where a ſtar's circle of longitude cuts the ecliptic.

LONGITUDE *of a Place*, in geography, its diſtance from ſome firſt meridian, or an arch of the equator intercepted between the meridian of the place and the firſt meridian.

LONGITUDE, in navigation, the diſtance of a ſhip or place, eaſt or weſt, from one another, counted in degrees of the equator. If this diſtance be counted in leagues, miles, &c. or in degrees of the meridian, and not in thoſe proper to the parallel of latitude, it is uſually called departure.

Since the difference of longitude between any two places is equal to the arch of the equator intercepted between the two meridians paſſing through the two places; which is analogous to the quantity of time that the ſun requires to move from the meridian of one place to that of another; or, in the language of the Copernicans, that is elapſed between the application of the meridian of one of the places to the ſun and the meridian of the other; for ſince the ſun finiſhes his diurnal revolution in the ſpace of 24 hours, or, which is the ſame thing, ſince the revolution of the earth about her axis is performed in the ſame time; it follows that in every hour there paſſes over the meridian one twenty-fourth part of 360 degrees, or of the whole circumference of the equator, equal to fifteen degrees; in two hours, one twelfth part, or thirty degrees; and, in any greater or leſſer part of time, a proportional greater or leſſer part of the equator; whence it follows, that if the difference of longitude, or arch of the equator intercepted between the meridians paſſing through any two places, be known, the difference of the times of the day in thoſe two places is known alſo; and conſequently, the hour in one place being known, the hour in the other place is known alſo; and, on the contrary, if the difference between the times at any two places be known, the difference of longitude between thoſe two places is known alſo, by reducing the difference of the times into degrees and minutes, allowing fifteen degrees to an hour, &c.

Hence it is, that if two or more places lie under the ſame meridian, the hour in one will be the ſame with the hour in the other; and, on the contrary, if in two or more places the hour be the ſame, thoſe places lie under the ſame meridian.

And, becauſe the ſun in all places conſtantly riſes in the eaſt, he muſt neceſſarily apply himſelf to the meridian of the eaſtermoſt place firſt, and, conſequently, in that place that lies to the eaſtermoſt, the noon happens ſooneſt; and the hour of the day or diſtance of the ſun from the meridian at any other time muſt be greateſt.

Whence it appears, that if, by any contrivance whatſoever, the hour of the day at the ſame point of abſolute time in two different places can be obtained, the difference of longitude between thoſe places is alſo known; and by comparing the times together, it is eaſy to pronounce which place of the two lies to the eaſtward or weſtward of the other.

Wherefore if two or more perſons can view the ſame appearance at two or more places, and pronounce the time at each place when ſuch appearance was viſible; or if the time when any notable appearance ſhall happen at any place be predicted, and the time when that appearance was viſible at any other place was determined; theſe times being compared together, will give the difference of meridians, or difference of longitude between the two places.

Now ſince an eclipſe of the moon proceeds from nothing

thing elſe but an interception of the earth between her and the ſun, by which means ſhe is prevented from reflecting the light ſhe receives from the ſun, the moment that any part of her body begins to be deprived of the ſolar rays, it is viſible to all thoſe people who can ſee her at the ſame time; whence if two or more different people, at two or more different places, obſerve the times when it firſt began or ended, or note the time when any number of digits was eclipſed, or when the ſhadow begins to cover or quit any remarkable ſpot, the difference of thoſe times, if there be any, when compared together, will give the difference of longitude between the places of obſervation.

The longitudes of places may alſo be determined from the obſervations of ſolar eclipſes; but theſe being incumbered with the conſiderations of parallaxes, are not near ſo proper as thoſe of the moon are; and each of theſe happening but rarely, another excellent expedient has been thought of, and that is the eclipſes of Jupiter's ſatellites.

Jupiter has been found to have four ſatellites or moons conſtantly attending him, always obſerving the ſame laws in moving round about him. See the article JUPITER.

Now as neither Jupiter nor any of his attendants have any native light of their own, but ſhine with a borrowed light from the ſun, it happens that each of theſe, in every revolution about Jupiter, ſuffers two eclipſes, one at their entrance into the ſhadow, the other at the entrance of their paſſage behind his body; whence in each revolution of the ſatellite there are four remarkable appearances, by the obſervation of any one of which the buſineſs may be done, viz. one at the entrance into the ſhadow, and one at the emerſion out of it; one at the entrance behind the body, and another at the coming out; but the latter of theſe, viz. the ingreſs and egreſs of the ſatellite, into and from under the body, is not ſo much regarded by aſtronomers as the immerſion into and out of the ſhadow, becauſe, in the former, the difficulty of pronouncing the exact time is very great, it requiring, in each obſerver, eyes equally good and ſtrong, and teleſcopes equally large; but the obſervation of the former of theſe, viz. the immerſion into, and emerſion out of the ſhadow, is eaſy and practicable, becauſe the quick motions of the ſatellites plunge them ſo quick into the ſhadow of Jupiter, that it is no difficult matter to pronounce, by any teleſcope, by which they may be ſeen, the exact time of their immerſion and emerſion, as any one may ſoon be ſatisfied, if he will but try the experiment.

Now, inaſmuch as each of theſe happens at the ſame moment of abſolute time, if two or more perſons, in different places, note the time of obſervation, theſe, when compared together, will give the difference of longitude between the two places of obſervation. And, when we conſider the great number of theſe eclipſes that happen every year, there being more viſible in one year than there are days in it, and, conſequently, but few nights when Jupiter may be ſeen, and which is near eleven months of the year, but that an eclipſe of one or other happens, and ſometimes two or three in a night; the eaſineſs with which they may be made, there requiring only a teleſcope of eight or ten feet in length, which may be almoſt managed with the hand; and the little likelihood there is of miſſing the times of ingreſs or egreſs, they being in a manner momentaneous; and laſtly, the great exactneſs to which they would give the difference of longitude, it being certainly as exact as the latitude can at preſent be taken; it is much to be wondered at, that the more ſkilful part of our ſeamen have ſo long neglected them, and eſpecially in the ſeveral ports into which they ſail.

Beſides theſe, there is another method equally uſeful, expeditious, and certain; and that is, the appulſes of the moon to certain fixed ſtars, and their occultations by the interpoſition of her body; for, the moon finiſhing her revolution in the ſpace of twenty-ſeven days, ſeven hours, forty-three minutes, there are but few clear nights, when the moon does not paſs over, or ſo near to ſome fixed ſtar, that her diſtance from it, or the time of her viſible conjunction with it, may be eaſily obſerved by the teleſcope and micrometer only; and theſe when compared together, or with the viſible time computed to the meridian of ſome place when a good theory of the moon ſhall be obtained, will ſhew the difference of longitude of thoſe places.

The lunar theory is already brought to very great perfection, and the Nautical Ephemerides, now preparing by that able mathematician Mr. George Witchel, will, it is hoped, render the method of finding the longitude at ſea very practicable; eſpecially as the ingenious Mr. Maſkeline has already favoured the world with a treatiſe called the Mariner's Guide, wherein he has fully explained the method of finding the longitude from obſervations made on the appulſes of the moon to the fixed ſtars.

Mr. Flamſteed has given us the places of near one thouſand fixed ſtars, confirmed by ſeveral obſervations, that lie within the zodiac, each of which will be covered by the moon and the reſt of the planets, in one revolution of their node; ſo that ſcarce one night can happen but ſome one or other of them will be eclipſed, or approached ſo near unto, as to come within the compaſs of a teleſcope, in one place of the earth or other: add to theſe the eclipſes of Jupiter's ſatellites, and it is ſcarce poſſible that any clear night can happen, but the heavens afford us ſome agreeable phænomenon or other, by which the longitude of any place may be duly aſcertained.

In the Philoſophical Tranſactions, N° 1, we have an account of a ſucceſsful experiment made with two pendulum-watches by major Holmes, in a voyage from the coaſt of Guinea homewards. This and ſome other ſucceſſes encouraged monſieur Huygens ſo far, that, after he had improved the ſtructure of theſe watches, he publiſhed an account at large for the ſhewing how and in what manner theſe watches are to be uſed in finding the longitude at ſea, with directions for adjuſting of them and keeping a journal by them; which account the curious reader may ſee at large in the Philoſophical Tranſactions, N° 47.

This method has been purſued by the ingenious Mr. John Harriſon, who, after many years labour, has at laſt completed a time-keeper, which has every requiſite neceſſary for finding the longitude at ſea; and from ſeveral experiments, particularly two voyages to the Weſt-Indies, it was found to keep time ſo very accurately as not to vary above a minute in the whole voyage: and he has accordingly received 10,000l. being half the ſtipulated reward for this diſcovery; and will, it is preſumed, receive the other moiety as ſoon as his watch ſhall be found to keep time with the ſame degree of accuracy, in the frozen zone. The reader will therefore be pleaſed with finding ſome account of this ingenious contrivance, which we ſhall give from a report delievered to the board of longitude, by Mr. William Ludlam, one of the gentlemen to whom Mr. Harriſon was referred to make a diſcovery of the principles of his time pieee.

"The defects in common watches, ſays Mr. Ludlam, which Mr. Harriſon propoſes to remedy, are the following.

"1. That the main-ſpring acts not conſtantly with the ſame force upon the wheels, and through them upon the balance. 2. That the balance, either urged with an unequal force, or meeting with a different reſiſtance from the air, or the oil, or the friction, vibrates through a greater or leſs arch. 3. That theſe unequal vibrations are not performed in equal times. 4. That the force of the balance-ſpring is altered by a change of heat.

"To remedy the firſt defect, Mr. Harriſon has contrived, that his watch ſhall be moved by a very tender ſpring, which never unrolls itſelf more than one eighth part of a turn, and acts upon the balance through one wheel only. But ſuch a ſpring cannot keep the watch in motion a long time. He has therefore joined another, whoſe office is to wind up the firſt ſpring eight times in every minute, and which is itſelf wound up but once in a day.

"To remedy the ſecond defect, Mr. Harriſon uſes a much ſtronger balance-ſpring than in a common watch. For if the force of this ſpring upon the balance remains the ſame, whilſt the force of the other varies, the errors ariſing from that variation will be the leſs as the fixed force is the greater. But a ſtronger ſpring will require either a heavier or a larger balance. A heavier balance would

would have a greater friction. Mr. Harriſon therefore increaſes the diameter of it. In a common watch it is under an inch, in this of Mr. Harriſon's two inches and two tenths.

"Had theſe remedies been perfect, it would have been unneceſſary to conſider the defects of the third ſort. But the methods already deſcribed only leſſening the errors, not removing them, Mr. Harriſon uſes two ways to make the times of the vibrations equal, though the arches may be unequal. One is to place a pin, ſo that the balance-ſpring, preſſing againſt it, has its force increaſed; but increaſed leſs when the vibrations are larger; the other to give the palates ſuch a ſhape, that the wheels preſs them with leſs advantage, when the vibrations are larger.

"To remedy the laſt defect, Mr. Harriſon uſes a bar compounded of two thin plates of braſs and ſteel, about two inches in length, rivetted in ſeveral places together, faſtened at one end, and having two pins at the other, between which the balance-ſpring paſſes. If this bar be ſtraight in temperate weather, braſs changing its length by heat more than ſteel, the braſs ſide becomes convex when it is heated; and the ſteel ſide, when it is cold: and thus the pins lay hold of a different part of the ſpring in different degrees of heat, and lengthen or ſhorten it, as the regulator does in a common watch.

"The two firſt of theſe improvements, any good workman, who ſhould be permitted to view and take to pieces Mr. Harriſon's watch, and be acquainted with the tools he uſes, and the directions he has given, could, without doubt, exactly imitate. He could alſo make the palates of the ſhape propoſed; but for the other improvements, Mr. Harriſon has given no rules. He ſays, that he adjuſted thoſe parts by repeated trials, and that he knows no other method. This ſeems to require patience and perſeverance; but with theſe qualifications other workmen need not deſpair of ſucceſs equal to Mr. Harriſon's. There is no reaſon to ſuſpect that Mr. Harriſon has concealed from us any part of his art.

"If our opinion of the excellence and uſefulneſs of this machine be aſked, I muſt fairly own, that nothing but experience can determine the uſe of it with certainty; however, I think it my duty, ſays the above gentleman, to declare to the board the beſt judgment I can form.

"The firſt of Mr. Harriſon's alterations is, I believe, an improvement, but not very conſiderable. Probably if the other defects in common watches could be removed, the changes in the force of the main-ſpring would not occaſion ſuch errors as would make them uſeleſs at ſea.

"The next alteration ſeems to be of greater importance; I ſuppoſe that it contributes more to the exactneſs of the watch, than all the other changes put together; but is attended with ſome inconvenience. The watch is liable to be diſordered, and even ſtopped by almoſt any ſudden motion, and, when ſtopped, does not move again of itſelf. But as it has gone two voyages without any ſuch accident, it may ſeem that this danger at ſea is not conſiderable.

"The principle on which Mr. Harriſon forms the alterations of the third ſort is, that the longer vibrations of a balance moved by the ſame ſpring, are performed in leſs time. This is contrary to the received opinion among the philoſophers and workmen. But if Mr. Harriſon is right, yet whether the method he has propoſed will correct the errors, or not, is to me quite uncertain.

"The laſt alteration beforementioned is ingenious and uſeful; but that it can be made to anſwer exactly to the different degrees of heat, ſeems not probable."

LONGITUDE *of Motion*, according to ſome philoſophers, is the diſtance which the center of any moving body runs through, as it moves on in a right line. See the article MOTION.

LONGITUDINAL, in general, denotes ſomething placed lengthwiſe: thus ſome of the fibres of the veſſels in the human body are placed longitudinally, others tranſverſely, or acroſs.

LONICERA, honey-ſuckle, in botany, a genus of plants, the corolla of which conſiſts of a ſingle petal; the tube is oblong and gibboſe downwards; the limb is divided into five ſegments, one of which is more deeply ſerrated than the reſt: the fruit is a roundiſh umbilicated berry, containing two cells; the ſeeds are roundiſh and compreſſed.

LOOF, in ſhip-building, that part of a ſhip where the bow begins, or where the planks of her fore part begin to bend, and round inward, as ſhe grows narrower approaching the ſtem. See BOW.

LOOKING-GLASSES are nothing but plane mirrors of glaſs; which being impervious to the light, reflect the images of things placed before them; for the theory of which ſee the articles MIRROR and REFLECTION.

For the caſting, grinding, and poliſhing glaſſes, ſee the article GLASS.

For foliating of looking-glaſſes, ſee the article FOLIATING.

LOOM, a frame compoſed of a variety of parts, uſed in all the branches of weaving; for a particular deſcription of which, ſee WEAVING.

LOOMING, in the ſea-language, appearance, as the ſhip looms large, i. e. appears towering.

LOOP, in the iron works, denotes a part of a ſow, or block of caſt iron, broken or melted off from the reſt.

LOPPING, among gardeners, the cutting off the ſide branches of trees.

It is very obſervable that moſt old trees are hollow within; which does not proceed from the nature of the trees, but is the fault of thoſe who have the management of them, who ſuffer the tops to grow large before they lop them; as the aſh, elm, hornbeam, &c. and perſuade themſelves, that they may have the more great wood; but, in the mean time, do not conſider that the cutting off great tops endangers the life of a tree; or, at beſt, wounds it ſo, that many trees yearly decay more in their bodies, than the yearly tops come to; and at the ſame time that they furniſh themſelves with more great wood, they do it at the loſs of the owner. And, indeed, though the hornbeam and elm will bear great tops, when the body is little more than a ſhell; yet, the aſh, if it comes to take wet at the head, very rarely bears more top after the body of the tree decays. Therefore, if once theſe trees decay much in the middle, they will be worth little but for the fire; ſo that if you find a timber-tree decay, it ſhould be cut down in time that the timber be not loſt.

The lopping of your trees, that is, at ten or twelve years old at moſt, will preſerve them much longer, and will occaſion the ſhoots to grow more into wood in one year, than they do in old tops at two or three. Great boughs, ill taken off, ſpoil many a tree; for which reaſon they ſhould always be taken off cloſe and ſmooth, and not parallel to the horizon; and cover the wound with loam and horſe-dung mixed, to prevent the wet from entering the body of the tree.

When trees are at their full growth, there are ſeveral ſigns of their decay; as the withering or dying of many of their top branches; or if the wet enters at any knot; or they are anywiſe hollow, or diſcoloured; if they make but poor ſhoots; or if woodpeckers make any hole in them.

This lopping of trees is only to be underſtood for pollard-trees; becauſe nothing is more injurious to the growth of timber-trees, than that of lopping or cutting off great branches from them. Whoever will be at the trouble of trying the experiment upon two trees of equal age and ſize, growing near each other, to lop or cut off the ſide branches from one of them, and ſuffer all the branches to grow upon the other, will in a few years, find the latter to exceed the other in growth every way; and this will not decay near ſo ſoon.

All ſorts of reſinous trees, or ſuch as abound with a milky juice, ſhould be lopped very ſparingly; for they are ſubject to decay, when often cut. The beſt ſeaſon for lopping theſe trees is ſoon after Bartholomew tide; at which time they ſeldom bleed much, and the wound is commonly healed over before the cold weather comes on. *Miller's Gard. Dict.*

The lopping of young trees, that is, of ſuch as are ten or twelve years old, will preſerve them much longer, and will occaſion the ſhoots to grow more into wood in one year, than they do in old tops in two or three. The taking off of large boughs in a careleſs manner deſtroys many a tree; they ſhould therefore always be lopped with great

great care, and the wound covered with ſome loam to keep it from rotting, and prevent the wet from entering and getting into the body of the trees.

All ſorts of reſinous trees, or ſuch as abound with a milky juice, ſhould be lopped but very ſparingly, for they are very ſubject to decay, when cut. The beſt ſeaſon for the lopping theſe is the end of Auguſt, when they will not bleed very much, and the wounds will heal before the hard weather.

The generality of the world are againſt pruning timber trees at all, and, where they naturally grow ſtraight and regular, it is much better let alone. But all common faults in ſhape may be regulated by this lopping them while young, and it can be attended with no ill conſequence to the timber; for the cut not lying near the timber pith cannot affect it, when grown up, and ſquared in the working for beams and other uſes, or to be quartered; for all the defects occaſioned by ſuch wounds, are in the ſuperficial parts, and all the four quarters are perfectly ſound within.

As to the large foreſt trees, they ſhould not be lopped at all, except in caſes of great neceſſity, and then the large boughs muſt not be cut, but only the ſide branches; and even theſe muſt be cut off cloſe, that the bark may ſoon cover the wound, and yet a little ſlanting, that the water may run off, not lodge upon the cut part.

If there is a neceſſity of cutting off a large bough, as by its being broken or cankered, let it be cut off ſlanting at about four feet diſtance from the body of the tree, and that if poſſible near ſome place where there is a young ſhoot from it, which may receive the ſap, and grow up in its place. No ſtump muſt be left ſtanding out farther than this, becauſe they are wounded parts which never can heal, and which will always be letting in the water, and will ſerve as pipes to convey that water into the heart of the body of the tree, and by degrees will utterly ſpoil it. All that grow upright, whether they be large or ſmall branches, muſt in cutting be taken off ſlanting, never evenly, for the ſame reaſon; thoſe boughs that bear from the head are to be cut with the ſlope on the lower ſide, and on any occaſion that great wounds are given to a tree, they ſhould be covered with a mixture of clay and horſe-dung, which will make them heal much ſooner than they otherwiſe would do. *Mortimer's Huſbandry.*

LORD, a title of honour, given to thoſe who are noble, either by birth or creation; in this ſenſe it amounts to much the ſame as peer of the realm, or lord of parliament. This title, by the courteſy of England, is alſo given to all the ſons of dukes and marquiſes, and to the eldeſt ſons of earls: and it is alſo a title of honour beſtowed on thoſe who are honourable by their employments, as lord advocate, lord chamberlain, lord chancellor, &c.

LORICATION, COATING, in chemiſtry, is the covering a glaſs or earthen veſſel with a coat or cruſt of a matter able to reſiſt the heat, to prevent its breaking in the performing an operation that requires great violence of fire.

When veſſels are expoſed naked to the greateſt fire, it eaſily happens that they burſt by throwing freſh cold fuel into the fire, for the preventing of which, the operator muſt have recourſe to lorication, or coating. This is performed in the following manner: Take ſome of the ſame matter of which the muffles and crucibles are made, and inſtead of water moiſten it with freſh blood not yet coagulated, and diluted with twice or thrice the ſame quantity of water, to make a thin paſte of it; then add to this paſte cow's hairs, or other hairs, not very long nor ſtiff, and if you have at hand glaſs pulverized and ſifted, it may alſo be of ſervice to mix ſome of it with the reſt; then with this maſs beſmear your veſſel with a pencil, and dry it; when dried, beſmear it a ſecond time, and dry it again; repeat this a third and fourth time, till the veſſel be covered over with a cruſt or coat, one third or fourth part of an inch. See CRUCIBLE.

LOTION, *Lotio*, waſhing, in phyſic, a ſort of medicine compounded of liquid ingredients for beautifying the face, and cleanſing it from any deformity which the blood throws out. It alſo denotes a medicine that holds a medium between a fomentation and a bath.

LOTION, in pharmacy, a preparation of medicines by waſhing in ſome liquid, either to clear them of the dregs, or of ſome ſalt or corroſive ſpirit, or to communicate ſome virtue to them.

LOTUS, the ſquare podded vetch, in botany, a genus of plants, the corolla of which is papilionaceous; the vexillum is roundiſh, and bent back, with an oblong concave unguis; the alæ are roundiſh, and ſhorter than the vexillum; the carina is gibbous underneath, and ſhut above: the fruit is a cylindric pod, conſiſting of two valves, and containing two cells: the ſeeds are numerous and roundiſh.

LOVAGE, in botany, the Engliſh name for the liguſticum. See LIGUSTICUM.

LOVE-APPLE, the fruit of a ſpecies of ſolanum, a plant cultivated in gardens among us for the ſingularity of its appearance; the Portugueſe eat this fruit either raw or ſtewed, as do alſo the Jew-families in England.

LOUIS, *or Knight of* St. LOUIS, the name of a military order in France inſtituted by Louis XIV. in 1693. Their collars are of a flame-colour, and paſs from left to right; the king is their grand maſter.

LOUSE, *Pediculus*, in zoology. See the article PEDICULUS.

LOWERING, among diſtillers, a term uſed to expreſs the debaſing the ſtrength of any ſpirituous liquor by mixing water with it. The ſtandard and marketable price of theſe liquors is fixed, in regard to a certain ſtrength in them called proof; this is that ſtrength, which makes them, when ſhook in a phial, or poured from on high into a glaſs, retain a froth or crown of bubles for ſome time. In this ſtate ſpirits conſiſt of about half pure, or totally inflammable ſpirits, and half water; and if any foreign or home ſpirit is to be expoſed to ſale, and is found to have that proof wanting, ſcarce any one will buy it, till it has been diſtilled again, and brought to that ſtrength; and if it be above that ſtrength, the proprietor uſually adds water to it, to bring it down to that ſtandard. This addition of water, to debaſe its ſtrength, is what is called lowering it. People well acquainted with the goods will indeed buy ſpirits at any ſtrength, only lowering a ſample to the proof ſtrength, and by that judging of the ſtrength of the whole; but the generality of buyers will not enter into this, but muſt have it all lowered for them.

There is another kind of lowering in practice among the retailers of ſpirituous liquors to the vulgar; this is the reducing it under the ſtandard of proof. They buy it proof, and afterwards increaſe their profit upon it, by lowering it with water one eighth part. The quantity of ſpirit is what they generally allow themſelves for the addition of water; and whoever has the art of doing this, without deſtroying the bubble proof, as this is eaſily done by means of ſome addition, that gives a greater tenacity to the parts of the ſpirit, will deceive all that judge by this proof alone; that is, very nearly all who are concerned in the ſpirit trade. Such an additional quantity of water, as one eighth, makes the ſpirit taſte ſofter and cooler, and will make many prefer it to the ſtronger ſpirit, which is hotter and more fiery; but unleſs the ſpirit, thus lowered, were tolerably clean, or the proof be ſome other way preſerved, the addition of the water lets looſe ſome of the coarſe oil, which makes the liquor milky, and leaves a very nauſeous taſte in the mouth. *Shaw's Eſſay on Diſtillery.*

LOXIA, in the Linnæan ſyſtem of zoology, the name of a genus of birds of the order of the paſſeres, the diſtinguiſhing characters of which are, that the tongue is plain, equal, and whole; the beak large, thick, and ſhort, and crooked and convex both ways.

LOZENGE, LOZANGE, *Rhombus*, in geometry, a quadrilateral figure, conſiſting of four equal and parallel ſides, two of whoſe oppoſite angles are acute, and the other two obtuſe; the diſtance between the two obtuſe ones being always equal to the length of one ſide: when the ſides are unequal, this figure is called a rhomboides.

Scaliger derives the word from the Latin *laurengia*, as this figure ſomewhat reſembles that of a laurel leaf.

LOZENGE, in heraldry, a rhombus, or figure of equal ſides, but unequal angles, reſembling a quarry of glaſs in our old windows, placed erect, pointwiſe. It is in this

figure that all unmarried gentlewomen and widows bear their coats of arms; becauſe, as ſome ſay, it was the figure of the Amazonian ſhield; or as others, becauſe it is the ancient figure of the ſpindle.

LOZENGE, in pharmacy, the ſame with what is otherwiſe called troche. See the article TROCHE.

LUCERNE, in botany, &c. a plant frequently cultivated in the manner of clover, and known among authors by the names of the medica and medicago.

It is the alfaſa of the Spaniards, and the lucerne, grand treffle, or fænum Burgundiacum, as ſome botaniſts call it, of the French. It has a perennial root, and an annual ſtalk, which riſes full three feet high in good land, and is garniſhed at each point with trifoliate leaves, whoſe lobes are ſpear-ſhaped, about an inch and a half long, and half an inch broad, ſawed towards the ſtalks. The flowers grow in ſpikes, which are from two to near three inches in length, ſtanding upon naked foot ſtalks two inches long, riſing from the wings of the ſtalks: they are of the pea bloom, or butterfly, kind; of a fine purple colour, and are ſucceeded by compreſſed moon-ſhaped pods, which contain ſeveral kidney-ſhaped ſeeds. It flowers in June, and its ſeed ripens in September.

There are the following varieties of this ſpecies of lucerne, viz. one with violet-coloured flowers: another with yellow flowers; a third with yellow and violet flowers mixed; and a fourth with variegated flowers: but, as Mr. Miller obſerves, theſe are only variations of the ſame plant, ariſing accidentally from the ſeed. However, neither the yellow, nor the variegated, flowered lucerne is ever ſo ſtrong as that with purple flowers, nor is it, conſequently, ſo profitable to the huſbandman.

Columella calls this the choiceſt of all fodder, becauſe it will laſt ten years, and will bear being cut down four, and ſometimes ſix times in a year; it enriches the land on which it grows, fattens the cattle fed with it, and is a remedy for ſick cattle. About three quarters of an acre of it is abundantly ſufficient to feed three horſes during the whole year. Yet notwithſtanding it was ſo much eſteemed by the ancients, and hath been cultivated to great advantage in France and Switzerland for many years, it has not yet found ſo good a reception in England as it juſtly deſerves; nor is it cultivated here in any conſiderable quantity, though it will ſucceed as well in this country as in either of the laſt mentioned; being extremely hardy, and reſiſting the ſevereſt cold of our climate.

The ſoil in which this plant is found to ſucceed beſt in this country, is a light, dry, looſe, ſandy land, which ſhould be well ploughed and dreſſed, and the roots of all noxious weeds, ſuch as couch graſs, &c. deſtroyed; otherwiſe theſe will over-grow the plants while young, and prevent their progreſs.

The beſt time to ſow the ſeed is about the middle of April, when the weather is ſettled and fair: for if you ſow it when the ground is very wet, or in a rainy ſeaſon, the ſeeds will burſt and come to nothing, as is often the caſe with ſeveral of the leguminous plants; therefore you ſhould always obſerve to ſow it in a dry ſeaſon, and if there happens ſome rain in about a week or ten days after it is ſown, the plants will ſoon appear above ground.

After having well ploughed and harrowed the land very fine, you ſhould make a drill quite acroſs the ground, almoſt half an inch deep, into which the ſeeds ſhould be ſcattered very thin: then cover them over a quarter of an inch thick, or ſomewhat more, with the earth: then proceed to make another drill, about a foot and a half from the former, ſowing the ſeeds therein in the ſame manner as before, and ſo proceed through the whole ſpot of ground, allowing the ſame diſtance between row and row, and ſcatter the ſeeds very thin in the drills. In this manner, an acre of land will require about ſix pounds of ſeed: for when it is ſown thicker, if the ſeeds grow well, the plants will be ſo cloſe as to ſpoil each other in a year or two, the heads of them growing to a conſiderable ſize, as will alſo the roots, provided they have room; for the crown of ſome will meaſure eighteen inches diameter; from which near four hundred ſhoots have been cut at one time, which is an extraordinary increaſe, and this upon a poor dry gravelly ſoil, which had not been dunged for many years; but the roots were at leaſt ten years old; ſo that if this crop be well cultivated, it will continue many years, and be equally good as when it was firſt ſown: for the roots generally run down very deep in the ground, provided the ſoil be dry; and although they ſhould meet a hard gravel a foot below the ſurface, yet their roots would penetrate it and make their way downward, ſome of them having been taken up, which were above a yard in length, and had run two feet into a rock of gravel, ſo hard as not to be looſened without mattocks, and crows of iron, and that with much difficulty.

The reaſon for directing this ſeed to be ſown in rows is, that the plants may have room to grow; and for the better ſtirring the ground between them, to deſtroy the weeds, and encourage the growth of the plants, which may be very eaſily effected with a Dutch hoe, juſt after the cutting the crop each time, which will cauſe the plants to ſhoot again in a very little time, and be much ſtronger than in ſuch places where the ground cannot be ſtirred: but when the plants firſt come up, the ground between ſhould be hoed with a common hoe; and if in doing of this you cut up the plants where they are too thick, it will cauſe the remaining to be much ſtronger. This hoeing ſhould be repeated two or three times while the plants are young, according as the weeds are produced, obſerving always to do it in dry weather, that the weeds may the better be deſtroyed; for if it be done in moiſt weather, they will root and grow again.

With this management, the plants will grow to the height of two feet, or more, by the beginning of Auguſt, when the flowers will begin to appear, at which time the lucerne ſhould be cut, obſerving to do it in a dry ſeaſon, if it is to be made hay, and keep it often turned, that it may ſoon dry, and be carried off the ground; for if it lie long upon the roots, it will prevent their ſhooting again. After the crop is taken off, you ſhould ſtir the ground between the rows with a hoe, to kill the weeds, and looſen the ſurface, which will cauſe the plants to ſhoot out again in a ſhort time, ſo that by the beginning of September there will be ſhoots four or five inches high, when you may turn in ſheep upon it to feed it down: nor ſhould the ſhoots be ſuffered to remain upon the plants, which would decay when the froſty weather comes on, and fall down upon the crown of the roots, and prevent their ſhooting early the ſucceeding ſpring.

The beſt way therefore is to feed it until November, when it will have done ſhooting for that ſeaſon: but it ſhould not be fed by large cattle the firſt year, becauſe the roots being young, would be in danger of being deſtroyed, either by their trampling upon them, or their pulling them out of the ground: but ſheep will be of ſervice to the roots by dunging the ground, provided they do not eat it too cloſe, ſo as to endanger the crown of the roots.

In the beginning of February, the ground between the rows ſhould be again ſtirred with the hoe, to encourage them to ſhoot again: but in doing this you ſhould be careful not to injure the crown of the roots, upon which the buds are at that time very turgid, and ready to puſh. With this management, if the ſoil be warm, by the middle of March the ſhoots will be five or ſix inches high, when, if you are in want of fodder, you may feed it down till a week in April; after which it ſhould be ſuffered to grow for a crop, which will be fit to cut the beginning of June, when you ſhould obſerve to get it off the ground as ſoon as poſſible, and ſtir the ground again with the Dutch hoe, which will forward the plants ſhooting again; ſo that by the middle, or latter end of July, there will be another crop fit to cut, which muſt be managed as before; after which it ſhould be fed down again in autumn: and as the roots by this time will have taken deep hold in the ground, there will be little danger of hurting them, if you ſhould turn in larger cattle; but you muſt always obſerve not to ſuffer them to remain after the roots have done ſhooting, leſt they ſhould eat down the crown of the roots below the buds, which would conſiderably damage, if not deſtroy them.

In this manner you may continue conſtantly to have two crops to cut, and two feedings upon this plant; and in good ſeaſons there may be three crops cut, and two

feedings, which will be a great improvement, eſpecially as this plant will grow upon dry barren ſoils, where graſs will come to little, and be of great uſe in dry ſummers, when graſs is often burnt up: and as it is an early plant in the ſpring, ſo it will be of great ſervice when fodder falls ſhort at that ſeaſon, when it will be fit to feed at leaſt a month before graſs or clover; for this plant is often eight inches high by the middle of March, at which time the graſs in the ſame place is ſcarcely one inch high.

Cold will not injure this plant; for in the very cold winter, 1728-9, ſome roots of this plant which were dug up in October, and laid upon the ground in the open air till the beginning of March, were again planted, and they ſhot out very vigorouſly ſoon after: nay, even while they lay upon the ground, they ſtruck out fibres from the under ſide of the roots, and had begun to ſhoot green from the crown of the roots: but wet will altogether deſtroy the roots; for a little of the ſeed being ſown upon a moiſt ſpot of ground for a trial, it came up very well, and flouriſhed exceedingly during the ſummer ſeaſon; but in winter, when the great rains fell, the roots began to rot at bottom; and before the ſpring moſt of them were deſtroyed.

The beſt places to procure the ſeed from, are Swiſſerland and the northern parts of France, which ſucceeds better with us than that which comes from a more ſouthern climate: but this ſeed may be ſaved in England in great plenty; in order to which, a ſmall quantity of the plants ſhould be ſuffered to grow uncut till the ſeeds are ripe, when it muſt be cut, and laid to dry in an open barn, where the air may freely paſs through: but the ſeed muſt be defended from the wet; for if it be expoſed thereto, it will ſhoot while it remains in the pod, whereby it will be ſpoiled. When it is quite dry, it muſt be threſhed out, and cleanſed from the huſk, and preſerved in a dry place till the ſeaſon for ſowing it: and this ſeed ſaved in England is much preferable to any brought from abroad; the plants produced from it being much ſtronger than thoſe produced from the French, Helvetian, and Turky ſeeds, which are ſown at the ſame time, and on the ſame ſoil and ſituation.

LUCID INTERVALS, in lunatics, the times wherein they appear to be in their ſenſes. See the article LUNATIC.

LUCINDA, in aſtronomy, an appellation given to ſeveral fixed ſtars on account of their ſuperior brightneſs; as the lucida coronæ, a ſtar of the ſecond magnitude, in the northern crown; the lucida hydræ, or cor hydræ; and the lucida lyræ, a ſtar of the firſt magnitude in that conſtellation.

LUCIUS, the pike, or jack, in ichthyology, a ſpecies of eſox, with a depreſſed roſtrum.

The pike grows to a conſiderable ſize, but uſually is found from fourteen inches to two feet in length: it is all over variegated with round yellowiſh ſpots. It is a well known and very voracious fiſh.

LUES, among phyſicians, is, in general, uſed for a diſeaſe of any kind; but, in a more particular ſenſe, is reſtrained to contagious and peſtilential diſeaſes: thus the lues Gallica, or venerea, ſignifies the venereal diſeaſe.

LUFF, amongſt ſailors, the order from the pilot to guide the ſhip's head nearer to the direction of the wind, or nearer to that part of the horizon from which the wind bloweth.

She keeps a good LUFF, i. e. holds her way well, without deviating to the leeward of her courſe. See the article LEEWARD.

LUFF-TACKLE, a complication of pullies conſiſting of two blocks, which may be either both of them double, or one of them ſingle. The rope which forms the tackle, and is called the fall, is paſſed alternately through the blocks, and then has its end faſtened to one of them, till it becomes four or five fold: the mechanical power of a luff-tackle is very great, inſomuch that three or four men will draw as much weight with this as ſeven or eight would with a ſingle rope faſtened to the ſame body. See the article TACKLE.

This experiment might undoubtedly be aſcertained with the niceſt accuracy, but we do not remember to have heard or read of its being done: it might, however, be worth the trial of ſome curious mechanic.

LUKE, or *Goſpel of St.* LUKE, a canonical book of the New Teſtament.

Some think it was properly St. Paul's Goſpel, and that when that Apoſtle ſpeaks of his Goſpel, he means what is called St. Luke's. Irenæus ſays, that St. Luke digeſted into writing what St. Paul preached to the Gentiles; and Gregory Nazianzen tells us, that St. Luke wrote with the aſſiſtance of St. Paul.

"St. Luke, ſays a modern writer, is pure, copious, and flowing in his language, and has a wonderful and entertaining variety of ſelect circumſtances in his narration of our Saviour's divine actions. He acquaints us with numerous paſſages of the Evangelical hiſtory, not related by any other Evangeliſt; both in his Goſpel and Apoſtolical Acts, he is accurate and neat, clear and flowing, with a natural and eaſy grace: his ſtyle is admirably accommodated to the deſign of his hiſtory; it had a good deal of reſemblance to that of his great maſter St. Paul; and, like him, he had a learned and liberal education. I believe he had been very converſant with the beſt claſſics; for many of his words and expreſſions are exactly parallel to theirs." *Blackwall's Sacred Claſſics.*

St. LUKE *the Evangeliſt's Day*, a feſtival in the Chriſtian church, obſerved on the eighteenth of October.

LUMBAGO, in phyſic, a violent pain in the loins, which affects the patient in ſuch a manner that he can ſcarcely move. It is a ſcorbutic ſymptom, and frequently excited by the gout or rheumatiſm.

LUMBARIS, a name given to the arteries and veins which ſpread over the loins; or an epithet to diſtinguiſh thoſe branches of the aorta which carry the blood to the muſcles of the loins, to thoſe of the abdomen and other of the circumjacent parts, and alſo to certain veins which bring back the blood from the loins into the trunk of the vena cava.

LUMBRICAL, a name given to four muſcles of the fingers, and to as many of the toes. They are in each called the flexors of the firſt phalanx; thoſe of the fingers ariſe deep and tendinous, and are inſerted into the firſt phalanges on the ſide next the thumb: thoſe of the toes have their origin from the tendon of the muſculus perforans, and from the interior part of the calcaneum: their termination is at the firſt phalanx of the ſeveral toes.

LUNA, in aſtronomy, the moon. See the article MOON.

LUNA, among chemiſts, ſignifies ſilver. See SILVER.

LUNAR, ſomething belonging to the moon; thus we ſay lunar month, lunar year, lunar dial, lunar eclipſe, &c. See the articles MOON, MONTH, YEAR, &c.

LUNATIC, a perſon affected with lunacy, the cure of which is to be attempted by evacuations of all kinds; as bleeding, vomiting, cathartics, &c. See MADNESS.

LUNGS, a part of the human body, which is the cauſe or inſtrument of reſpiration. The lungs are the largeſt viſcus of the thorax: they are ſituated in the two ſides of it, with the heart as it were between them; and are connected, by means of the mediaſtinum, with the ſternum and vertebræ; with the heart, by means of the pulmonary veſſels, and immediately with the aſpera arteria. The colour of the lungs, in infants, is a fine florid red; in adults, it is darker; and in old people, livid, or variegated with black and white. When inflated, they have ſome reſemblance to the hoof of an ox; and are convex on the upper ſide, and concave underneath. They are divided into two large lobes, the right and left; the left, which is the ſmaller, is divided again into three ſmaller ones. The membrane with which the lungs are ſurrounded, is continuous with the pleura. The ſubſtance of the lungs is ſpongeous, or veſiculous, and they ſeem, indeed, entirely compoſed of a number of ſmall veſicles of a fleſhy texture, and of a variety of veſſels.

The veſſels of the lungs are the bronchia, the bronchial artery and vein, the pulmonary artery and vein, the nerves, and the lymphatics. See BRONCHIA, &c.

The uſes of the lungs are, 1. To perform the office of reſpiration, by which the blood is attenuated in the plexus of the arteries called the rete vaſculoſum. 2. To be aſſiſtant to the voice in ſpeaking, and to the ſenſe of

ſmelling. They are alſo emunctories of the blood, and are of many other important ſervices.

LUNG-WORT, *Pulmonaria*, in botany. See PULMONARIA.

LUNISOLAR YEAR, in chronology, a period of years produced by multiplying the cycle of the moon, 19, by 28, that of the ſun; the product is 532; in which ſpace of time theſe luminaries return to the ſame point in the heavens.

LUNULA, in geometry, a plane figure like a creſcent, or half-moon, for the quadrature of which, ſee QUADRATURE.

LUPERCALIA, in antiquity, a feſtival of the antient Romans in honour of the god Pan, obſerved on the fifteenth of February, and ſo called from the luperci, the prieſts of that fabulous deity.

LUPIA, in ſurgery, a kind of encyſted tumor, called alſo talpa and teſtuda. See ENCYSTED and TUMOR.

LUPINE, *lupinus*, in botany, a genus of plants, the corolla of which is papilionaceous; the vexillum is cordated, roundiſh, and emarginated: the alæ are oval, and almoſt of the ſame length with the vexillum; the carina is divided into two ſegments at the baſe: the fruit is a large, oblong, coriaceous, compreſſed, acuminated pod, containing only one cell: the ſeeds are numerous, roundiſh, and compreſſed.

LUPULMUM, in botany, a ſpecies of trefoil. See the article TREFOIL.

LUPULUS, the hop, in botany, &c. See the article HOP.

LUPUS, the wolf, in zoology. See the article WOLF.

LUPUS MARINUS, the ſea-wolf, in ichthyology, conſtitutes a diſtinct genus of malacopterygious fiſhes; with a compreſſed body, and ſix or more oſſicles in the membrane of the gills. On the back there is only one fin, which extends almoſt from the head to the tail. It is a very ſingular fiſh, growing to four or five feet long.

LUPUS, in aſtronomy, a conſtellation of the ſouthern hemiſphere. See CENTAUR.

LURE, in falconry, a device of leather, in the form of a bird, with two wings ſtuck with feathers, and baited with a piece of fleſh; wherewith to reclaim or call back a hawk, when at a conſiderable diſtance.

LUSERNE, or LUCERNE. See LUCERNE.

LUSTRATION, in antiquity, ſacrifices or ceremonies by which the antients purified their cities, fields, armies, or people, defiled by any crime or impurity. Some of theſe luſtrations were public, others private. There were three ſpecies or manners of performing luſtrations, viz. by fire and ſulphur, by water, and by air, which laſt was done by fanning and agitating the air round the thing to be purified. Some of theſe luſtrations were neceſſary, that is, could not be diſpenſed with, as luſtrations of houſes in time of a plague, or upon the death of any perſon: others again were done out of choice, and at pleaſure. The public luſtrations at Rome were celebrated every fifth year, in which they led a victim thrice round the place to be purified, and in the mean time burnt a great quantity of perfumes. Their country luſtrations, which they called ambarvalia, were celebrated before they began to reap their corn: in thoſe of the armies, which they called armiluſtria, ſome choſen ſoldiers, crowned with laurel, led the victims, which were a cow, a ſheep, and a bull, thrice round the army ranged in battle-array in the field of Mars, to which deity the victims were afterwards ſacrificed, after pouring out many imprecations on the enemies of the Romans. The luſtrations of their flocks were performed in this manner: the ſhepherd ſprinkled them with pure water, and thrice ſurrounded his ſheepfold with a compoſition of ſavin, laurel, and brimſtone ſet on fire, and afterwards ſacrificed to the goddeſs Pales an offering of milk boiled, wine, a cake and millet. As for private houſes, they were luſtrated with water, a fumigation of laurel, juniper, olive-tree, ſavin, and ſuch like; and the victim commonly was a pig. Luſtrations made for particular perſons were commonly called expiations, and the victims piacula. There were alſo a kind of luſtration uſed for infants, by which they were purified, girls the third, and boys the ninth day after their birth, which ceremony was performed with pure water and ſpittle.

LUSTRE, the gloſs or brightneſs appearing on any thing, particularly on manufactures of ſilk, wool, or ſtuff. It is likewiſe uſed to denote the compoſition or manner of giving that gloſs.

The luſtre of ſilks is given them by waſhing in ſoap, then clear water, and dipping them in alum-water cold. To give ſtuffs a beautiful luſtre, for every eight pounds of ſtuff allow a quarter of a pound of linſeed; boil it half an hour, and then ſtrain it through a cloth, and let it ſtand till it is turned almoſt to a jelly: afterwards put an ounce and a half of gum to diſſolve twenty-four hours; then mix the liquor, and put the cloth into this mixture; take it out, dry it in the ſhade, and preſs it. If once doing is not ſufficient, repeat the operation. Curriers give a luſtre to black leather firſt with juice of bar-berries, then with gum-arabic, ale, vinegar, and Flanders glue, boiled together. For coloured leather, they uſe the white of an egg beaten in water. Moroccoes have their luſtre from juice of bar-berries and lemon or orange. For hats, the luſtre is frequently given with common water, ſometimes a little black dye is added: the ſame luſtre ſerves for furs, except that for very black furs they ſometimes prepare a luſtre of galls, copperas, Roman alum, ox's marrow, and other ingredients.

LUSTRUM, in Roman antiquity, a general muſter and review of all the citizens and their goods, which was performed by the cenſors every fifth year, who afterwards made a ſolemn luſtration.

LUTE, or LUTING, among chemiſts, a mixed, tenacious, ductile ſubſtance, which grows ſolid with drying; and when applied to the junctures of veſſels for diſtillation, ſtops them up.

When the ſubject is merely aqueous, linſeed meal, ground fine, and well worked up into a ſtiff paſte with the white of an egg, makes a proper luting; it grows hard with heat, and if it happens to crack, it is repaired by a freſh application.

In the diſtillation of all fermented inflammable ſpirits and volatile alcaline ſalts, a paſte made of the ſame meal, well worked up with cold water, anſwers very well.

In the diſtillation of mild acids or acetous liquors, a bladder ſteeped in water, till it grows ſlimy, makes an excellent luting.

A luting that acquires a ſtony hardneſs is neceſſary in the diſtillation of foſſil acids, as vitriol, ſea-ſalt, &c. which is called the philoſophical luting, and may be prepared from the calx of copperas and quick lime, by boiling the caput mortuum in vitriol, in ſeveral parcels of water, till thoroughly waſhed, then drying the powder and preſerving it in a cloſe veſſel. This powder is to be rubbed with an equal quantity of quick-lime, and wrought into a paſte with the whites of eggs firſt beat thin; and this luting is immediately to be applied to the veſſel, being firſt a little heated: or beat pure ſand and potter's clay together in ſuch proportion with water, till the matter no longer ſticks to the fingers; then add a fourth part of common lime, and the drier this is applied, the better, provided it be left ductile, and the cracks are eaſily ſtopped up by the ſame.

To coat veſſels in the ſtronger diſtillations with a naked fire, beat fat potters earth and powdered ſand with water into a well wrought paſte, which will not ſtick to the fingers, adding a little common lime at the laſt, and beating them together: then, the veſſel being expoſed to the vapour of hot water, ſpread the cement all over it equably with the hand, afterwards ſprinkle the ſurface of the coating with hot and dry ſand, and let the coat dry ſlowly in a cool place, minding to fill up the cracks.

The London chemiſts uſe for the ſame purpoſe ſifted wood aſhes beat up to a due conſiſtence with the white of eggs and a little gum water. The ſame ſervice may be performed in a more excellent manner by a mixture of linſeed oil and ceruſs made by inſolation or decoction, and afterwards ground upon a marble with freſh ceruſs, till the whole be of the conſiſtence of an unguent.

LUTE is alſo a muſical inſtrument with ſtrings.

LUTHERANS, the Chriſtians who follow the opinions of Martin Luther, one of the principal reformers of the church in the ſixteenth century.

LUTHERN, in architecture, a kind of window over the corniche, in the roof of a building; ſtanding perpendicularly

cularly over the naked of a wall, and ſerving to illuminate the upper ſtory.

Lutherns are of various forms, as ſquare, ſemi-circular, round, called bulls-eyes, flat arches, &c.

LUTRA, the otter, in zoology. See the article OTTER.

LUTUM, among chemiſts, denotes a lute; and *lutum ſapientiæ*, the hermetical ſeal. See LUTE and HERMETICAL.

LUXATION, *Luxatio*, in ſurgery, the receſs or removal of the moveable extremity of a bone from the hollow or ſocket in which it naturally moved, accompanied with a hindrance of motion. This removal is either total or partial; the former is a luxation, and the latter a diſtortion.

The method of healing luxations is very near the ſame with that of fractures.

To cure a luxation two things are neceſſary; firſt, a reduction of the luxated parts; and ſecondly, a retention of them in their natural ſituation.

We are alſo, during the courſe of the cure, by proper remedies and a due regimen, to mitigate the moſt troubleſome ſymptoms, and to prevent future ones.

The retaining diſlocated bones in their proper ſituation, may be compaſſed with leſs difficulty than in fractured bones; for luxations in the upper extremities ſeldom require any ſtrict bandage, or long reſt. But when this happens in the lower extremities, the patient ſhould reſt ſome days in his bed, and not move the limb, till the joint has recovered its uſual ſtrength.

In a luxation of long ſtanding likewiſe a bandage and reſt are altogether neceſſary, till the former vigour of the ligaments is reſtored; though here, without a gentle motion, there will be danger of a ſtiffneſs. In the mean time it will be proper to bathe the bandages plentifully with ſome warm ſtrengthening ſpirit. The bandages ſhould be neither too tight, nor too lax. The application of plaſters, mean time, is rather pernicious than ſerviceable.

The treatment of the ſymptoms attending diſlocations, as inflammations, tumors, pains, convulſions, and hæmorrhages, is the ſame as that in fractures and wounds; but after reduction they generally diſappear inſenſibly. When the ligaments are very much debilitated, it is extremely ſerviceable, after having rubbed the part well with warm linen, to foment it with burnt rectified ſpirit of wine, and after that a quantity of ſome ſtrengthening ſpirit, as directed in fractures, applying a proper bandage.

If a luxation is attended with a wound, the eighteen-headed bandage is proper. An abſceſs ſhould be opened, as ſoon as it is ripe; for otherwiſe the pus will corrode the articulation or bone, and produce a dangerous fiſtula, which can be remedied only by amputation. When the adjacent ligament, tendons, and ſkin, are broken and deſtroyed, the caſe is then, according to Hippocrates, abſolutely incurable; and they will be ſo far from uniting firmly, that an attempt to reduce them will excite convulſions and a gangrene: for the preſervation of life, therefore, the limb ſhould be immediately amputated.

LYCANTHROPY, *Lycanthropia*, in phyſic, a ſpecies of madneſs or melancholy, in which the patients wander about in the night-time, and in every thing imitating the wolves. Some bite and ſnarl like dogs, and hence it has been called cynanthropy.

The word is derived from the Greek, λυκος, a wolf, and ανθρωπος, a man.

In the time of the fit the patient ſhould be treated with phlebotomy, the blood being ſuffered to run till he faints. Meats of good juice, with baths of ſweet water, are to be preſcribed. Whey is to be drank for three days together, and a purge of hiera or colocynthis twice or thrice adminiſtered. After purging, theriaca is to be exhibited, together with other things proper for the cure of melancholy. *Oribaſius.*

LYCEUM, in Grecian antiquity, an academy ſituated upon the banks of the Iliſſus at Athens. It was compoſed of porticos and walks, where Ariſtotle taught philoſophy; walking there conſtantly every day till the hour of anointing, whence he and his followers were called Peripatetics. See PERIPATETICS.

LYCHNIS, catch-fly, or cuckow-flower, in botany, a genus of plants, the flower of which conſiſts of five petals; the ungues of which equal the cup in length; and their limb is plain; the nectarium is compoſed of two denticles, placed in the neck of each petal: the fruit is a capſule, approaching to an oval figure, covered, and containing only one cell, with numerous roundiſh ſeeds.

LYCIUM, Avignon thorn, in botany, a genus of plants, the corolla of which is a ſingle, funnel-like petal, with a cylindraceous tube, and the limb divided into five ſegments: the fruit is a roundiſh biocular berry, containing a great many kidney-ſhaped ſeeds.

LYCODONTES, in natural hiſtory, the petrified teeth of the lupus-piſcis, or wolf-fiſh, frequently found foſſile. They are of different ſhapes, but the moſt common kind riſe into a ſemiorbicular form, and are hollow within, ſomewhat reſembling an acorn-cup: this hollow is found ſometimes empty, and ſometimes filled with the ſtratum in which it is immerſed. Many of them have an outer circle, of a different colour from the reſt.

LYCOPERDON, puff ball, in botany, a genus of funguſes, of a fleſhy ſubſtance like other muſhrooms, and roundiſh ſhape. They are ſometimes ſeſſile, and ſometimes ſtand on a thick pedicle: they produce ſeparate male and female flowers, contained in the cellular fungous ſubſtance; which remains a long time confuſed, and the fructifications not formed: and when they are formed and the cells diſtinct, it is but a very ſhort time before the very matter of the cells breaks to powder, and the ſeeds fall out of the cavities of the placentæ; and the whole matter, powder, ſeeds, and filaments, of the placentæ, are diſcharged altogether in form of a fine duſt.

LYCOPODIUM, wolf's claw-moſs, in botany, a genus of moſſes conſiſting of branches, furniſhed with leaves, and producing ſpikes formed of ſquamæ, of a different figure from the leaves; at the baſes of which are placed capſules, of a kidney-like ſhape, which have no cup or vagina; and, when ripe, open longitudinally into two parts, and diſcharge a great quantity of fine powder.

LYCOPUS, water hore-hound, in botany, a genus of plants, the flower of which conſiſts of a ſingle petal, with a cylindraceous tube, and a quadrifid limb: there is no fruit; the ſeeds, which are four, and roundiſh, being lodged in the cup.

LYING-TO, or LYING-BY, in navigation, arranging the ſails in ſuch a ſituation that they counteract each other nearly with equal effort, ſome of them drawing her forward, and others forcing her back; the effect of which is, that ſhe makes no way through the ſea, only a very little to the leeward. The intent of lying-by, in general, is to wait for ſome ſhip or boat which is approaching or expected; or in the night-time to prevent running on land, ſhoals, or in the way of danger apprehended to be near.

LYING-TO *in a Storm*, is going with a very little ſail to keep the ſhip from rolling violently, and is more properly expreſſed trying. See TRYING.

LYMPH, *Lympha*, a fine fluid, ſeparated in the body from the maſs of blood, and contained in peculiar veſſels.

Dr. Keil ſays, that the lymph being chemically examined, will be found to contain a great deal of volatile, but not fixed ſalt, ſome phlegm, ſome ſulphur, and a little earth. The uſe of the lymph, he obſerves, may be gathered from the conſideration of the parts into which it diſcharges itſelf: that which comes from the head, neck, and arms, is thrown into the jugular and ſubclavian veins; all the lymphatics which the parts in the cavity of the thorax ſend out, empty themſelves into the thoracic duct; and the lymph from all the reſt of the body, flows to the receptacle of the chyle; ſo that there can be no doubt but its chief uſe is to dilute and perfect the chyle before it mixes with the blood. Now the whole lymph which is ſeparated from the blood, being requiſite for this uſe, it is plain there could be no glands in the abdomen appropriated for the ſeparation of the whole lymph, but what muſt have had a very great ſhare of the blood

which paſſes through the aorta, in order to ſeparate ſo great a quantity of lymph; but the liver and kidneys requiring alſo a great quantity of blood, and which could not be avoided, nature choſe to ſeparate the lymph from the blood which goes to all the parts of the body, rather than appoint particular glands for it in the abdomen, which would have been more at hand, but would have robbed the other parts of a large quantity of blood, and occaſioned a very unequal diſtribution of it.

For the lymphatic glands, ſee the article GLAND.

There are three ſorts of veſſels which go by the name of lymphatics, whereas formerly that word was uſed to ſignify the tranſparent veſſels which accompany the lymphatic glands. The original ſources of theſe veſſels, Winſlow obſerves, are very difficult to be found out, and even their diſtribution through the body has not been ſufficiently traced, to enable us to deſcribe them particularly. As to their termination, we are ſure, that, for the moſt part, they end in the thoracic duct. Beſides theſe veſſels which accompany the glands, there are others, of the ſame ſtructure, found on the ſeveral viſcera, where no lymphatic glands have yet been diſcovered. We meet with them in very great numbers in the external membrane of the liver, and in the duplicature of the ſuperior membranous ligament of this organ. Several diſcoveries about theſe veſſels have been made in brutes.

The third ſort of veſſels termed lymphatic veſſels, are the ſmall arteries and veins which in the natural ſtate tranſmit only the ſerous part of the blood. Theſe veſſels differ from thoſe of the firſt, in the ſmallneſs of their diameter, and in their ſtructure and ſituation. All theſe little arteries and veins are uniform, extremely narrow, and though their ſides are not thinner than thoſe of the valvular lymphatics, yet their diameters are generally leſs. The other lymphatics are full of valves and very thin, but they are not narrow in proportion. The arterial and venous lymphatics are found on the parts which are naturally white, as on the ſkin, and the white of the eye; and their origin are eaſily diſcoverable; but the valvular lymphatics are confined to the internal parts of the body, and are found on the parts of all colours; but we cannot eaſily trace them to their original ſtate.

LYMPHATICS, or LYMPHEDUCTS, in anatomy, fine ſmall veſſels that convey the lymph.

LYNX, or OUNCE, in zoology, a ſpecies of the felis kind, with a truncated tail, a brown body ſpotted with black; the head is large, but not very long; the forehead is flat; the eyes are very large and fierce; the ears are very large and open, but they terminate in a point at the top, and are there ornamented with a pencil of fine black hairs; the mouth is furniſhed with very terrible teeth, and there are whiſkers about it, as alſo over the eyes; the neck is long and thick, the breaſt large and broad, the legs ſtrong, the claws terrible, the tail ſhort and abrupt; and the whole animal large and robuſt, ſomewhat leſs than the lion, very fierce, and remarkable for the quickneſs of its ſight.

LYRE, *Lyra*, a muſical inſtrument of the ſtring kind, much uſed by the ancients. See CITHARA.

The lyre, among poets, painters, ſtatuaries, carvers, &c. is attributed to Apollo and the Muſes.

LYRE, *Lyra*, in aſtronomy, a conſtellation of the northern hemiſphere, the number of whoſe ſtars in Ptolemy's and Tycho's catalogues are only ten, but nineteen in the Britannic catalogue.

LYRIC, in general, ſignifies ſomething ſung or played on the lyre: but it is more particularly applied to the ancient odes and ſtanzas, anſwering to our airs and ſongs, and may be played on inſtruments.

This ſpecies of poetry was originally employed in celebrating the praiſes of gods and heroes, though it was afterwards introduced into feaſts and public diverſions. Mr. Barnes ſhews how unjuſt it is to exclude heroic ſubjects from this kind of verſe, which is capable of all the elevation ſuch matters require. The characteriſtic of this kind of poetry is, according to Trapp, the ſweetneſs and variety of the verſe, the delicacy of the words and thoughts, the agreeableneſs of the numbers, and the deſcription of things moſt pleaſing in their own natures. At firſt the lyric verſe was only of one kind, but afterwards they ſo continued to vary the feet and numbers, that the variety of them now are almoſt innumerable.

This kind of poem is diſtinguiſhed from all other odes by the happy tranſitions and digreſſions which it beautifully admits, and the ſurpriſing and natural eaſy returns to the ſubject, which is not to be obtained without great judgment and genius.

The lyric is, of all kinds of poetry, the moſt poetical, and is as diſtinct, both in ſtyle and thought, from the reſt, as poetry is in general from proſe: it is the boldeſt of all other kinds, full of rapture, and elevated from common language the moſt that is poſſible: ſome odes there are likewiſe, in the free and looſe manner, which ſeem to avoid all method, and yet are conducted by a very clear one; which affect tranſitions ſeemingly without art, but for that reaſon have the more of it; which are above connection, and delight in exclamations and frequent invocations of the muſes; which begin and end abruptly, and are carried on through a variety of matter with a ſort of divine pathos, above rules and laws, and without regard to the common forms of grammar. Pindar has ſet his ſucceſſors the example of digreſſions and excurſions. To write a lyric poem are required not only a flowing imagination, brightneſs, life, ſublimity, and elegance, but the niceſt art and fineſt judgment, ſo as to ſeem luxuriant, and not be ſo; and under the ſhew of tranſgreſſing all laws, to preſerve them.

LYSIMACHIA, willow herb, in botany, a genus of plants, the corolla of which conſiſts of a ſingle petal; the tube is ſcarce diſcernible; the limb is divided into five ovato-oblong ſegments; the fruit is a capſule of a globoſe figure, compoſed of ten valves, and having only one cell; the ſeeds are numerous, and angulated, the receptacle globoſe, large, and punctuated.

M.

MAC

M, A liquid conſonant, and the twelfth letter of the alphabet.

The ſound of this letter is formed by ſhutting the lips, and thereby intercepting the breath, as it is ſtrongly expreſſed through the mouth and noſtrils jointly. Its ſound is always the ſame in Engliſh; it ſuffers no conſonant after it in the beginning of words and ſyllables, unleſs in ſome derived from the Greek, as *amneſty*, &c.

M, in preſcription, ſignifies a maniple, or handful; and at the end of a receipt it imports *miſce*, or mingle.

M, in aſtronomy, &c. denotes meridional, ſouthern; ſometimes *meridies*, or mid-day.

M, in law, the brand of a perſon convicted of manſlaughter, and admitted to the benefit of the clergy; it is burnt on the brawn of the left thumb.

M, among the ancients, was a numeral letter, ſignifying one thouſand; and when a daſh was added at the top of it as $\bar{M}$, it ſignified a thouſand times a thouſand.

MABBY, according to Mr. Boyle, is a kind of wine made from potatoes, and ſaid to be uſed in Barbadoes.

MACAO, or MACAW, in ornithology, a name given to the larger ſpecies of parrots with very long tails.

MACARONIC, or MACARONIAN, an appellation given to a burleſque kind of poetry, made up of a jumble of words of different languages, and words of the vulgar tongue latinized.

MACCABEES, two apocryphal books of Scripture; ſo called from Judas Mattathias, ſurnamed Maccabeus. The firſt book of the Maccabees is an excellent hiſtory, and comes neareſt the ſtyle and manner of the ſacred hiſtorians of any extant. It contains the hiſtory of forty years, from the reign of Antiochus Epiphanes to the death of Simon the high-prieſt; that is, from the year of the world 3829 to the year 3869, 131 years before Chriſt. The ſecond book of the Maccabees begins with two epiſtles ſent from the Jews of Jeruſalem to the Jews of Egypt and Alexandria, to exhort them to obſerve the feaſt of the dedication of the new altar, erected by Judas on his purifying the temple. After theſe epiſtles follows the preface of the author to his hiſtory, which is an abridgement of a larger work, compoſed by one Jaſon, a Jew of Cyrene, who wrote the hiſtory of Judas Maccabeus, and his brethren, and the wars againſt Antiochus Epiphanes, and Eupator his ſon. The ſecond book does not, by any means, equal the accuracy and excellency of the firſt. It contains a hiſtory of about fifteen years, from the execution of Heliodorus's commiſſion, who was ſent by Seleucus to fetch away the treaſures of the temple, to the victory obtained by Judas Maccabeus over Nicanor; that is, from the year of the world 3828, to the year 3843, 147 years before Chriſt.

MACE, *Macis*, the ſecond coat or covering of the nutmeg.

It is a thin and flat membranous ſubſtance, of an oleaginous nature, a yelloviſh colour, extremely fragrant, and of a pleaſant, but acrid and oleaginous taſte. It is to be choſen new, not dry, and of a fragrant ſmell, tough, oleaginous, and of a good yellow.

MAC

Mace abounds with the ſame ſort of oil that is found in the nutmeg, but it is thinner in the mace, and is in a greater quantity. If the oil be ſeparated by diſtillation, what comes firſt over it is thin and limpid like water, and is of the moſt fragrant ſmell; what follows this is yellowiſh, and ſomewhat thicker; and, finally, a third comes over, if the fire be made more violent, which is reddiſh; and all three of theſe are ſo ſubtile and volatile, that, if they are not kept in veſſels very cloſe ſtopped, they will, in a great part, evaporate into the air, all their finer part flying off. An oil may alſo be drawn from mace, in the ſame manner as from nutmegs, and is of a ſomewhat ſofter conſiſtence.

Mace is carminative, ſtomachic, and aſtringent; it poſſeſſes all the virtues of the nutmeg, if taken in a larger doſe; and people have become delirious, for ſome hours, after an immoderate uſe of it. The oils of mace and nutmeg, whether prepared by diſtillation or by expreſſion, are ſo much of the ſame nature, that they may be indiſcriminately uſed for one another on all occaſions. They give eaſe in cholics, and often in nephritic caſes, taken internally from one drop to five or ſix of the diſtilled oil, or an unequal quantity of the expreſſed; and externally, they are of uſe to rub up paralytic limbs; they alſo aſſiſt digeſtion, and will often ſtop vomitings and hiccoughs, only by being rubbed on the regions of the ſtomach. The nurſes have a cuſtom of applying oil of mace, by expreſſion, to children's navels to eaſe their gripes, and that often with ſucceſs; and we are aſſured by authors of credit, that rubbed on the temples, it promotes ſleep. The oils, by diſtillation, are very properly added to the ſtronger cathartics in form of pills, and prove excellent correctives.

MACERATION, *Maceratio*, in pharmacy, an infuſion or ſoaking of ingredients in water, &c. in order either to ſoften them, or extract their virtues. It is a kind of digeſtion.

MACHINE, *Machina*, in general, whatever hath force ſufficient to raiſe or ſtop the motion of a heavy body.

Machines are either ſimple or compound; the ſimple ones are the ſeven mechanical powers, viz. lever, balance, pully, axis and wheel, wedge, ſcrew, and inclined plane. See MECHANICAL POWERS, LEVER, BALANCE, &c.

If the given power is not able to overcome the given reſiſtance when directly applied, that is, when the power applied is leſs than the weight or reſiſtance given; then the thing is to be performed by the help of a machine made with levers, wheels, pullies, ſcrews, &c. ſo adjuſted, that when the weight and power are put in motion on the machine, the velocity of the power may be at leaſt ſo much greater than that of the weight, as the weight and friction of the machine, taken together, is greater than the power. For on this principle depends the mechaniſm or contrivance of mechanical engines uſed to draw or raiſe heavy bodies, or overcome any other force; the whole deſign of theſe being to give ſuch a velocity to the power in reſpect of the weight, as that the momentum of the power may exceed the momentum of the

weight. For if machines are ſo contrived, that the velocity of the agent and reſiſtant are reciprocally as their forces, the agent will juſt ſuſtain the reſiſtant; but with a greater degree of velocity will overcome it. So that if the exceſs of velocity in the power is ſo great as to overcome all that reſiſtance which commonly ariſes from the friction or attrition of contiguous bodies, as they ſlide by one another, or from the coheſion of bodies that are to be ſeparated, or from the weights of bodies to be raiſed; the exceſs of the force remaining, after all theſe reſiſtances are overcome, will produce an acceleration of motion proportional thereto, as well in the parts of the machine, as in the reſiſting body. Now how a machine may be contrived to perform this to the beſt advantage, will appear from the following rules.

1 Having aſſigned the proportion of your power and the weight to be raiſed, the next thing is to conſider how to combine levers, wheels, pullies, &c. ſo that working together, they may be able to give a velocity to the power, which ſhall be to that of the weight ſomething greater than in the proportion of the weight to the power. This done you muſt eſtimate your quantity of friction, and if the velocity of the power be to that of the weight ſtill in a greater proportion than the weight and friction taken together is to the power; then your machine will be able to raiſe the weight. And note, this proportion muſt be ſo much greater, as you would have your engine work faſter.

2. But the proportion of the velocity of the power and weight muſt not be made too great neither: for it is a fault to give a machine too much power, as well as too little. For if the power can raiſe the weight and overcome the reſiſtance, and the engine perform its proper effect in a convenient time, and works well, it is ſufficient for the end propoſed. And it is in vain to make more additions to the engine to increaſe the power any further; for that would not only be a needleſs expence, but the engine would loſe time in working.

3. As to the power applied to work the engine, it may be either a living power, as men, horſes, &c. or an artificial power, as a ſpring, &c. or a natural power, as wind, water, fire, weights, &c.

When the quantity of the power is known, it matters not as to the effect what kind of power it is; for the ſame quantity of any ſort will produce the ſame effect. And different ſorts of powers may be applied in an equal quantity, a great variety of ways.

The moſt eaſy power applied to a machine is weight, if it be capable of affecting the thing deſigned. If not, then wind, water, &c. if that can conveniently be had, and without much expence.

A ſpring is alſo a convenient moving power for ſeveral machines. But it never acts equally as a weight does; but is ſtronger when much bent, than when but a little bent, and that in proportion to the degree of bending, or the diſtance it is forced to. But ſprings grow weaker by often bending, or remaining long bent; yet they recover part of their ſtrength by lying unbent.

The natural powers wind and water may be applied with vaſt advantage to the working of great engines, when managed with ſkill and judgment. The due application of theſe has much abridged the labours of men. For there is ſcarce any labour to be performed, but an ingenious artificer can tell how to apply theſe powers to execute his deſign, and anſwer his purpoſe. For any conſtant motion being given, it may, by a due application, be made to produce any other motions we deſire. Therefore theſe powers are the moſt eaſy and uſeful, and of the greateſt benefit to mankind. Beſides, they coſt nothing, nor require any repetition or renewing, like a weight or a ſpring, which require to be wound up. When theſe cannot be had, or cannot ſerve our end, we have recourſe to ſome living power, as men, horſes, &c.

4. Men may apply their ſtrength ſeveral ways in working a machine. A man of ordinary ſtrength, turning a roller by the handle, can act for a whole day, againſt a reſiſtance equal to thirty pounds weight. And if he works ten hours in a day, he will raiſe a weight of 30 lb. $3\frac{1}{2}$ feet in a ſecond; or if the weight be greater, he will raiſe it ſo much leſs in proportion.

But a man may act, for a ſmall time, againſt a reſiſtance of 50 lb. or more.

If two men work at a windlaſs, or roller, they can more eaſily draw up 70 lb. than one man can 30 lb. provided the elbow of one of the handles be at right angles to that of the other. And with a fly or heavy wheel applied to it, a man may do one-third part more work; and for a little while act with a force, or overcome a continual reſiſtance, of 80 lb. and work a whole day when the reſiſtance is but 40 lb.

Men uſed to carrying, ſuch as porters, will carry ſome 150 lb. others 200 or 250 lb. according to their ſtrength.

A man can draw but about 70 or 80 lb. horizontally; for he can but apply about half his weight.

If the weight of a man be 140 lb. he can act with no greater force in thruſting horizontally, at the height of his ſhoulders, than 27 lb.

A horſe draws to greateſt advantage, when the line of direction is a little elevated above the horizon, and the power acts againſt his breaſt; and can draw 200 lb. for eight hours in a day, at two miles and a half an hour. If he draws 240 lb. he can work but ſix hours, and not quite ſo faſt; and in both caſes, if he carries ſome weight, he will draw better than if he carried none. And this is the weight a horſe is ſuppoſed to be able to draw over a pully out of a well. In a cart, a horſe may draw 1000 lb. The moſt force a horſe can exert is when he draws ſomething above a horizontal poſition.

The worſt way of applying the ſtrength of a horſe, is to make him carry or draw up a hill. And three men, with 100 lb. on their backs, will climb up a ſteep hill faſter than a horſe with 300 lb.

A round walk for a horſe to draw in, at a mill, &c. ſhould not be leſs than forty feet diameter.

5. Every machine ought to be made of as few parts, and thoſe as ſimple as poſſible, to anſwer its purpoſe; not only becauſe the expence of making and repairing will be leſs, but it will alſo be leſs liable to any diſorder. And it is needleſs to do a thing with many, which may be done with fewer parts.

6. If a weight is to be raiſed but a very little way, the lever is the moſt ſimple, eaſy, and ready machine. Or if the weight be very great, the common ſcrew is moſt proper. But if the weight is to be raiſed a great way, the wheel and axle is a proper power, and blocks and pullies are eaſier ſtill; and the ſame may be done by help of the perpetual ſcrew.

Great wheels to be wrought by men or cattle are of moſt uſe and convenience, when their axles are perpendicular to the horizon; but if by water, &c. then it is beſt to have their axles horizontal.

7. As to the combination of ſimple machines together, to make a compound one; though the lever when ſimple cannot raiſe a weight to any great height, and in this caſe is of little ſervice; yet it is of great uſe when compounded with others. Thus the ſpokes of a great wheel are all levers perpetually acting; and a beam fixed to the axis to draw the wheel about by men, or horſes, is a lever. The lever alſo may be combined with the ſcrew, but not conveniently with pullies or with the wedge. The wheel and axle is combined with great advantage with pullies. The ſcrew is not well combined with pullies; but the perpetual ſcrew combined with the wheel is very ſerviceable. The wedge cannot be combined with any other mechanical power; and it only performs its effect by percuſſion; but this force of percuſſion may be increaſed by engines.

Pullies may be combined with pullies, and wheels with wheels. Therefore if any ſingle wheel would be too large, and take up too much room, it may be divided into two or three more wheels and trundles, or wheels and pinions, as in clock-work; ſo as to have the ſame power, and perform the ſame effect.

In wheels with teeth, the number of teeth which play together in two wheels ought to be prime to each other, that the ſame teeth may not meet at every revolution; for when different teeth meet, they by degrees wear themſelves into a proper figure: therefore they ſhould be contrived that the ſame teeth meet as ſeldom as poſſible.

8. The ſtrength of every part of the machine ought to be

be made proportional to the ſtreſs it is to bear. And therefore let every lever be made ſo much ſtronger, as its length and the weight it is to ſupport is greater; and let its ſtrength diminiſh proportionally from the fulcrum, or point where the greateſt ſtreſs is, to each end. The axles of wheels and pullies muſt be ſo much ſtronger as they are to bear greater weight. The teeth of wheels, and the wheels themſelves, which act with greater force, muſt be proportionally ſtronger. And in any combination of wheels and axles, make their ſtrength diminiſh gradually from the weight to the power, ſo that the ſtrength of every part be reciprocally as the velocity it has. The ſtrength of ropes muſt be according to their tenſion, and that is as the ſquares of their diameters. And in general whatever parts a machine is compoſed of, the ſtrength of every particular part of it muſt be adjuſted to the ſtreſs upon it; therefore in ſquare beams the cubes of the diameters muſt be made proportional to the ſtreſs they bear. And let no part be ſtronger or bigger than is neceſſary for the ſtreſs upon it: not only for the eaſe and well going of the machine, but for diminiſhing the friction. For all ſuperfluous matter in any part of it, is nothing but a dead weight upon the machine, and ſerves for nothing but to clog its motion. And he is by no means a perfect mechanic, that does not only adjuſt the ſtrength to the ſtreſs; but alſo contrive all the parts to laſt equally well, that the whole machine may fail together.

9. To have the friction as little as poſſible, the machine ought to be made of the feweſt and ſimpleſt parts. The diameters of the wheels and pullies ought to be large, and the diameters of the arbors or ſpindles they run on, as ſmall as can be conſiſtent with their ſtrength. All ropes and cords muſt be as pliable as poſſible, and for that end rubbed with tar or greaſe; the teeth of wheels muſt be made to fit and fill up the openings; and cut into the form of epicycloids. All the axles, where the motion is, and all teeth where they work, and all parts that in working rub upon one another, muſt be made ſmooth; and when the machine goes, muſt be oiled or greaſed.

10. When any motion is to be long continued, contrive the power to move or act always one way, if it can be done. For this is better and eaſier performed than when the motion is interrupted, and the power is forced to move firſt one way and then another; becauſe every new change of motion requires a new additional force to effect it. Beſides, a body in motion cannot ſuddenly receive a contrary motion, without great violence. And the moving any part of the machine contrary ways by turns, with ſudden jerks, tends only to ſhake the machine to pieces.

11. In a machine that moves always one way, endeavour to have the motion uniform.

12. But when the nature of the thing requires that a motion is to be ſuddenly communicated to a body, or ſuddenly ſtopped; to prevent any damage or violence to the engine, by a ſudden jolt, let the force act againſt ſome ſpring, or beam of wood, which may ſupply the place of a ſpring.

13. In regard to the ſize of the machine; let it be made as large as it can conveniently. The greater the machine the exacter it will work, and perform all its motions the better. For there will always be ſome errors in the making, as well as in the materials; and conſequently in the working of the machine. The reſiſtance of the medium in ſome machines has a ſenſible effect. But all theſe mechanical errors bear a leſs proportion to the motion of the machine in great machines than in little ones; being nearly reciprocally as their diameters; ſuppoſing they are made of the ſame matter, and with the ſame accuracy, and are equally well finiſhed: therefore in a ſmall machine they are more ſenſible; but in a great one almoſt vaniſh: therefore great machines will anſwer better than ſmaller, in all reſpects, except in ſtrength. For the greater the machine the weaker it is, and leſs able to reſiſt any violence.

14. For engines that go by water, it is neceſſary to meaſure the velocity and force of the water. To get the velocity, drop in pieces of ſticks, &c. and obſerve how far they are carried in a ſecond, or any given time.

But if it flows through a hole in a reſervoir, or ſtanding receptacle of water, the velocity will be found from the depth of the hole below the ſurface.

Thus let $s = 16\frac{1}{12}$ feet. $v =$ velocity of the fluid per ſecond. B = the area of the hole. H = height of the water; all in feet. Then the velocity $v = \sqrt{2s\,H}$; and its force = the weight of the quantity $\frac{vv}{2s}$ B or H B of water, or $= \frac{62\frac{1}{2}}{112}$ H B hundred weight: becauſe a cubic foot is $= 62\frac{1}{2}$ lb. avoird. Alſo a hogſhead is about $8\frac{1}{2}$ feet, or 531 lb. and a ton is four hogſheads.

When you have but a ſmall quantity of water, you muſt contrive it to fall as high as you can, to have the greater velocity, and conſequently more force upon the engine.

15. If water is to be conveyed through pipes to a great diſtance, and the deſcent be but ſmall; ſo much larger pipes muſt be uſed, becauſe the water will come ſlow.

Water ſhould not be driven through pipes faſter than four feet per ſecond, by reaſon of the friction of the tubes. Nor ſhould it be much wire-drawn, that is, ſqueezed through ſmaller pipes; for that creates a reſiſtance, as the water-way is leſs in narrow pipes.

16. When any work is to be performed by a water wheel moved by the water running under it and ſtriking the paddles or ladle boards. The channel it moves in ought to be ſomething wider than the hole of the adjutage, and ſo cloſe to the floats on every ſide, as to let little or no water paſs; and when paſt the wheel, to open a little that the water may ſpread. It is of no advantage to have a great number of floats or paddles, for theſe paſt the perpendicular are reſiſted by the back water, and thoſe before it are ſtruck obliquely. The greateſt effect that ſuch a wheel can perform, in communicating any motion, is when the paddles of the wheel move with $\frac{1}{3}$ the velocity of the water; in which caſe, the force upon the paddles is $\frac{4}{9}$ only; ſuppoſing the abſolute force of the water againſt the paddle, when the wheel ſtands ſtill, to be 1. So that the utmoſt motion which the wheel can generate, is but $\frac{4}{27}$ of that which the force of the water againſt the paddles at reſt, would produce. This is when the wheel is at the beſt; but oftentimes far leſs is done. *Emerſon's Mechanics.*

MACHINERY, in epic and dramatic poetry, is when the poet introduces the uſe of machines, or brings ſome ſupernatural being upon the ſtage, in order to ſolve ſome difficulty, or to perform ſome exploit out of the reach of human power. The ancient dramatic poets never made uſe of machines, unleſs where there was an abſolute neceſſity for ſo doing; whence the precept of Horace,

Nec Deus interſit, niſi dignus vindice nodus inciderit.

It is quite otherwiſe with epic poets, who introduce machines in every part of their poems; ſo that nothing is done without the intervention of the gods. In Milton's Paradiſe Loſt, by far the greater part of the actors are ſupernatural perſonages: Homer and Virgil do nothing without them; and in Voltaire's Henriade, the poet has made excellent uſe of St. Louis.

As to the manner in which theſe machines ſhould act, it is ſometimes inviſibly, by ſimple inſpirations and ſuggeſtions; ſometimes by actually appearing under ſome human form; and, laſtly, by means of dreams and oracles, which partake of the other two. However, all theſe ſhould be ſo managed as to keep within the bounds of probability.

MACKREL, in ichthyology, a ſpecies of ſcomber, with five pinnules at the extremity of the back, and a ſpine at the anus.

MACROCOSM, the great world, or univerſe.

The word is Greek μακροκοσμος, and derived from μακρος, great, and κοσμος, the world.

MACROLOGY, in rhetoric, a too copious ſtyle. See the article STYLE.

MACULÆ, in aſtronomy, dark ſpots appearing on the luminous faces of the ſun, moon, and even ſome of the planets; in which ſenſe they ſtand contradiſtinguiſhed from faculæ. See FACULÆ.

Theſe ſpots are moſt numerous and eaſily obſerved in the ſun. It is not uncommon to ſee them in various

forms, magnitudes, and numbers, moving over the ſun's diſk. They were firſt of all diſcovered by the Lyncean aſtronomer Galileo, in the year 1610, ſoon after he had finiſhed his new invented teleſcope. That theſe ſpots adhere to, or float upon, the ſurface of the ſun, is evident for many reaſons. 1. Many of them are obſerved to break out near the middle of the ſun's diſk; others to decay and vaniſh there, or at ſome diſtance from his limb. 2. Their apparent velocities are always greateſt over the middle of the diſk, and gradually ſlower from thence on each ſide towards the limb. 3. The ſhape of the ſpots varies according to their poſition on the ſeveral parts of the diſk: thoſe which are round and broad in the middle, grow oblong and ſlender as they approach the limb, according as they ought to appear by the rules of optics.

By comparing many obſervations of the intervals of time in which the ſpots made their revolution, by Galileo, Caſſini, Scheiner, Hevelius, Dr. Halley, Dr. Derham, and others, it is found that 27 days, 12 hours, 20 minutes, is the meaſure of one of them at a mean; but in this time the earth deſcribes the angular motion of 26° 22′, about the ſun's center: therefore ſay, as the angular motion of 360° + 26° 22′, is to 360°; ſo is 27 days, 12 hours, 20 minutes, to 25 days, 15 hours, 16 minutes; which, therefore, is the time of the ſun's revolution about its axis.

Had the ſpots moved over the ſun in right lined directions, it would have ſhewn the ſun's axis to have been perpendicular to the plane of the ecliptic; but ſince they move in a curvilinear path, it proves his axis inclined to the axis of the ecliptic, and it is found by obſervation, that the angle is equal to 7° 30′; that is, if BD (plate LXXXI. *fig.* 6.) paſſing through the center of the ſun C, be perpendicular to the plane of the earth's equator H I, then will the axis of the ſun's motion, A E, contain, with that perpendicular, the angle A C B = 7° 30′ = G C I, the angle which the equator of the ſun G F makes with the plane of the ecliptic: and the points in which a plane, paſſing through the perpendicular B D and axis A E, cuts the ecliptic, are in the eighth degree of piſces, on the ſide next the ſun's north pole A, and conſequently in the eighth degree of virgo, on the other ſide next the ſun's ſouth pole E. Scheiner had determined the angle B C A to be 7°, and Caſſini made it 8° by his obſervations, which is the reaſon why 7° 30′ is choſen for a mean.

As to the magnitude of the ſpots, they are very conſiderable, as will appear if we obſerve that ſome of them are ſo large as to be plainly viſible to the naked eye: thus Galileo ſaw one of them in the year 1612; and Mr. Martin aſſures us, that he knew two gentlemen that thus viewed them within a few years paſt; whence he concludes, that theſe ſpots muſt therefore ſubtend, at leaſt, an angle of one minute. Now the diameter of the earth, if removed to the ſun, would ſubtend an angle of but 20″; ſo that the diameter of a ſpot, juſt viſible to the naked eye, is, to the diameter of the earth, as 60 to 20, or as 3 to 1; and, therefore, the ſurface of the ſpot, if circular, to a great circle of the earth, is as 9 to 1: but four great circles are equal to the earth's ſuperficies; whence the ſurface of the ſpot is, to the ſurface of the earth, as 9 to 4, or as 2 $\frac{1}{4}$ to 1. Gaſſendus ſays, he ſaw a ſpot whoſe diameter was equal to $\frac{1}{30}$ of that of the ſun, and therefore ſubtended an angle at the eye of 1′ 3″; its ſurface was therefore 5 times larger than the ſurface of the whole earth.

What theſe ſpots are, it is preſumed, no body can tell; but they ſeem to be rather thin ſubſtances than ſolid bodies, becauſe they loſe the appearance of ſolidity in going off the diſk of the ſun: they reſemble ſomething of the nature of ſcum or ſcoria, ſwimming on the ſurface, which are generated and diſſolved by cauſes little known to us: but whatever theſe ſolar ſpots are, it is certain they are produced from cauſes very inconſtant and irregular; for Scheiner ſays he frequently ſaw fifty at once, but for twenty years after ſcarce any appeared. And in this century the ſpots were very frequent and numerous till the year 1741, when, for three years ſucceſſively, very few appeared; and now, ſince the year 1744, they have again appeared as uſual.

Theſe maculæ are not peculiar to the ſun, they have been obſerved in all the planets. Thus Venus was obſerved to have ſeveral by ſignior Bianchini, in the year 1726. As in Venus, ſo in Mars both dark and bright ſpots have been obſerved, firſt by Galileo, and afterwards by Caſſini, &c. Jupiter has had his ſpots obſervable ever ſince the invention and uſe of large teleſcopes. Saturn, by reaſon of his great diſtance on one hand, and Mercury, by reaſon of his ſmallneſs and vicinity to the ſun on the other, have not as yet had any ſpots diſcovered on their ſurfaces, and conſequently nothing in relation to their diurnal motions and inclinations of their axis to the planes of their orbits can be known, which circumſtances are determined in all the other planets, as well as in the ſun, by means of theſe maculæ. See the articles VENUS, MARS, and JUPITER.

The ſpots, or maculæ, obſervable on the moon's ſurface, ſeem to be only cavities or large caverns, on which the ſun ſhining very obliquely, and touching only their upper edge with his light, the deeper places remain without light; but as the ſun riſes higher upon them, they receive more light, and the ſhadow, or dark parts grow ſmaller and ſhorter, till the ſun comes at laſt to ſhine directly upon them, and then the whole cavity will be illuſtrated: but the dark, duſky ſpots, which continue always the ſame, are ſuppoſed to proceed from a kind of matter or ſoil which reflects leſs light than that of the other regions. See MOON.

MADDER, in commerce, is one of the aſperifolious ſtellated plants, or of thoſe which have rough narrow leaves ſet in form of a ſtar at the joints of the ſtalks. The root, which is the only part made uſe of, is long, ſlender, of a red colour both on the outſide and within, excepting a whitiſh pith which runs along the middle.

This plant was formerly cultivated among us in quantity for the uſe of the dyers, who for ſome time paſt have been ſupplied from Holland and Zealand: its culture is now again ſet on foot in this kingdom, under the laudable encouragement of a public ſociety. There are ſome exotic plants which degenerate in our climate, as alkanet; but this is not the caſe with madder, that produced in England being equal to the beſt that is brought from abroad.

The method of cultivating this uſeful plant, as practiſed by the Dutch, is as follows.

In autumn they plow the land, where they intend to plant madder in the ſpring, and lay it in high ridges, that the froſt may mellow it; in March they plow it again; and at this ſeaſon they work it very deep, laying it up in ridges eighteen inches aſunder, and about a foot high; then about the beginning of April, when the madder will begin to ſhoot out of the ground, they open the earth about their old roots, and take off all the ſide-ſhoots, which extend themſelves horizontally, juſt under the ſurface of the ground, preſerving as much root to them as poſſible: theſe they tranſplant immediately upon the tops of the new ridges, at about a foot apart, obſerving always to do this when there are ſome ſhowers, becauſe then the plants will take root in a few days, and will require no water.

When the plants are growing, they carefully keep the ground hoed, to prevent the weeds from coming up between them; for if they are ſmothered by weeds, eſpecially when young, it will either deſtroy or weaken them ſo much, that they ſeldom do well after. In theſe ridges they let the plants remain two ſeaſons, during which time they keep the ground very clean; and at Michaelmas, when the tops of the plants are decayed, they take up the roots, and dry them for ſale.

This is what I could learn of their method of cultivating this plant; to which I will ſubjoin a few obſervations of my own, which I have ſince made upon the culture of madder in England. And, firſt, I find there is no neceſſity for laying the ground up in ridges in England, as is practiſed by the Dutch, eſpecially in dry land, becauſe the places where I ſaw it, were very wet land, which is often floated in winter; ſo that, if the plants were not elevated upon ridges, their roots would rot in winter. Secondly, they ſhould be planted at a greater diſtance in England; the rows ſhould be at leaſt three feet diſtant, and the plants eighteen inches aſunder in the rows: for as they extend themſelves pretty far under ground, ſo where

where they are planted too near, their roots will not have room to grow. And thirdly, I find, that if all the horizontal roots are deſtroyed from time to time, as they are produced, it will cauſe the large downright roots to be much bigger, in which the goodneſs of this commodity chiefly conſiſts: for if the upper roots are ſuffered to remain, they will draw off the principal nouriſhment from the downright roots, as I have experienced; for I planted a few roots upon the ſame ſoil and ſituation, which were of equal ſtrength, and rooted equally well: half of theſe I hoed round, and cut off the horizontal roots, and the other half I permitted the horizontal roots to remain on; and when I took them all up, thoſe which I had hoed about, and kept clear from horizontal roots, were almoſt as large again as the other, and the roots were double the weight; which plainly proves it neceſſary to cut off thoſe ſuperfluous roots: ſo that where this plant is cultivated in quantity, it will be an excellent method to uſe the hoeing-plough, to ſtir the ground, and deſtroy the weeds; for with this inſtrument a large quantity of ground may be kept clean at a ſmall expence: and as this will ſtir the ground much deeper than a common hoe, it will cut the ſuperficial roots, and thereby improve the principal roots.

The crop of madder ſhould be ſhifted into freſh land; for the ground which has had one crop, will not be fit to receive another in leſs than four years; during which time any other annual crop may be cultivated on the land. *Miller.*

When the madder roots are arrived at perfection, they are taken up, well dried, and then reduced to powder by the following mill.

Deſcription of a mill at Liſle, in Flanders, for pulveriſing madder. Plate LXXXIII. *fig.* 1. repreſents the parts of a madder mill: it is inſulated, and covered only by a ſlight thatch. The figures 2, 3, 4, 5, and 6, are ſupplementary to the firſt: we muſt have recourſe to them in our explanation of the parts of the mill: they are therefore diſtinguiſhed by the ſame letters, and each piece is repreſented apart.

A is a lever, or pole, nine feet eight inches long, and ſix inches by four in magnitude. B, the axis of the wheel, ſix feet four inches ſix lines high, and nine or ten inches diameter. C, ſtays, or knees, four feet ſix inches long, and four or five inches ſquare. D, the cogged wheel, three feet one inch ſix lines ſemi-diameter, and furniſhed with fifty-ſeven cogs.

The fellies, or circumference of this wheel, muſt be eight inches by four large: they are ſecured by an iron hoop. The traverſes are ſix inches by four thick, pinned and keyed. The cogs are made of apple-tree wood, and project three inches three lines: they are two inches and a half by two, at their inſertion, and two inches and a half by one at the top: and beneath the wheel they are two inches long, and one and a half ſquare: they act on the rounds of the trundle-head about one inch and a half of their length. The pins that faſten them are alſo apple-tree wood.

E is a beam twelve inches ſquare. F, the trundle-head, thirteen inches ſemi-diameter, furniſhed with eighteen rounds, each a foot long, and two inches diameter: the ends of this trundle-head are two inches and a half thick, and hooped with iron. There are alſo two iron bars pinned on to ſecure the joints of the wood.

G is another axle-tree, or turning-beam, eighteen feet ſix inches ſix lines long, ten inches ſquare near the trundle-head, and fourteen inches diameter in its octogonal part. H, liſters four inches nine lines long, five inches broad, two inches and a half thick. Hence it is apparent, that there are fifteen lifters inſerted into the axle-tree, to ſerve five beetles; that is, three to each. For this reaſon the lifters, the catches, and the peſtles, are diſtinguiſhed by the ſame figure.

K, flyers four feet five inches long, and four inches ſquare: they are loaded with lead at their ends. L catches, which anſwer to the lifters, H: they project five inches nine lines, and are five inches broad and two and a half thick.

M, other catches inſerted into the ſides, or thickneſs of the beetles, N, and anſwer to the levers, Q, N, beetles ten feet four inches long, and four inches ſquare. They are rounded at the end next the mortars, and ſhod with an iron foot four inches diameter, which may be ſeen in figure 6. The beetles are numbered in this manner, 1, 4, 2, 5, 3, (*fig.* 1.) to ſhew the order in which they play when the machine is in motion. O, croſs-bars ſix inches by four, which ſupport the joints, P.

P, joints eight inches long, ſix wide and four thick. An iron pin, keyed, paſſes through each joint, and ſupports a moveable lever, Q, which acts on the catch, M, when the peſtle, N, is to be kept up. Q, levers, two feet three inches ſix lines long, three inches thick, by four wide.

R, keeps, ſix or eight inches wide to prevent the beetles from being diſordered. S, an upright poſt four inches ſquare, in which the croſs-bars and keeps are inſerted. T, mortars cut in a ſingle piece of wood ſixteen inches ſquare: they are eleven inches deep, and their greateſt diameter is ſeven inches: the bottom is lined with lead three or four lines thick.

V, a trough to prevent waſte, over which hangs a cloth, faſtened above to the keep, whilſt the mill is at work.

X, a beam twelve inches ſquare; this beam, and that at the other end, marked E, reſt on the timber work that ſupports the roof. The ſockets and pivots may be ſo well comprehended by the plate, that letters of reference were thought unneceſſary: the ſockets are braſs, the pivots ſteel.

We have purpoſely omitted giving the dimenſions of every part, to avoid confuſion; but the machine may be eaſily conſtructed by attending to the deſcription we have given, which is very exact.

But though the mill deſcribed above, is now actually employed in grinding or pulverizing madder at Liſle; yet it labours under ſeveral imperfections, which we ſhall endeavour to point out, and deſcribe a mill conſtructed in a more perfect manner.

There will be however no occaſion to deſcribe the wheel work of this mill; it being the ſame as that of Liſle: it will be ſufficient to give the proportion of the parts which compoſe it. The pole, or lever, from the center of the axis of the cogged wheel, to the part where the links of the ſpring-tree bar are faſtened, is nine feet long; the wheel is five feet ſemi-diameter, and has ſeventy-two cogs; the trundle-head is ten inches ſemi-diameter to the center of the rounds, and has twelve rounds; thus it makes ſix turns to one of the wheel. The horſe, going three feet in a ſecond, makes three rounds and a half in a minute, and the trundle-head twenty. The axle-tree having on its circumference three lifters to every beetle, each beetle makes ſix ſtrokes in a minute, and the four two hundred and forty in the ſame ſpace. The ſquare part of the axle-tree, on which the trundle-head is fixed, is made out of a piece of wood five inches ſemi-diameter; the other part of the axle-tree is larger, being ſeven inches ſemi-diameter. It is neceſſary it ſhould be ſo large, that the tenons of the lifters may have a proper length and thickneſs: it is much better to be round than an octogon, or any other faced form, as the mortiſes may be more regularly made. From the end of the lifters to the center of the axle-tree is twelve inches; ſo that in their motion they form a circle two feet diameter: the upper face of theſe lifters is cut in a curve, the radii of which are tangents to the circumference of the abovementioned circle; the largeſt of theſe tangents is twelve inches, and determines the greateſt riſe of the beetles. By the liſters being thus curved, the reſiſtance is equal, at whatever height the beetles may be, as they are always in contact with the lifters at the ſame diſtance from their center of gravity. As there are on the length of the axle-tree twelve lifters in four parts, they form, one with the other, angles of thirty degrees, ſuppoſing them to be ſeen one behind the other, as if inſerted on the ſame plane: on this account, when the firſt beetle is raiſed to half its height, the ſecond is about to riſe; the firſt quitting the liſter, the third is on the point of riſing, &c. We ſay, on the point, becauſe we are to obſerve, that the lifters go under the catches, or under that which ſupplies their place, five or ſix lines; and that the greateſt tangent of the curve, being twelve inches, is leſs, by near ſeven lines, than the ſixth part of the circumference of the circle, and gives the firſt beetle

time to quit the lifter before the third riſes: this is neceſſary, that the power may never have more than two beetles to act upon.

The front of the frame-work is that ſide before which the axle-tree turns. The frame-work conſiſts of two beams, ten feet long, and eight inches ſquare: betwixt them, at each end, is a traverſe quarter, ſix inches by four. In the middle of the length and width of the beams, riſe two uprights, which are mortiſed and pinned: they are twelve feet eight inches high without their tenons, fourteen inches wide, and ſix inches thick, ſupported by a brace mortiſed into the front at the height of two feet, at the back part four feet and a half. Betwixt theſe two uprights is the block on which the beetles fall: it is made of a piece of dry tough elm, four feet and a half long betwixt the uprights, to which it is joined by a dove-tail two inches thick, and as much deep: it is twenty inches high, and eighteen broad: it reſts the whole breadth of its ends on the edge of the beams, and betwixt them, on three pieces of wood, at equal diſtances, that lie on the brick work, which ſupports the whole. The block is divided croſs-ways, by a partition two inches thick, parallel with the uprights, and of the ſame breadth, fixed into the block by two tenons, and in a groove wide enough to receive its whole thickneſs; the ſame is obſerved in the back part of the firſt keep, which is fixed: the upper-end is, in like manner, fixed to the upper-keep: this partition divides the block croſs-ways into two troughs, each twenty inches long, formed by two ſloping planks; ſo that the troughs are four inches and a half wide at the bottom within, eleven inches and a half at the top, and twelve inches perpendicularly high: and to prevent the loſs of the light duſt that riſes in the work, the ſpace betwixt the edge of the troughs, and the firſt keep, is boarded up; the boards at the back-part, as well as the ſides of the troughs there, are faſtened with grooves and dove-tails into the uprights and partition; thoſe before lift up in a groove like a ſaſh, and are faſtened by turn-buckles; the fronts of the troughs take entirely off; the pulverized root is taken out with a wooden ſpoon, and a feather broom, and they let it fall on a ſhelf before, which has a ledge four inches high; the fronts of the troughs are then put on again, and are filled with branch-madder; the ſliding-ſhutters are pulled down, and the peſtles are ſet at liberty to work, which had before been ſtopped whilſt the troughs were emptied; this takes but little time in doing; and the mill continues going during the time they gather up the root, and bolt or ſift it. There are two keeps, which ſerve to direct the beetles: the under part of the firſt is three feet, and the under part of the ſecond ten feet: above the block they are three inches and a half thick; the firſt is made level in the front with the back of the groove, that the ſliding-ſhutters may reſt on it when they are raiſed. Each keep conſiſts of two parts; thoſe at the back are let into the uprights, and pinned to them, and ſtrongly faſtened to the partition: thoſe in the front are made to take down, and put up, as occaſion ſerves; they ſlide in the grooves of the uprights, and thoſe that run along the middle of the partition: they have, beſides, two pins, by which they are kept in their places.

The beetles are, at the lower part, twelve inches wide, eighteen inches high, and four inches thick; ſo that their face, or bottom, contains forty-eight ſquare-inches: the upper part, or ſtock of each peſtle, is eight feet and a half long, four inches wide, and three thick; ſo that in the whole, they are ten feet long, without compriſing the cutters, which are four inches long, and formed like a carpenter's chiſſel: the blades of them are two inches and a half wide, and the tongues three inches and a half long: there are ſeventeen to each beetle. There are no catches, becauſe the lifters being in contact with their extremity, always at the ſame diſtance, five inches from the center of gravity of the beetles, the reſiſtance occaſioned by the friction of the ſtocks in the keeps, would have been very conſiderable. To avoid this inconvenience, a mortiſe twenty-five inches long, and three inches wide, is made in the face of the ſtocks of the peſtles, ſtrengthened on the ſides by cheeks two inches thick. The upper parts of theſe mortiſes are ſix feet above the block; that is, on a level with the center of the axle-tree: this part is lined with a plate of copper, ſtrongly ſcrewed, well poliſhed, and rounded at the edge, to facilitate the fall of the beetles. On the ſide of the beetle-ſtock, ſixteen inches below the upper keep, are fixed catches a full inch thick, two inches high, and projecting four inches, to keep the beetles up whilſt the troughs are emptying.

The levers, which ſerve for this purpoſe, are placed behind, and reſt on ſhoulders fixed on a piece of wood, which bears by its two ends on two brackets, mortiſed and pinned into the two uprights, and ſupported by braces: theſe pieces are ſix inches ſquare. The levers are made of quarter-ſtuff, ſix inches and a half ſquare, as well as the lifters of the axle-tree. The upper face of the ſhorteſt arm of the lever is rounded like the lifters, in a curve deſcribed by the original circle, the radius of which is the ſpace from the middle of the catch to the center of motion of the lever, which ſhould be parallel to the bottom of the catch. The radius of this circle, as well as the greateſt of the curve, ſhould be fifteen inches, that the beetle, being raiſed thirteen or fourteen inches, may not ſlip off. That the levers may be the ſtronger, the wood muſt not be croſs grained; and in the center of motion, it ſhould be traverſed by a ſquare iron bar, projecting two inches on each ſide: theſe projections, being rounded into pivots, reſt on the ſhoulders in braſs ſockets. A cord is faſtened to the ſhorteſt arm, and the end of it is faſtened occaſionally to wooden pins at the back of the block, to keep the levers ſomewhat lower than the catches, whilſt the beetles are at work. The longeſt arm leſſens by degrees towards the end, till it is reduced to a ſquare: at this part is fixed another cord, which is faſtened to the ſame wooden pins, when the beetles are to be kept up. The above deſcription, with figures on the copper-plate, will be ſufficient for an ingenious mechanic to conſtruct a mill of this kind, which will doubtleſs be of great advantage to this kingdom, as conſiderable quantities of madder are now planted, and ſome of it fit for uſe.

Madder root gives out its colour both to water and to rectified ſpirit: the watery tincture is of a dark dull red, the ſpirituous of a deep bright one. Taken internally, for it has ſometimes been uſed medicinally as an aperient and diuretic, it tinges the urine red. In the Philoſophical Tranſactions, and in the Memoirs of the French Academy, there are accounts of its producing a like effect upon the bones of animals, to whom it had been given with their food: all the bones, particularly the more ſolid ones, were changed both externally and internally to a deep red, but neither the cartilaginous or fleſhy parts ſuffered any alteration. Some of theſe bones, macerated in water for many weeks together, and afterwards ſteeped and boiled in ſpirit of wine, loſt nothing of their colour, nor communicated any tinge to the liquors.

Madder imparts to woollen-cloth, prepared with alum and tartar, a very durable, though not a very beautiful red dye. As it is the cheapeſt of all the red drugs that give a durable colour, it is the principal one commonly made uſe of for ordinary ſtuffs. Sometimes its dye is heightened by the addition of Brazil-wood; and ſometimes it is employed in conjunction with the dearer reds, as cochineal, for demiſcarlets and demicrimſons. Mr. Hellot, from whoſe *Art de Teindre* the remaining part of this account is extracted, informs us, that thoſe who dye the beſt madder reds are particularly careful to keep the liquor of a heat conſiderably below boiling, increaſing the fire only towards the end, ſo as to make it boil for a minute or two juſt before the cloth is taken out, to confirm the dye. A boiling heat enables water to extract not only the red but a tawny or browniſh matter, which debaſes the red to a dull brick colour.

The proportion of madder is, about half the weight of the cloth. The beſt proportion of ſalts for preparing the cloth to receive the dye, ſeems to be, five parts of alum, and one of red tartar, for ſixteen of the ſtuff; which is to be boiled with theſe for two hours or longer, then kept moiſt for ſome days, and afterwards digeſted with the madder.

A variation in the proportion of the ſalts varies the colour communicated by the madder; and not only the ſhade but the ſpecies of colour. If the alum be diminiſhed and

and the tartar increaſed, the dye proves a red cinnamon: if the alum be entirely omitted, the red is deſtroyed, and a very durable tawny cinnamon is produced.

On boiling the dyed cloth in weak alcaline ley, great part of the colour is deſtroyed, and the remainder appears of a dirty or a kind of fallow hue: ſolution of ſope, on the other hand, diſcharges a part, and leaves the remaining red more lively than before.

Volatile alcalies heighten the red colour of madder, but at the ſame time render it fugitive like themſelves: madder prepared with lime and urine, after the manner practiſed for archil, loſt its red colour on attempting to dye with it, and communicated to the cloth only permanent nut colours.

If a pure red, as that of cochineal, be applied on cloth which has been previouſly dyed blue, and afterwards prepared for receiving this red by boiling with alum and tartar, a purple or violet will be produced, according as the blue or the red prevail. The madder red has not this effect; for as its colour is not a pure red, but is tarniſhed by the tawny matter which its woody fibres have in common with other roots; it gives upon blue only a cheſnut dye, more or leſs deep according to the deepneſs of the blue applied firſt.

There are, however, means of obtaining from madder a fine purple, without the addition of any other colouring drug. A piece of white woollen cloth, weighing half an ounce, was boiled for half an hour with ten grains of Roman alum, and ſix grains of cryſtals of tartar, and then taken out, ſqueezed, and ſuffered to cool. Twenty-four grains of bunch madder were added to the ſame liquor; and after the madder had given out its colour, twenty drops of a ſolution of biſmuth, made in ſpirit of nitre diluted with equal its weight of water, were dropt in. The cloth was now dipt again, and in half an hour taken out, ſqueezed, and waſhed: it appeared of a crimſon colour, nearly as beautiful as if it had been dyed with cochineal. To try the effect of loading it further with the colouring matter, it was returned into the liquor and boiled for a quarter of an hour longer: it had now acquired a purple colour ſufficiently vivid.

On varying this experiment, by keeping the cloth moiſt for ſome days after the preparation with alum and tartar, then dipping it in a plain decoction of madder made as uſual without ſalts; and adding, when it had gained a bright cinnamon colour, the ſame ſolution of biſmuth, the dye, inſtead of a purple, proved only a cheſnut.

The charge of erecting a kiln for drying, and a mill for pulverizing the madder roots, induced Mr. Dambourney to try how far the green root would anſwer the purpoſes of dyeing without any previous preparation. "I therefore, ſays this ingenious gentleman, waſhed them well that no earth might remain upon them: but having myſelf experienced that, as Mr. Du Hamel obſerves, this root loſes ſeven eights of its weight when it is dried ſufficiently to be reduced into powder, I judged that I muſt proportion my quantity accordingly. I therefore put into a quantity of liquor which would have required a pound of powdered madder, eight pound of freſh roots bruiſed in a mortar, and with this I dyed ſome cotton, in the uſual way. When the dyeing was finiſhed, I found that the liquor was ſtill over-charged, though the cotton had imbibed ſo deep a dye as to require two boilings to bring it down to the uſual colour: upon which I repeated the experiment with ſix pounds, and afterwards with four pounds, and I found that this laſt proportion of undried roots is that which gives a colour equal to what is extracted from a pound of dried and powdered madder. One half of the quantity of roots commonly uſed may therefore be ſaved by dyeing with them when they are freſh dug: but though this is a great ſaving, it is not the only one.

"1. There is no need to build kilns or ſheds for drying the roots in changeable weather.

"2. One is exempted from the inconveniences of a too haſty or too ſlow drying, either of which is equally hurtful to the quality of the madder.

"3. The waſte occaſioned by the peeling, garbling, winnowing, &c. of the roots, in the doing of which many if not all of the ſmall ones, that are not for example thicker than ſtraws, are ſeparated with the refuſe parts, and thereby generally loſt, is hereby ſaved.

"4. The expence of grinding is ſaved, together with the waſte and fraud which may be committed at the mill; and likewiſe the inconvenience of waiting till the mill is at liberty, which is of no ſmall conſequence in places where there are not mills appropriated to the grinding of madder only.

"5. Laſtly, the roots thus uſed do not evaporate or ferment, as the powdered madder always does if it be not ſpeedily uſed.

"All theſe advantages put together may be deemed equivalent to a ſaving of five eights in the quantity. The planter who knows how to dye may reap the benefit of them the moment that his roots are large enough to be taken up: the dyers by trade will by degrees be ſenſible of the advantage, and ſhare the profit with the planter, when the madder grounds are near them: they will even find themſelves under a neceſſity of ſo doing whenever this method ſhall become general, and this will be the means of rendering it ſuch; for as there is no particular time to be waited for in order to the madder's acquiring maturity, after it has been planted eighteen months; the huſbandman who carries a parcel of freſh roots to market will be ſure of ſelling them in that ſtate, and the dyer may buy them daily, in proportion to the quantity he wants; or he may agree with the planter for ſuch and ſuch quantities to be delivered to him at ſuch and ſuch times.—I have moreover experienced that theſe roots may be kept freſh during ſeveral months, by laying them in a hole three feet deep, in alternate layers of roots and of earth."

MADNESS, *Mania*, a moſt dreadful kind of delirium without a fever.

Melancholy and madneſs may very juſtly be conſidered as diſeaſes nearly allied; for they have both the ſame origin, that is, an exceſſive congeſtion of blood in the brain: they only differ in degree, and with reſpect to the time of invaſion; melancholy being the primary diſeaſe, of which madneſs is the augmentation. Both theſe diſorders ſuppoſe a weakneſs of the brain, which may proceed from an hereditary diſpoſition; from violent diſorders of the mind, eſpecially long continued grief, ſadneſs, anxiety, dread, and terror; from cloſe ſtudy and intenſe application of mind to one ſubject; from narcotic and ſtupefying medicines; from previous diſeaſes, eſpecially acute fevers; from a ſuppreſſion of hæmorrhages, and omitting cuſtomary bleeding; from exceſſive cold, eſpecially of the lower parts, which forces the blood to the lungs, heart, and brain; and from violent anger, which will change melancholy into madneſs.

It is evident from obſervation, that the blood of maniac patients is black, and hotter than in the natural ſtate; that the ſerum ſeparates more ſlowly and in a leſs quantity than in healthy perſons; and that the excrements are hard, of a dark red or greyiſh colour, and the urine light and thin.

The antecedent ſigns of madneſs are a redneſs and ſuffuſion of the eyes with blood; a tremulous and inconſtant vibration of the eye-lids; a change of diſpoſition and behaviour; ſupercilious looks, a haughty carriage, diſdainful expreſſions, a grinding of the teeth, and unaccountable malice to particular perſons: alſo little ſleep, a violent head-ach, quickneſs of hearing, incredible ſtrength, inſenſibility of cold; and, in women, an accumulation of blood in the breaſts, in the increaſe of this diſorder.

Diſeaſes of the mind have ſomething in them ſo different from other diſorders, that they ſometimes remit for a long time, but return at certain periods, eſpecially about the ſolſtices. It may likewiſe be obſerved, that the raving fits of mad people, which keep the lunar periods, are generally accompanied with epileptic ſymptoms.

This diſeaſe, when it is primary or idiopathic, is worſe than the ſymptomatic, that accompanies the hyſteric or hypochondriac paſſion, which is eaſily cured; as is that alſo which ſucceeds intermitting fevers, a ſuppreſſion of the menſes, of the lochia, of the hæmorrhoids, or which is occaſioned by narcotics. When the paroxyſms are ſlight in the idiopathic kind, the cure is not very difficult; but if it is inveterate, and has but ſhort remiſſions, it is almoſt incurable. Sometimes this diſeaſe terminates by

critical excretions of blood from the noſe, uterus, or anus; ſometimes diarrhœas and dyſenteries will terminate theſe diſorders; and puſtules, ulcers, and the itch have alſo done the ſame. As to the cure, bleeding is the moſt efficacious of all remedies; and where there is a redundance of thick grumous blood, a vein is firſt to be opened in the foot, a few days after in the arm; then in the jugular vein, or one in the noſtrils with a ſtraw; and laſt of all the frontal vein, with a blunt lancet, for fear of hurting the pericranium. Tepid baths made of rain or river-water are alſo convenient; and before the patient enters the bath, he ſhould have cold water poured on his head. Purgatives are likewiſe uſeful; but the lenient are to be preferred to the draſtic: thus manna, caſſia, rhubarb, cream of tartar, or tartar vitriolate, are moſt convenient, when the diſeaſe ariſes from the hypochondriac paſſion, a ſtagnation of the blood in the inteſtines, or in the ramifications of the vena portæ, eſpecially when taken in decoctions and infuſions at repeated intervals, ſo as to operate in an alterative manner. Some kinds of mineral waters are alſo highly efficacious in melancholy and madneſs: but nothing is better for removing the cauſe of theſe diſorders, than depurated mercury. Particular medicines among vegetables, are balm, betony, vervain, brooklime, ſage, worm-blood, flowers of St. John's wort, of the lime-tree, and camphire: from animals, aſs's blood: among minerals, ſteel, cinnabar, ſugar of lead, and the calx and tincture of ſilver. Hoffman is of opinion, that nothing better deſerves the name of a ſpecific in theſe diſeaſes than motion and exerciſe, when duly proportioned to the ſtrength of the body. Sedative medicines are good, but not opiates and narcotics, for theſe induce ſtupidity and folly: thoſe that are good in an epilepſy, will be here beneficial, ſuch as caſtor, ſhavings of hartſhorn, the roots and ſeeds of piony, antiepileptic powders, the valerian root, flowers of the lily of the valley and of the lime-tree. Boerhaave ſays, the principal remedy for raving madneſs is dipping in the ſea, and keeping the patient there as long as he can bear it. As a high degree of the itch has terminated theſe diſorders, it may be proper to make iſſues in the back; but bliſters, contrary to Shaw's opinion, are prejudicial; for by ſtimulating the nervous membranes and the dura mater, they increaſe the ſpaſmodic ſtricture, and the motion of the groſs and bilious blood through the head and the other parts of the body.

As to diet, the patient ſhould carefully abſtain from ſalt and ſmoked fleſh, whether beef or pork; from ſhell fiſh; from fiſh of a heavy and noxious quality; from aliments prepared with onions and garlic: all which generate a thick blood. He ſhould, in general, eat no more than is ſufficient to ſupport nature. Small beer, or cold pure water, are the beſt drink; but ſweet and ſtrong wines are highly prejudicial, as is alſo exceſſive ſmoking tobacco. Change of air and travelling may be beneficial.

For the madneſs proceeding from the bite of a mad dog, ſee HYDROPHOBIA.

MADREPORA, in botany, a genus of ſubmarine plants, of a ſtony hardneſs, but ſomewhat approaching to the form of other vegetables. It is compoſed of a main ſtem, and ſubdivided into a number of branches, which are full of holes or pores, in a radiated form.

MADRIER, in the military art, a long and broad plank of wood, uſed for ſupporting the earth in mining and carrying on a ſap, and in making coffers, caponiers, galleries, and for many other uſes at a ſiege. Madriers are alſo uſed to cover the mouths of petards, after they are loaded, and are fixed with the petards to the gates or other places deſigned to be forced open.

MADRIGAL, in the Italian, Spaniſh, and French poetry, is a ſhort amorous poem, compoſed of a number of free and unequal verſes, neither confined to the regularity of a ſonnet, nor to the point of an epigram, but only conſiſting of ſome tender and delicate thought, expreſſed with a beautiful, noble, and elegant ſimplicity. The madrigal is uſually conſidered as the ſhorteſt of all the leſſer kinds of poetry, except the epigram: it will admit of fewer verſes than either the ſonnet or the roundelay; no other rule is regarded in mingling the rhimes, and the different kinds of verſe, but the fancy and convenience of the author: however, this poem allows of leſs licence than many others, both with reſpect to rhime, meaſure, and delicacy of expreſſion.

MÆMACTERION, *μαιμακτηριων*, in ancient chronology, the fourth month of the Athenian year, conſiſting of only twenty-nine days, and anſwering to the latter part of September and the beginning of October.

MAGAS, in ancient muſic, the name of two inſtruments, the one a ſtringed kind, and the other a kind of flute, which is ſaid to have yielded very high and very low ſounds at the ſame time.

MAGAS alſo ſignifies the bridge of any inſtrument.

MAGAZINE, a place in which ſtores are kept of arms, ammunition, proviſions, &c. Every fortified town ought to be furniſhed with a large magazine, which ſhould contain ſtores of all kinds, ſufficient to enable the garriſon and inhabitants to hold out a long ſiege, and in which ſmiths, carpenters, wheelwrights, &c. may be employed in making every thing belonging to the artillery, as carriages, waggons, &c.

MAGAZINE *of a Ship of War*, a ſmall ſtore-houſe in the after or fore-part of a ſhip's hold, where the gunpowder is ſtowed, and filled into cartridges, bombs, grenadoes, &c. by the gunner and his mates, ready for engagement.

MAGDALEN, or *Nuns of St. Magdalen*, an order of religious in the Romiſh church, dedicated to St. Mary Magdalen, and ſometimes called Magdalenettes. Theſe chiefly conſiſt of courtezans, who quitting their profeſſion, devote the reſt of their lives to repentance and mortification.

MAGI, or MAGIANS, an ancient religious ſect in Perſia, and other Eaſtern countries, who maintained, that there were two principles, the one the cauſe of all good, the other the cauſe of all evil; and abominating the adoration of images, worſhipped God only by fire, which they looked upon as the brighteſt and moſt glorious ſymbol of Oromaſdes, or the good god; as darkneſs is the trueſt ſymbol of Arimanius, or the evil god. This religion was reformed by Zoroaſter, who maintained that there was one ſupreme independent Being; and under him two principles or angels, one the angel of goodneſs and light, and the other of evil and darkneſs: that there is a perpetual ſtruggle between them, which ſhall laſt to the end of the world; that then the angel of darkneſs and his diſciples ſhall go into a world of their own, where they ſhall be puniſhed in everlaſting darkneſs; and the angel of light and his diſciples ſhall alſo go into a world of their own, where they ſhall be rewarded in everlaſting light.

The prieſts of the magi were the moſt ſkilful mathematicians and philoſophers of the ages in which they lived, inſomuch that a learned man and a magian became equivalent terms. The vulgar looked on their knowledge as more than natural, and imagined them inſpired by ſome ſupernatural power: and hence thoſe who practiſed wicked and miſchievous arts, taking upon themſelves the name of magians, drew on it that ill ſignification which the word magician now bears among us.

This ſect ſtill ſubſiſts in Perſia, under the denomination of Gaurs, where they watch the ſacred fire with the greateſt care, and never ſuffer it to be extinguiſhed. See the article GAURS.

MAGIC originally ſignified only the knowledge of the more ſublime parts of philoſophy; but as the magi likewiſe profeſſed aſtrology, divination, and ſorcery, the term magic became odious, being uſed to ſignify an unlawful diabolical kind of ſcience, acquired by the aſſiſtance of the devil and departed ſouls. See the articles ASTROLOGY, DIVINATION, NECROMANCY, &c.

Natural magic is only the application of natural philoſophy to the production of ſurpriſing, but yet natural effects. The common natural magic, found in books, gives us only ſome childiſh and ſuperſtitious traditions of the ſympathies and antipathies of things, or of their occult and peculiar properties; which are uſually intermixed with many trifling experiments, admired rather for their diſguiſe than for themſelves. See EXPERIMENTAL PHILOSOPHY.

MAGIC *Lantern*, in optics. See *Magic* LANTERN.

MAGIC *Square*, a ſquare figure formed of a ſeries of numbers in arithmetical progreſſion, diſpoſed into ſuch parallel

parallel and equal ranks, as that the ſums of each row, as well diagonally as laterally, ſhall be equal.

MAGISTERY, in chemiſtry, commonly denotes a white powder, prepared of certain ſubſtances by precipitation. Theſe ſubſtances are either of the mineral kind, as earth, ſtones, &c. or vegetables, as herbs, reſins, &c. or animals, as bones, horns, and cruſtaceous parts.

The method of preparing it is thus; take the ſubſtance from which you deſign to prepare the magiſtery, and bruiſe or break it groſly; then pour thereon a proper liquor, an acid, &c. in order to its ſolution or extraction. The ſolution is precipitated by an affuſion of the liquor, or by the matter by whoſe force that of the ſolvent is blunted: the precipitated powder may be waſhed, if neceſſary, with common water, and afterwards gently dried. *Schroder.*

MAGISTERY *of Biſmuth* is made by diſſolving biſmuth in ſpirit of nitre, and pouring on it ſalt water, which precipitates the magiſtery to the bottom.

MAGISTERY *of Lead* is made by diſſolving ſaccharum ſaturni in diſtilled vinegar, and then precipitating it with oil of tartar per deliquium.

MAGISTERY *of Reſins*, or reſinous extracts of ſcammony, jalap, &c. are made by diſſolving the matter in ſpirit of wine, and precipitating it with water.

Mr. Boyle takes magiſtery to conſiſt in a preparation of a body, whereby it is converted, by means of ſome additament, into a body of a different kind, as when iron or copper is turned into cryſtals of Mars and Venus.

MAGISTRATE, any public officer to whom the executive power of the law is committed, either wholly, or in part.

MAGNA CHARTA, the great charter of the liberties of England, and the baſis of our laws and privileges.

This charter may be ſaid to derive its origin from king Edward the Confeſſor, who granted ſeveral privileges to the church and ſtate, by charter: theſe liberties and privileges were alſo granted and confirmed by king Henry I. by a celebrated great charter, now loſt; but which was confirmed or re-enacted by king Henry II. and king John. Henry III. the ſucceſſor of this laſt prince, after having cauſed twelve men to make enquiry into the liberties of England in the reign of Hen. I. granted a new charter, which was the ſame as the preſent magna charta; this he ſeveral times confirmed, and as often broke; till in the thirty-ſeventh year of his reign, he went to Weſtminſter-hall, and there, in the preſence of the nobility and biſhops, who held lighted candles in their hands, magna charta was read, the king all the while holding his hand to his breaſt, and at laſt ſolemnly ſwearing faithfully and inviolably to obſerve all the things therein contained, &c. then the biſhops extinguiſhing the candles, and throwing them on the ground, they all cried out, "Thus let him be extinguiſhed, and ſtink in hell, who violates this charter." It is obſerved, notwithſtanding the ſolemnity of this confirmation, king Henry, the very next year, again invaded the rights of his people, till the barons entered into a war againſt him, when, after various ſucceſs, he confirmed this charter, and the charter of the foreſt, in the fifty-ſecond year of his reign. This excellent charter, ſo equitable and beneficial to the ſubject, is the moſt ancient written law in the kingdom: by the 25 Edw. I. it is ordained, that it ſhall be taken as the common law; and by the 43 Edward III. all ſtatutes made againſt it are declared to be void.

MAGNESIA, or MANGANESE, in natural hiſtory. See MANGANESE.

MAGNESIA ALBA, in the materia medica, a fine white earth, ſoluble readily in all acids, the vitriolic as well as the others, into a bitter purgative liquor; and not convertible by fire into quicklime.

This earth has not hitherto been found naturally pure or in a ſeparate ſtate: it was for ſeveral years a celebrated ſecret in the hands of ſome particular perſons abroad, till its preparation was made public by Lanciſi in the year 1717, and afterwards by Hoffman in 1722. It was then extracted from the mother-ley, or the liquor which remains after the cryſtallization, of rough nitre; either by precipitation with a ſolution of fixed alcaline ſalt; or by evaporating the liquor, and calcining the dry reſiduum, ſo as to diſſipate the acids, by which the earth had been made diſſoluble.

The magneſia, in this mother-ley, appears to have proceeded from the vegetable aſhes, which are either made ingredients in the compoſitions from which nitre is obtained, or elſe added to the elixation of the nitre: for the aſhes of different woods, burnt to perfect whiteneſs, and freed from their alcaline ſalt, were found to be of the ſame nature with the true magneſia. But as quicklime alſo, in moſt of the German, French, and other European nitre-works, is commonly employed in large quantity, the earth obtained from the mother-ley's of thoſe works is rather a calcareous earth than magneſia. What is now brought from abroad, under the name of magneſia, gives plain proofs of its calcareous nature, by its burning into quicklime, and forming a ſelenites with the vitriolic acid.

The true magneſia is obtained in great purity, from a filtered ſolution of ſal catharticus amarus; by adding a filtered ſolution of any alcaline ſalt, till a freſh addition produces no further milkineſs. The white earth, which precipitates, is to be waſhed by repeated affuſions of hot as well as cold water, and then dried for uſe.

The magneſia is recommended by Hoffman as an uſeful antacid, a ſafe and inoffenſive laxative in doſes of a dram or two, and a diaphoretic and diuretic, when given in ſmaller doſes, as fifteen or twenty grains. Since this time, it has of late come into great eſteem among us, particularly in heart-burns, and for preventing or removing the many diſorders which children are thrown into from a redundance of acid humours in the firſt paſſages. It is preferred, on account of its laxative quality, to the teſtaceous and other abſorbent earths, which, unleſs gentle purgatives are given occaſionally to carry them off, are apt to lodge in the body, and occaſion a coſtiveneſs very detrimental to infants. It muſt be obſerved, however, that it is not the magneſia itſelf which proves laxative, but the ſaline compound reſulting from its coalition with acids: if there are no acid juices in the ſtomach to diſſolve it, it has no ſenſible operation, and in ſuch caſes it may be rendered purgative by drinking any kind of acidulous liquors after it. All the other known ſoluble earths yield with acids, not purgative, but more or leſs aſtringent compounds.

MAGNET, *Magnes*, loadſtone, in natural hiſtory, a very rich iron ore, found in large detached maſſes, of a duſky iron grey, often tinged with browniſh or reddiſh, and when broken appearing ſomething like the common emery, but leſs ſparkling. It is very heavy, conſiderably hard, of a perfectly irregular and uneven ſurface, and of a firm ſtructure, but uſually with ſome porous irregularities within. It is found in England, and all other places where there are iron mines.

The word is derived from a city in Lydia, called Magneſia, where this ſtone was firſt found.

This famous ſtone was well known to the ancients, but ſcarce any other property of it than that of its attracting iron, as we may ſee in Pliny B. 36. c. 16. However, it appears, that they knew ſomething of its communicating virtue, particularly Plato, when deſcribing that famous chain of iron rings put together, the firſt of which was held by a magnet; and Lucretius makes mention of the ſame magnetic quality operating through the hardeſt bodies.

But we do not ſee by any paſſage in their writings, that they knew any thing of the directive virtue of the loadſtone: and we are utterly in the dark as to the time this diſcovery was firſt made, as alſo when it was applied to the uſe of navigation. It, however, appears, that this diſcovery was made before the year one thouſand one hundred and eighty.

The primary properties of the loadſtone are the following: 1. Every loadſtone has two points, called poles, which emit the magnetic virtue. 2. One of theſe poles attracts, the other repels iron, but no other body. 3. This virtue, being the third ſpecies of attraction, is communicated to iron very copiouſly by the touch, which renders it ſtrongly magnetic. 4. A piece of iron ſo touched by the loadſtone, and nicely ſuſpended on a ſharp point, will be determined to ſettle itſelf in a direction nearly north and ſouth. 5. The end of the needle touched by the ſouth pole of the ſtone, will point northwards; and the contrary. 6. Needles touched by the

the ſtone, will dip below the horizon, or be directed on the touched part to a point within the earth's ſurface: this is called the dipping needle. 7. This virtue may alſo be communicated to iron by a ſtrong attrition all one way. 8. Iron rods or bars acquire a magnetic virtue by ſtanding long in one poſition. 9. Fire totally deſtroys this virtue, by making the ſtone or iron red hot. 10. This power is exerted ſenſibly to the diſtance of ſeveral feet. 11. It is ſenſibly continued through the ſubſtance of ſeveral contiguous bodies or pieces of iron. 12. It pervades the pores of the hardeſt body. And, 13. equally attracts the iron in vacuo as in open air. Theſe and many more are the properties of a body, not more wonderful than uſeful to mankind. See the articles POLE, NEEDLE, VARIATION, &c.

There is a very curious method of rendering viſible the directions which the magnetic effluvia take in going out of the ſtone: thus, let A B, C D, (plate LXXXI. *fig.* 7.) be the poles of the ſtone; about every ſide gently ſtrew ſome ſteel-filings on a ſheet of white paper; theſe ſmall particles will be affected by the effluvia of the ſtone, and ſo poſited as to ſhew the courſe and direction of the magnetic particles on every part: thus, in the middle of each pole, between A B, and C D, it appears to go nearly ſtraight on; towards the ſides it proceeds in lines more and more curved, till at laſt the curved lines from both poles meeting and coinciding, form numberleſs curves on each ſide, nearly of a circular figure, as repreſented in the diagram. This ſeems to ſhew that the magnetic virtue emitted from each pole, circulates to, and enters the other.

The cauſe of the variation of the needle has remained hitherto without any demonſtrative diſcovery; yet ſince its declination, and inclination, or dipping, (ſee the article DIPPING NEEDLE,) do both of them manifeſtly indicate the cauſe to be ſomewhere in the earth, it has given occaſion to philoſophy to frame hypotheſes for a ſolution, which makes the earth a large or general magnet or loadſtone, of which all the leſſer ones are but ſo many parts or fragments, and being poſſeſſed of the ſame virtue, will, when left to move freely, have the ſame diſpoſition and ſimilarity of poſition, and other circumſtances.

The moſt conſiderable of theſe hypotheſes is that of the late ſagacious Dr. Halley, which is this; the globe of the earth is one great magnet, having four magnetical poles or points of attraction, near each pole of the equator two; and that in thoſe parts of the world which lie near adjacent to any one of thoſe magnetical poles, the needle is chiefly governed thereby, the neareſt pole being always predominant over the more remote one. Of the north poles, that which is neareſt to us he ſuppoſes to be in the meridian of the land's end, which governs the variations in European Tartary, and the North Sea; the other he places in a meridian paſſing through California, about 15 degrees from the north pole of the world, which governs the needle in North America, and the oceans on either ſide. In like manner he accounts for the variations in the ſouthern hemiſphere. See Philoſophical Tranſactions, N°. 148.

The variation of the needle from the north and ſouth points of the horizon, not being the ſame but variable in different years, and in a diverſe manner, in different parts of the earth, made the doctor farther conjecture, that two of the magnetic poles were fixed, and two moveable; and in order to make this out, he ſuppoſes the external part of the earth to be a ſhell or cortex, containing within it a magnetic moveable nucleus of a globular form, whoſe center of gravity is the ſame with that of the earth, and moveable about the ſame axis.

Now, if the motions of both the ſhell and nucleus were the ſame, the poles of each would always have the ſame poſition to each other; but he ſuppoſes the motion of the nucleus to be a very ſmall matter leſs than that of the ſhell, which yet is ſcarce ſenſible in 365 revolutions; and, if ſo, the magnetic poles of the nucleus will by ſlow degrees change their diſtance from the magnetic poles of the ſhell, and thus cauſe a variation in that needle's variation, which is governed by the moveable pole of the nucleus, while that variation which reſpects the fixed poles of the magnetic ſhell remains more conſtant; as in Hudſon's-bay the change is not obſerved to be near ſo faſt as in theſe parts of Europe.

The variation of the needle has within a century paſt undergone a remarkable alteration; for at London it was obſerved by Mr. Burrows in the year 1580, to be 11° 15′ eaſt; that is, if N. S. (*fig.* 8) repreſent the north and ſouth points of the horizon, and E. W. the eaſt and weſt points, the needle then had the ſituation A B, ſo that the arch B N = 11° 15′. After that, in the year 1622, it was obſerved by Mr. Gunter to be but 6° eaſt. In the year 1634, Mr. Gellibrand obſerved it to be 4° 5′ eaſt. In 1657, it was obſerved by Mr. Bond to be nothing at all, that is, the needle placed itſelf in the ſituation S, N, and pointed directly to the north. After this, in the year 1672, Dr. Halley obſerved it to be 2° 30′ weſtward; and again, in the year 1692, he found it 6° weſt. Since then, in the year 1722, Mr. Graham, by moſt accurate experiments, found it to be 14° 13′, and at preſent it is between 19 and 20 degrees; and in ſome places it has been found to be 23° weſtward.

The variation of the declination and inclination of the needle is variable and ſubject to no regular computation. What the quantity of both ſorts of variation is in the ſeveral parts of the world, is ſhewn in Dr. Halley's map of the world, improved from the obſervations of Mr. Pound.

The law of magnetic attraction ſeems not yet aſcertained. Sir Iſaac Newton ſuppoſes it to decreaſe nearly in the triplicate ratio of the diſtance; but Dr. Helſham, trying the experiment by his loadſtone, found it to be as the ſquares of the diſtances inverſely; and Mr. Martin aſſures us, that the power of his loadſtone decreaſes in a different manner from either, it being in the ſeſquiplicate ratio of the diſtances inverſely: for exactneſs, he made a ſquare bar of iron juſt a quarter of an inch thick, and then provided three pieces of wood of the ſame form and thickneſs exactly; then poiſing the loadſtone very nicely at the end of a ballance, which would turn with leſs than a grain, he placed under it the iron with firſt one piece of wood, then two pieces; and laſtly, all three pieces upon it; by which means the ſteel-points of the pole were kept at ¼, ½, ¾, of an inch from the iron; and in thoſe diſtances the weights put into the oppoſite ſcale, to raiſe the loadſtone from the wood, which is touched while the beam was horizontal, were as follows:

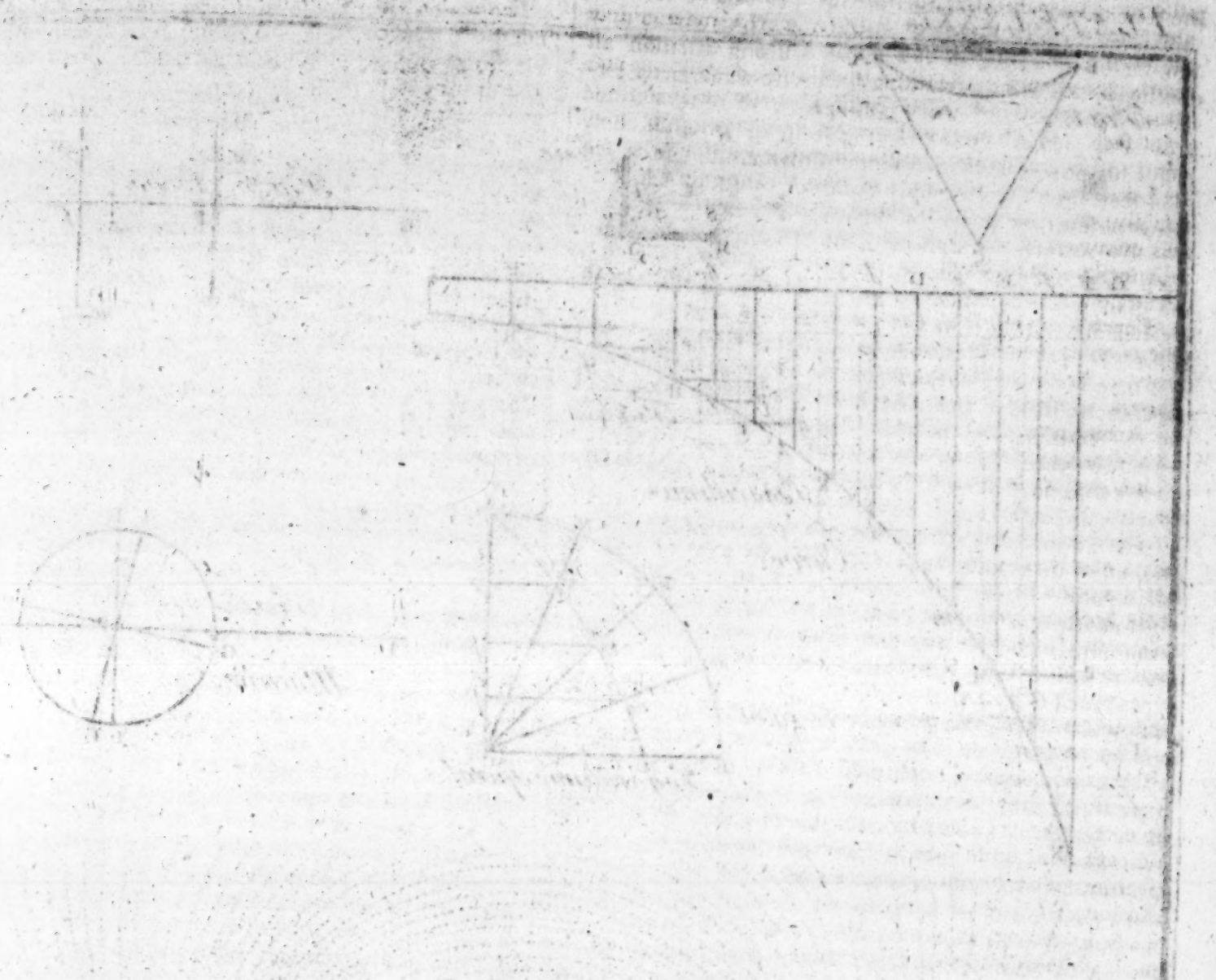
	Grains	Rat. of Sq.	Rat. of Cub.	S. Rat.
Diſtances ¼	156	156	56	156
½	58	39	19	56
¾	28	17	6	30

Whence it appears that the number of grains to counteract the power of the loadſtone in theſe diſtances, approach very near, and are almoſt the ſame with thoſe which are in the ſeſquiplicate ratio, but are widely different from thoſe which are in the duplicate ratio; and this experiment Mr. Martin tried ſeveral times for each diſtance, with ſcarce any variation in the ſucceſs.

The ingenious Muſchenbroek has, with indefatigable pains and application, made experiments of the attractions and repulſions of loadſtones in reſpect to iron and to each other, but could never find any regular proportion in the increaſe of attraction in their approach to, or decreaſe of attraction in their receſs from one another; only that the force of the magnetic virtue did increaſe in the approach to, and diminiſh in the receſs from the ſtone, but not exactly as the diſtance, nor as the ſquare or cube of the diſtance, nor as the ſquare or cube of the diſtance reciprocally; nor in any proportion reducible to numbers; and therefore he very reaſonably conjectures, that the repulſions and attractions diſturb one another, ſo as to confound the proportion; nor are we able to hope for any other rule concerning this matter, till a way be found, if ever it can be, of ſeparating the attracting from the repelling parts.

The power or force of magnets is generally greater in ſmall than in large ones, in proportion to their bulk. It is very rare that very large ones will take up more than three or four times their own weight, but a ſmall one is but tolerably good that will take up no more than eight, ten, or twelve times its weight. The honourable Mr. Berkeley has one whoſe weight is but 43 grains, which will

DAM



5 JA 59

PLATE LXXXI.

Facing Magnet.

Fig. 1. Line.

Fig. 2. Line.

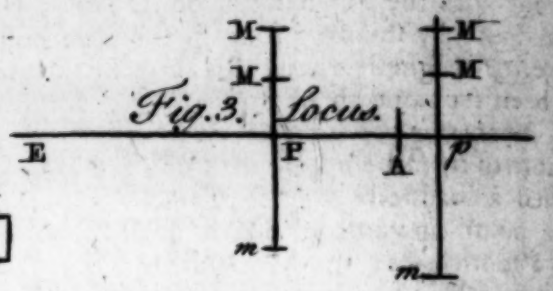


Fig. 3. Locus.

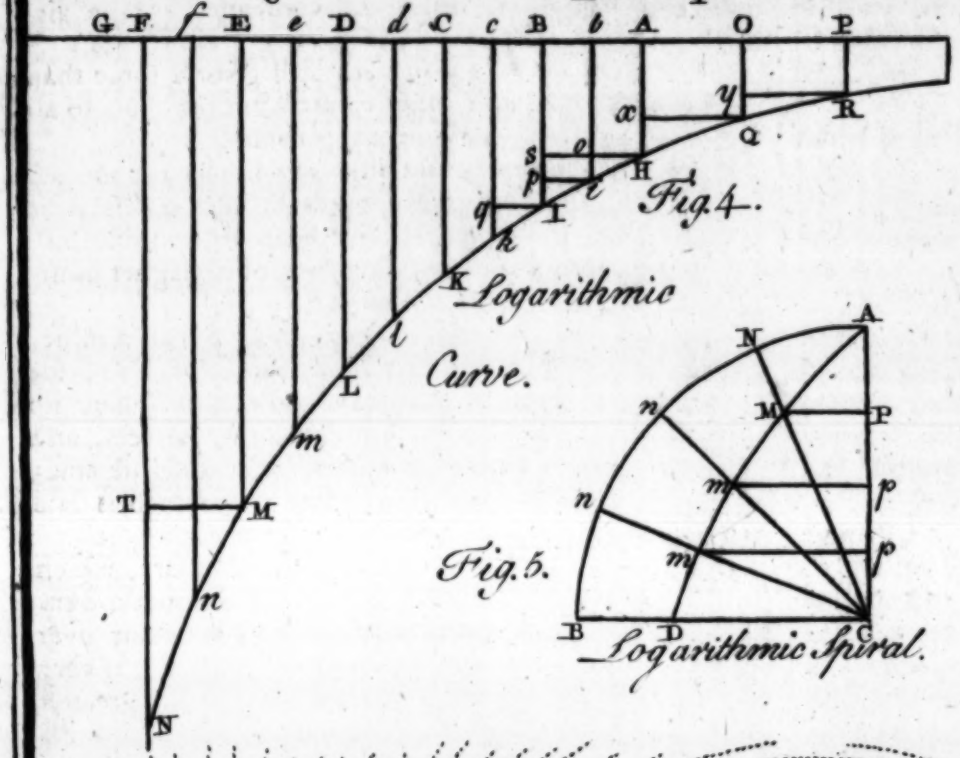


Fig. 4. Logarithmic Curve.

Fig. 5. Logarithmic Spiral.

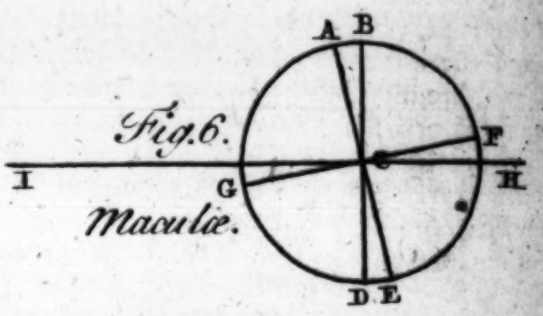


Fig. 6. Maculæ.

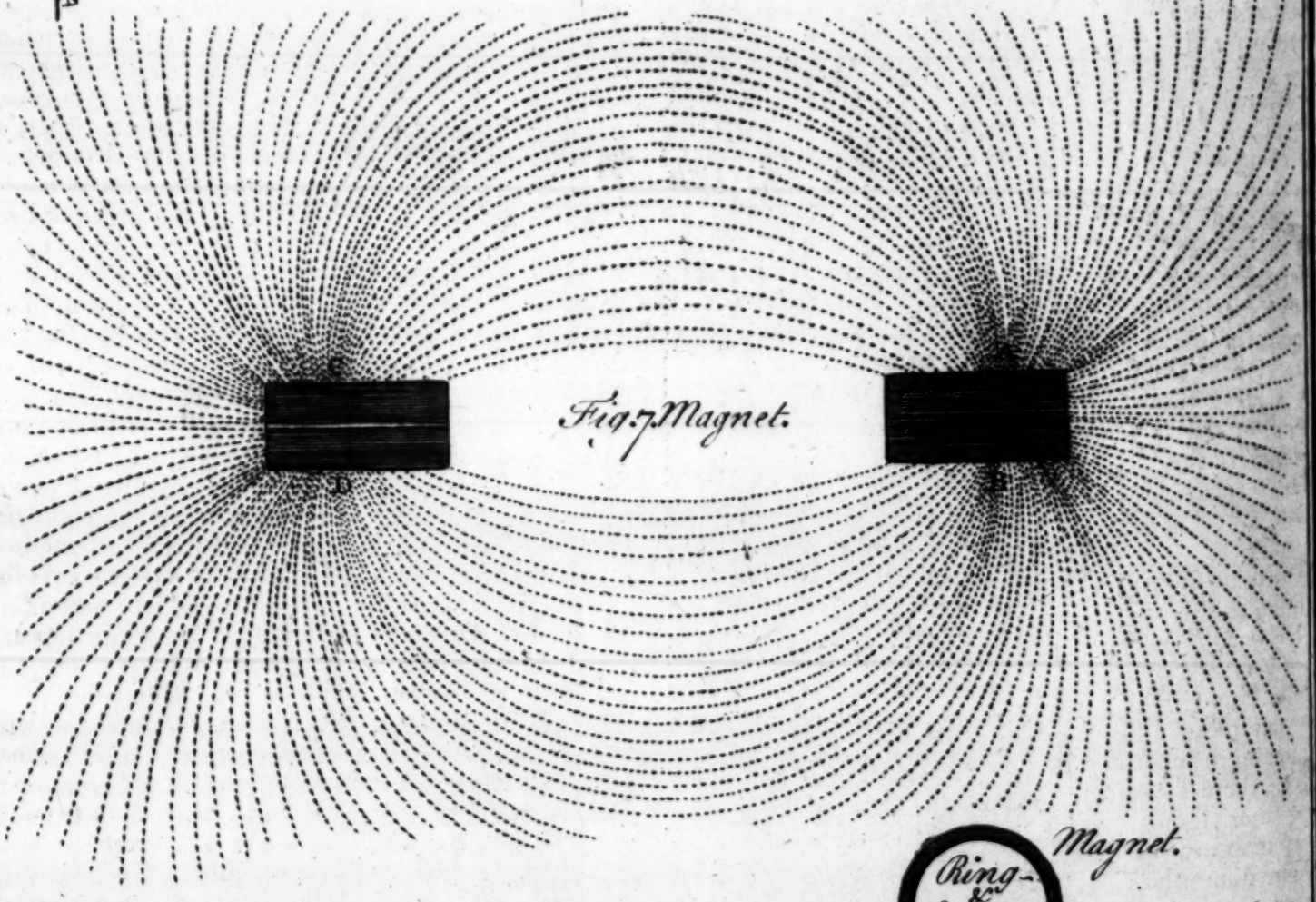


Fig. 7. Magnet.

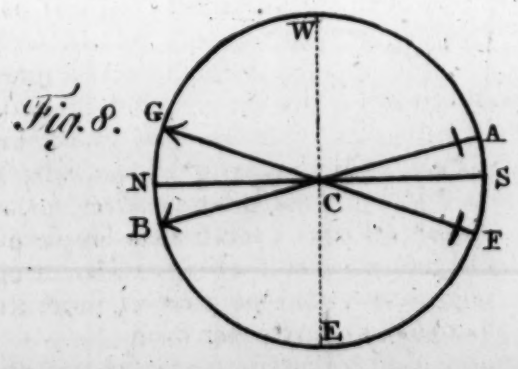


Fig. 8. Magnet.

Magnet.

Iron Weight.

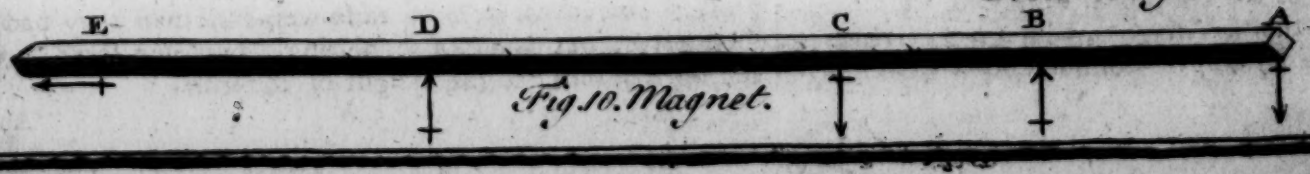


Fig. 10. Magnet.

will take up 1032 grains, which is 24 times its weight; but that of Mr. Newton, which he bears in his ring, inſtead of a diamond, weighs ſcarce three grains, will take up 746 grains, which is 250 times its weight, which is by far the beſt and ſtrongeſt it is preſumed ever ſeen; and therefore, as a curioſity, we have given a cut of the ring and ſtone with the iron hanging to it. (*fig.* 9.)

Iron bars, by ſtanding long in the ſame poſition, will acquire the magnetic virtue to a ſurpriſing degree. There have been ſeen one about 10 feet long and three inches thick, ſupporting the ſummer-beam of a room, which has been able to turn the needle at 8 or 10 feet diſtance, and exceeded a loadſtone of 3½ pounds weight. From the middle point upwards it was a north-pole, and downwards a ſouth-pole; and Mr. Martin ſays he has now by him an iron rod, which has ſeveral poles or parts which change the poſition of the magnetic needle. This rod was the beam of a large ſteel-yard, which let A E (*fig.* 10.) repreſent; then at A, and from thence to B, the ſouth end of the needle is attracted; at B, and from thence to C, the ſouth end is repelled, and the north end attracted; from C to D, the ſouth end is again attracted, and the north end repelled. Laſtly, at the end E begins another pole, and there the needle ſtands nearly parallel with the beam, with neither end attracted.

The poles of a loadſtone are not to be looked upon as two ſuch invariable points as never to change place; for according to Mr. Boyle, the poles of a little bit of magnet may be changed by applying them to the more vigorous poles of another, as has been confirmed by Dr. Knight, who can change at pleaſure the poles of a natural magnet, by means of iron bars magnetically impregnated. Upon gently cutting a magnet through the middle of its axis, each piece becomes a compleat magnet; for the parts that were contiguous under the equator before the magnet was cut, become poles, and even poles of different names; ſo that each piece may become equally a north or ſouth-pole, according as the ſection was made nearer the ſouth or north-pole of the large magnet; and the ſame thing would happen in any other ſub-diviſions. But upon cutting a magnet longitudinally, there will then be four poles, the ſame as before the cutting; only that there ſhall be formed in each piece a new axis parallel to the former, and more or leſs in the inſide of the magnet. We find by experience, that two magnets attract each other by the poles of different denominations; whereas, on the contrary, the two ſimilar poles repel each other.

By a great number of experiments we alſo learn that the form of a magnet in attraction and repulſion reaches ſometimes farther, ſometimes not ſo far. The activity of ſome reaches to 14 feet, and that of others is inſenſible within 8 or 9 inches; the ſphere of activity is greater on certain days than on others, without its ever appearing that the heat, moiſture, or drought of the air contribute any thing to this effect.

It has been found that the poles of the ſame denomination in magnets, and the caſe is the ſame in bodies magnetically impregnated, repel each other, while they are at a mean diſtance from the limits of their ſphere of activity, and on the contrary attract each other in the point of contact; there are other magnets that repel each other with greater vigour towards the middle of their ſphere of activity than near the point of contact, where it ſeems the repulſion diminiſhes: yet Mr. Mitchel pretends to have obſerved, by means of artificial magnets, that the two poles attract and repel equally at the ſame diſtances, and in all kinds of direction; that the error of thoſe who believed the repulſion to be weaker than the attraction was owing to this, that magnets and magnetical bodies are always weakened, by bringing the poles of the ſame denomination near each other; whereas their virtue is increaſed, when the poles of different denominations are brought near each other; that this augmentation or diminution of force, occaſioned by the proximity of two magnets, becomes inſenſible, in proportion as they are removed from each other: for which reaſon we ſee that at a great diſtance attraction and repulſion approach more and more to an equality, and are reciprocally removed from equality, in proportion as the reciprocal diſtance of two magnets diminiſhes; ſo that if a magnet, which is pretty ſtrong and pretty nigh to it, impair conſiderably a weak magnet that approaches it by the poles of the ſame denomination, it ſhall happen that the pole of this laſt ſhall be deſtroyed and changed into a pole of a different denomination, by means of which repulſion will be converted into attraction. In ſhort, by many experiments Mr. Mitchel was convinced, that attraction and repulſion increaſe and decreaſe in the inverſe ratio of the ſquares of the reſpective diſtances of the two poles.

All theſe effects of natural repulſion and attraction find no obſtacle from ſolids or fluids, the wind, flame, or the current of waters; and they are as lively in common air, as in that which is rarefied or condenſed in the air-pump.

The magnet attracts iron with ſtill greater force than it does another magnet; and this attraction extends to all bodies that contain ferrugineous particles.

No ſolid or fluid body can any way hinder the mutual action of iron and a magnet upon each other unleſs it be iron itſelf: nor does the exceſſive heat of iron diminiſh theſe effects, though the exceſſive heat of a magnet diminiſh its virtue, at leaſt for a time.

The attraction of a magnet newly dug out of a mine, makes it to take up only very ſmall pieces of iron; for which reaſon it muſt be armed, in order to augment its force: beſides this, the arming it unites, directs, and condenſes its virtue towards its poles, and cauſes its emanations to tend entirely towards the maſs which is laid thereon.

When you have determined where the poles are, which you may exactly find by placing over the magnet a very fine ſhort needle, which will ſtand perpendicular over each pole, and no where elſe; then you muſt file it very ſmooth at its poles, ſo that the axis ſhall have the greateſt length, yet without too much diminiſhing its other dimenſions. To determine the proportions of the armour, the greater the force of the magnet is, the thicker muſt the pieces of ſteel be of which it is to conſiſt; and for this purpoſe try the magnet with ſeveral ſteel-bars, and the greater weight it takes up with a ſteel-bar on, that bar is to be its armour. Though the attraction of an armed magnet appears conſiderable, yet very weak cauſes deſtroy its effect in a moment; for inſtance, when an oblong piece of iron is attracted under the pole of an excellent magnet, and the pole of a different denomination in another magnet that is weaker is preſented to the lower end of this piece of iron, this weaker magnet will very ſtrongly take away the iron. In like manner, if the point of a needle be put under one of the poles of a magnet ſo as to hang by its head, and preſent to this head any bar of iron by its upper end, the needle will immediately quit the magnet, in order to adhere to the bar; but if the needle hold by its head to the pole of the magnet, then neither the bar of iron, nor a weak magnet ſhall diſengage it; and there is another ſlight circumſtance which makes an armed and vigorous loadſtone appear to have no more force, and that is the too great length of the iron which is to be raiſed by one of the poles.

In order to communicate the magnetic virtue effectually, theſe methods are made uſe of. 1. It has been diſcovered that iron rubbed upon one of the poles of the magnet, acquires a great deal more virtue than from any other part thereof, and this is more conſiderable from an armed than a naked magnet. 2. The more gently the iron is preſſed, and the more it is preſſed againſt the pole, the more magnetical it becomes. 3. It is more convenient to impregnate iron on one pole than on both ſucceſſively. 4. The iron is much better impregnated by preſſing it uniformly, and in the ſame direction, according to its length, than by rubbing it by the middle; and the extremity which touches the pole laſt, retains the moſt virtue. 5. A piece of poliſhed ſteel, or a bit of pointed iron, receives more virtue than a ſimple piece of iron of the ſame figure; and, *cæteris paribus*, a piece of iron that is long, ſmall, and pointed, is more ſtrongly impregnated than that of any other form.

The communication of the magnetic virtue does not ſenſibly impair that of the loadſtone; though it has been obſerved, that ſome magnets have communicated a greater power to iron to raiſe weights, than they had themſelves, but without impairing their own force, or adding any thing to the weight of the iron.

As ſeveral ways have been propoſed for recovering the decayed virtue of loadſtones, but to little purpoſe, eſpecially that of keeping the ſtone conſtantly in ſteel filings, we ſhall here relate the remarkable experiment of Mr. Haac for this purpoſe, as it was attended with great ſucceſs. This gentleman had a magnet weighing fourteen ounces and a half, armed, which would take up ſixteen times its own weight; but having laid it by for ſome years unuſed, it loſt one fourth part of its virtue, or more; whereupon he hung as much weight to the ſtone as it would ſuſtain, and ſo left it for ſome weeks; then returning, he applied more weight to the former, which it very eaſily bore, and then repeating the addition of more weight at ſeveral periods, in the ſpace of about two years, he found that the ſtone had not only recovered its former ſtrength, but increaſed it ſo far, that it would now take up more than twenty pounds, whereas at firſt it would not take up fifteen.

Artificial MAGNET, a ſteel bar impregnated with the virtues of the magnet, ſo as to poſſeſs all the properties, and be uſed inſtead of the natural loadſtone.

There have been ſeveral methods propoſed for making artificial magnets, but none has yet met with greater ſucceſs than that of Mr. Canton's, a gentleman well known to the learned world, and to whom we owe this diſcovery.

Procure a dozen of bars, ſix of ſoft ſteel, each three inches long, one quarter of an inch broad, and one twentieth of an inch thick; with two pieces of iron, each half the length of one of the bars, but of the ſame breadth and thickneſs: alſo ſix pieces of hard ſteel, each five inches and a half long, half an inch broad, and three twentieths of an inch thick; with two pieces of iron of half the length, but the whole breadth and thickneſs of one of the hard bars; and let all the bars be marked with a line quite round them at one end. Then take an iron poker and tongs, (pl. LXXXII. *fig.* 3.) or two bars of iron, the larger they are and the longer they have been uſed, the better; and fixing the poker upright between the knees, hold to it, near the top, one of the ſoft bars, having its marked end downwards, by a piece of ſewing ſilk, which muſt be pulled tight by the left hand, that the bar may not ſlide: then graſping the tongs with the right hand, a little below the middle, and holding them nearly in a vertical poſition, let the bar be ſtroked by the lower end from the bottom to the top, about ten times on each ſide, which will give it a magnetic power ſufficient to lift a ſmall key at the marked end; which end, if the bar was ſuſpended on a point, would turn towards the north, and is therefore called the north pole, and the unmarked end is, for the ſame reaſon, called the ſouth pole. Four of the ſoft bars being impregnated after this manner, lay the two (*fig.* 1.) parallel to each other, at the diſtance of one fourth of an inch, between the two pieces of iron belonging to them, a north and a ſouth pole againſt each piece of iron: then take two of the four bars already made magnetical, and place them together ſo as to make a double bar in thickneſs, the north pole of one even with the ſouth pole of the other; and the remaining two being put to theſe, one on each ſide, ſo as to have two north and two ſouth poles together; ſeparate the north from the ſouth poles at one end by a large pin, and place them perpendicularly with that end downward on the middle of one of the parallel bars, the two north poles towards its ſouth, and the two ſouth poles towards its north end: ſlide them backward and forward three or four times the whole length of the bar, and removing them from the middle of this, place them on the middle of the other bar as before directed, and go over that in the ſame manner; then turn both the bars the other ſide upwards, and repeat the former operation: this being done, take the two from between the pieces of iron, and placing the two outermoſt of the touching bars in their room, let the other two be the outermoſt of the four to touch theſe with; and this proceſs being repeated till each pair of bars have been touched three or four times over, which will give them a conſiderable magnetic power, put the half dozen together after the manner of the four, (*fig.* 2.) and touch with them two pair of the hard bars placed between their irons, at the diſtance of about half an inch from each other; then lay the ſoft bars aſide, and with the four hard ones, let the other two be impregnated, (*fig.* 5.) holding the touching bars apart at the lower end near two tenths of an inch, to which diſtance let them be ſeparated after they are ſet on the parallel bar, and brought together again before they are taken off; this being obſerved, proceed according to the method deſcribed above, till each pair have been touched two or three times over; but as this vertical way of touching a bar will not give it quite ſo much of the magnetic virtue as it will receive, let each pair be now touched once or twice over in their parallel poſition between the irons, (*fig.* 6.) with two of the bars held horizontally, or nearly ſo, by drawing at the ſame time the north of one from the middle over the ſouth end, and the ſouth of the other from the middle over the north end of a parallel bar; then bringing them to the middle again, without touching the parallel bar, give three or four of theſe horizontal ſtrokes to each ſide. The horizontal touch, after the vertical, will make the bars as ſtrong as they poſſibly can be made, as appears by their not receiving any additional ſtrength, when the vertical touch is given by a great number of bars, and the horizontal by thoſe of a ſuperior magnetic power. This whole proceſs may be gone through in about half an hour; and each of the large bars, if well hardened, may be made to lift twenty-eight troy ounces, and ſometimes more. And when theſe bars are thus impregnated, they will give to an hard bar of the ſame ſize its full virtue in leſs than two minutes; and therefore will anſwer all the purpoſes of magnetiſm in navigation and experimental philoſophy much better than the loadſtone, which is known not to have a ſufficient power to impregnate hard bars. The half dozen being put into a caſe (*fig.* 4.) in ſuch a manner as that two poles of the ſame denomination may not be together, and their irons with them as one bar, they will retain the virtues they have received: but if their power ſhould, by making experiments, be ever ſo far impaired, it may be reſtored without any foreign aſſiſtance in a few minutes. And if, out of curioſity, a much larger ſet of bars ſhould be required, theſe will communicate to them a ſufficient power to proceed with, and they may in a ſhort time, by the ſame method, be brought to their full ſtrength.

MAGNIFYING, in philoſophy, the making of objects appear larger than they would otherwiſe do; whence convex lenſes, which have the power of doing this, are called magnifying glaſſes; and of ſuch glaſſes are microſcopes conſtructed. See LENS and MICROSCOPE.

MAGNITUDE, whatever is made up of parts locally extended, or that hath ſeveral dimenſions; as a line, ſurface, ſolid, &c. See the article LINE, &c.

The apparent magnitude of a body is that meaſured by the viſual angle, formed by rays drawn from its extremes to the center of the eye; ſo that whatever things are ſeen under the ſame or equal angles, appear equal; and *vice verſa*.

MAGNOLIA, the laurel-leaved tulip-tree, in botany, a genus of plants, the corolla of which conſiſts of nine oblong, hollow, and obtuſe petals, narroweſt towards the baſe: the fruit is an oval ſtrobilus, compoſed of compreſſed, roundiſh, acute, and cluſtered capſules, which are unilocular, and contain a ſingle kidney-ſhaped ſeed.

Could this beautiful tree be ſo far naturalized as to endure the cold of our ſevere winters, it would make one of the greateſt ornaments of our gardens. It is propagated by ſeeds, which ſhould be procured from Carolina.

MAHOMETANS, thoſe who believe and practiſe the religion of Mahomet.

The fundamental poſition on which Mahomet erected the ſuperſtructure of his religion, was, that there has been from the beginning of the world but one true orthodox belief, which conſiſts in acknowledging one only true God, and obeying ſuch of his meſſengers and prophets as he has from time to time ſent into the world, to reveal his will to mankind. Upon this foundation he ſet up for a prophet to extirpate idolatry, which was the religion of the Arabs, hs countrymen, and to reform the other abuſes crept into religion. The whole ſubſtance of his doctrine he therefore comprehended in theſe two principal articles of faith, "There is but one God, and Mahomet is his prophet;" in conſequence of which laſt article,

ticle, all ſuch ordinances and inſtitutions as he thought fit to eſtabliſh, were to be received as obligatory and of divine authority.

The Mahometans divide their religion into two general parts, faith and practice; of which the firſt is divided into ſix diſtinct branches; belief in God, in his angels, in his Scriptures, in his prophets, in the reſurrection and final judgment, and in God's abſolute decrees. The points relating to practice are, prayer, with waſhings, &c. alms, faſting, pilgrimage to Mecca, and circumciſion. In regard to theſe practical points, Mahomet, it is ſaid, declared, that the practice of religion is founded upon cleanlineſs, which is one half of faith and the key of prayer. Alms-giving is thought to be ſo pleaſing in the ſight of God, that the caliph Omar Ebn Abdalaziz uſed to ſay, prayer carries us half way to God; faſting brings us to the door of his palace; and alms procure us admiſſion: and Mahomet himſelf uſed to ſay of faſting, that it was the gate of religion; and the odour of the mouth of him who faſteth is more grateful to God, than that of muſk. Beſides theſe they have ſome negative precepts and inſtitutions of the koran, in which ſeveral things are prohibited, as uſury, the drinking of wine, all games that depend upon chance, the eating of blood and ſwine's fleſh, and whatever dies of itſelf, is ſtrangled, or is killed by a blow or by another beaſt. Theſe doctrines and practices Mahomet eſtabliſhed by the ſword, by preaching, and by the alkoran or koran, which contains the principles of his religion; and he and his followers met with ſuch ſucceſs, as in a few years to ſubdue half the known world. See ALCORAN.

MAIDEN, an inſtrument uſed in Scotland for beheading criminals.

This is a broad piece of iron about a foot ſquare, very ſharp on the lower part, and loaded above with a very heavy weight of lead. At the time of execution it is pulled up to the top of a narrow wooden frame, about ten feet high, and as broad as the engine, with mouldings on each ſide for the maiden to ſlide in. A convenience is made about four feet from the ground, for the priſoner to lay his neck; and there is a kind of bar ſo faſtened as to keep him from ſtirring. The priſoner being thus ſecured, and the ſign given, the maiden is let looſe, which in a moment ſeparates his head from his body.

MAIDEN-ASSIZE, an aſſize in which no perſon is condemned to die.

MAJESTY, a title given to kings, which frequently ſerves as a term of diſtinction.

MAIL, or *Coat of* MAIL, a piece of defenſive armour for the body, made of ſmall iron rings, interwoven in the manner of a net.

MAIM, MAIHEM, or MAYHEM, in law, a wound by which a perſon loſes the uſe of a member that might have been a defence to him.

MAIN, in the ſea-language, chief, principal, as the main-maſt, main-yard, main-ſail, main-hatchway, &c.

MAIN alſo implies ſome continent or great land, as oppoſed to iſland: We ſteered between the iſland and the main.

For the articles	MAIN-BOWLINES	See	BOWLINES
	MAIN-BRACES		BRACES
	MAIN-HATCHWAY		HATCHWAY
	MAIN-JEARS		JEARS
	MAIN-LIFTS		LIFTS
	MAIN-MAST		MAST
	MAIN-SAIL		SAIL
	MAIN-SHROUDS		SHROUDS
	MAIN-TYE		TYE
	MAIN-YARD		YARD.

MAINPRISE, in law, is the receiving a perſon into friendly cuſtody, who might otherwiſe be committed to priſon, on ſecurity given that he ſhall be forth-coming at a certain time and place appointed. There is a difference between bail and mainpriſe, for a perſon mainpriſed is ſaid to be at large from the day of his being mainpriſed, till the day of his appearance, and is not liable to be confined by his ſureties: but when a perſon is let to bail by a judge, &c. till a certain day, he is in law always accounted in the ward of his bail during the time, and they may, if they pleaſe, keep him in priſon.

MAINTENANCE, in law, is an unlawful maintaining or ſupporting a ſuit between others, by ſtirring up quarrels, or interfering in a cauſe in which the perſon has no concern.

MAJOR, in the art of war, the name of ſeveral officers of very different ranks and functions; as, 1. Major-general, the next officer to the lieutenant-general; his chief buſineſs is to receive the orders from the general, or in his abſence from the lieutenant-general of the day, which he is to diſtribute to the brigade-majors, with whom he is to regulate the guards, convoys, and detachments. When there are two attacks at a ſiege, he commands that on the left. He ought to be well acquainted with the ſtrength of each brigade, of each regiment in particular, and to have a liſt of all the field officers. In ſhort, he is in the army, what a major is in a regiment. He is allowed an aid de camp, and has a ſerjeant and fifteen men for his guard. 2. Major of a brigade, the officer who receives the orders from the major-general, and afterwards delivers them to the adjutants of the regiments at the head of the brigade; where he takes and marches the detachments, &c. to the general rendezvous. He ought to be an expert captain, to know the ſtate and condition of the brigade, and keep a roll of the colonels, lieutenant-colonels, majors, and adjutants. 3. Major of a regiment, the next officer to the lieutenant-colonel, generally promoted from the eldeſt captain. He is to take care that the regiment be well exerciſed, to ſee it march in good order, and to rally it in caſe of its being broke. He is the only officer among the foot that is allowed to be on horſeback in time of action, that he may the more readily execute the colonel's orders, either in advancing or drawing off the regiment. 4. Major of a regiment of horſe, is the firſt captain, who commands in the abſence of the colonel. 5. Town-major, the third officer in a garriſon, being next to the deputy-governor. He ought to underſtand fortification, and hath charge of the guards, rounds, patrols, &c. His buſineſs is alſo to take care that the ſoldiers arms are in good order; he likewiſe orders the gates to be opened and ſhut, and gives the governor an account of all that paſſes within the place.

There are alſo aids-major, drums-major, &c. ſo called from their preheminence above others of the ſame denomination.

MAJOR, in logic, the firſt propoſition of a ſyllogiſm. See the article SYLLOGISM.

MAJOR and MINOR, in muſic, ſignify imperfect concords, which differ from each other by a ſemi-tone minor. See CONCORD.

MAJOR-DOMO, an appellation formerly given to the ſteward or maſter of the king's houſhold.

MAJORANA, marjoram, in botany, a low plant, with ſlender, ſquare, branched, woody ſtalks, and little, oval, ſomewhat downy leaves, ſet in pairs: on the tops grow ſcaly heads of ſmall whitiſh labiated flowers, whoſe upper lip is erect and cloven, the lower divided into three ſegments. It is ſown annually in gardens, for culinary as well as medicinal uſes: the ſeeds, which rarely come to perfection in England, are procured from the ſouth of France, where the plant is ſaid to be indigenous.

The leaves and tops of marjoram have a pleaſant ſmell, and a moderately warm aromatic bitteriſh taſte. Infuſions of them in water, in colour browniſh, ſmell pretty ſtrongly, and taſte weakly and unpleaſantly of the herb: the blackiſh green tinctures, made in rectified ſpirit, have leſs ſmell, but a ſtronger and more agreeable taſte. In diſtillation with water, an eſſential oil is obtained, amounting, as Hoffman obſerves, to about one ounce from ſixty-four of the leaves ſlightly dried; when carefully drawn, of a pale yellow colour; by age, or too haſty fire in the diſtillation, contracting a reddiſh hue; of a very hot penetrating taſte, and in ſmell not near ſo agreeable as the marjoram itſelf: the remaining decoction, thus diveſted of the volatile aromatic matter, is weakly, but unpleaſantly, bitteriſh and auſtere. Great part of the aromatic matter of the herb riſes alſo in the inſpiſſation of the ſpirituous tincture, and impregnates the diſtilled ſpirit: the remaining extract is ſtronger in taſte than that made with water, its quantity being leſs, but has not much of the warmth or flavour of the marjoram.

This plant has been chiefly recommended in diſorders of

of the head and nerves, in uterine obſtructions and mucous diſcharges proceeding from what is called a cold cauſe, that is, from a laxity and debility of the ſolids, and a ſluggiſh ſtate of the juices, and in the humoural aſthmas and catarrhs of old people. The powder of the leaves, thin diſtilled water, and the eſſential oil properly diluted, are agreeable errhines, and accounted particularly uſeful in pituitous obſtructions of the noſtrils, and diſorders of the olfactory organs.

MAJORITY, the greater number of perſons.

MAIZE, a ſpecies of grain ſo generally uſed for food in America, that it has obtained the name of Indian corn.

The ſize of its ear differs greatly, according to the fertility of the ſoil, and the warmth of the climate in which it is cultivated; but at a medium, it is about a ſpan long, and commonly has eight or more rows of grain, each of which uſually contains upwards of thirty ſeeds, of various colours, as red, white, yellow, blue, olive, greeniſh, blackiſh, ſpeckled, ſtriped, &c. ſometimes in the ſame field, and the ſame ear: but the white and yellow are the moſt common: nor does this diverſity of colours ever reach beyond the outſide of the grain, the flour of which always is white, with a little tinge of yellow. Theſe ſeeds, which are as big as large peas, are round at their outer ſurface, very ſmooth, and ſet extremely cloſe, in ſtraight lines. The ear is cloathed and armed with ſeveral ſtrong thick huſks, which defend it not only from unſeaſonable rains and the cold of the night, for it does not ripen fully in ſome places, till towards the latter end of September, but alſo from crows and other birds, which, being allured by the ſweetneſs of the grain before it hardens, flock to it in great numbers, ſuck through the top of the outer covering, and devour as far as they can reach. In the northern colonies, the ſtalk of this plant, which contains a remarkably ſweet pith, and is jointed like a cane, does not grow near ſo high as in the ſouthern parts. It has long leaves, almoſt like flags, at every joint, and at the top a bunch of flowers, of various colours, highly pleaſing to the eye. The northern Indians, far up in the country, have a ſpecies of this grain, called Mohawk's corn, which never grows high, and, though planted in June, ripens in due ſeaſon. The general time of planting it is between the middle of March and the beginning of June, or, more particularly, from the middle of April to the middle of May.

This plant is ſeldom cultivated in England for uſe, though it might probably turn to good account, as was lately experienced by a gentleman in Lincolnſhire, who planted this corn in an open field, where it ripened perfectly, and yielded an abundant crop. Large quantities of it are raiſed in Aſia and Africa, in ſeveral parts of France, in Italy, Germany, and North America.

The Engliſh in North America plough the ground thoroughly before the grain is planted. They ſeldom, if ever, dung the whole face of the field, but ſometimes put a little dung in each hill of corn, if they think the ground requires it.

In order to plant the corn, they make trenches or furrows, with a plough, acroſs the field, at certain diſtances from each other, and croſs theſe with others of the ſame diſtance, which divide the field into ſquares; and where the trenches interſect, the grain is put in, and covered. Three or four grains are commonly planted for each hill. The intermediate ground is afterwards ploughed at leiſure, as the plants grow, and want more looſe earth for the roots to ſpread in. The hills are made at the time of weeding; ſome looſe earth being then hoed up over the roots, and round the ſtems or ſtalks of the corn.

The corn is planted at different diſtances in different places. In the northern colonies the maize grows low, ſeldom exceeding four or five feet in height; and the leaves being proportionably ſmall, the plants do not require ſo much ground as in the ſouthern colonies, where they frequently riſe to fourteen or fifteen feet. The ſpace generally allowed for the loweſt plants is three feet, and for the higheſt, five or ſix.

The pamcles, or toſſils, contain the *farina ſecundans* of the plant, and therefore ſhould not be cut off till the grain in the ear is filled. If the toſſils of a whole field ſhould be cut off before that time, there would be no grain at all in the ears. This has been proved by experiment.

In the more ſouthern colonies, where hay is ſcarce, and the leaves of this corn are very large, they cut them off for fodder; but in the northern colonies, where there is plenty of hay, and the leaves of the corn are ſmall, they generally neglect cutting off the toſſils, and ſtripping off the leaves. They are left on the ſtalks, and the cattle being turned into the fields, after the corn is gathered in, eat what they like of them; but they are not eſteemed ſo good as what has been cut in ſeaſon.

An eaſy way of taking the grain out of the ears, is to rub one againſt another, holding one in each hand.

When the ears are ſtripped off their huſks, they are reckoned in the beſt ſtate for preſervation; much better than when the grain is rubbed off from the ear: for then, ſay they, inſects can get at the ſoft part of the grain, and eat into it; which they cannot do while the ſoft part is connected with the cob in the ear, and the hard flinty part of every grain turned outward, and the grains cloſe to each other.

The manner of uſing this corn in America is various. It has this advantage over wheat, that ſubſtance may be drawn from your corn-fields long before the general harveſt; for the green ears roaſted are delicate food; and as the corn ripens and grows harder, the ears boiled are good eating with butter and ſalt. When it is ripe, the corn parched and ground into meal, is the hunting and war proviſion of the Indians; being light to carry, and affording good nouriſhment. They mix a little of it with water, and it needs no other cooking, having already paſſed the fire in the parching. The grain ſoaked in water, will part with its ſkin when beat in a large morter with a wooden peſtle; then it is boiled and eaten with milk. Being pounded coarſely, dry, it alſo boiled and eaten as rice. Bag puddings, and baked puddings made of it properly, are very good. The meal is alſo boiled with water, to make what they call a haſty pudding, which they eat with butter and ſugar, or with milk. This haſty-pudding, or boiled meal, being mixed with twice as much dry wheat flour, and worked into loaves, makes much better and pleaſanter bread than flour alone.

MAKING-UP, among diſtillers, the reducing ſpirits to a certain ſtandard of ſtrength, uſually called proof, by the admixture of water; which ſhould be either ſoft and clear river-water, or ſpring-water rendered ſoft by diſtillation.

MALACHI, or *the Prophecy of* MALACHI, a canonical book of the Old Teſtament, and the laſt of the twelve prophets. Malachi propheſied about three hundred years before Chriſt, reproving the Jews for their wickedneſs after their return from Babylon, charging them with rebellion, ſacrilege, adultery, prophaneneſs, and infidelity, and condemning the prieſts for being ſcandalouſly careleſs in their miniſtry; at the ſame time not forgetting to encourage the pious few, who, in that corrupt age, maintained their integrity. This prophet diſtinctly points at the Meſſiah, who was ſuddenly to come to his temple, and to be introduced by Elijah the prophet, that is, by John the Baptiſt, who came in the ſpirit and power of Elias or Elijah.

MALACHITES, or MOLOCHITES, in natural hiſtory, &c. a ſpecies of jaſper, ſuppoſed to be poſſeſſed of amuletic virtues. See JASPER and AMULET.

MALACIA, *μαλακια*, in medicine, is a languiſhing diſorder incident to pregnant women, in which they long ſometimes for one kind of food, and ſometimes for another, and eat it with an extraordinary greedineſs. When women labouring under this diſorder begin to abſtain from the improper and abſurd things they were fond of, and with leſs reluctance uſe laudable and wholeſome aliments, it is an infallible ſign of a beginning cure and approaching health. Pregnant women are generally freed from the malacia, about the fourth month; but if it continues longer it is dangerous, becauſe the peccant humours are deeply rooted. For the cure of this diſorder, in pregnant women, but few medicines are recommended for fear of abortion: however, gentle medicines may be uſed for evacuating and corroborating the ſtomach. In young women

women labouring under a chlorosis, this distemper is cured by the same medicines that are proper for removing the chlorosis. See the article CHLOROSIS.

MALACOPTERYGIOUS, among ichthyologists, an appellation given to one of the five orders of fishes, from their having the rays of their fins bony, but not pointed or sharp at the extremities, like those of acanthopterygious fishes, See the article FISH and ICHTHYOLOGY.

MALACOSTOMOUS FISHES, those destitute of teeth in the jaws, called in English leather-mouthed: as the tench, carp, bream, &c.

MALAGMA, a cataplasm. See the article CATAPLASM.

MALANDERS, in farriery, are cracks in the bend of a horse's knee, that discharge a sharp indigested matter; they are often the occasion of lameness, stiffness, and the horse's tumbling.

This distemper is cured by washing the parts with a lather of sope warmed, or old chamber-ley; and then applying over the cracks a strong mercurial ointment spread on tow, with which they should be dressed, night and morning, till all the scabs fall off: if this should not succeed, anoint them night and morning with a little of the following, and apply the above ointment over it.

Take of Æthiops mineral half an ounce; white vitriol one dram; soft green sope six ounces. Anoint with this often, but first clip away the hair, and clear the scabs. On their drying up, it may be proper to give a gentle purge or two; or the nitre balls may be taken advantageously for a fortnight, or three weeks.

MALE, *Mas*, among zoologists, that sex of animals which has the parts of generation without the body. See the articles ANIMAL, SEX, and GENERATION.

The term male has also, from some similitude to that sex in animals, been applied to several inanimate things: thus we say, a male flower, a male screw, &c. See the articles FLOWER and SCREW.

MALICE, in law, is a premeditated design to do mischief to another.

MALIGNANT, among physicians, a term applied to diseases of a very dangerous nature, and generally infectious: such are the dysentery, hospital fever, &c. in their worst stages.

MALL, or SEA-MALL, in ornithology, the English name of the lesser gull, with a grey back and spotted neck, and about the size of the common tame pigeon.

MALLEABLE, a property of metals, whereby they are capable of being extended under the hammer. See the articles DUCTILITY and METAL.

MALLEOLUS, in anatomy, a name given by anatomists to the inferior extremities of the tibia and fibula.

MALLET, a kind of large wooden hammer, used by artificers who work with a chissel, as sculptors, masons, and stonecutters, whose mallets are commonly round; and by joiners, carpenters, &c. who work with square-headed mallets.

Serving MALLET, among sailors, a mallet used in serving ropes. See the article SERVICE.

The use of the mallet is to bind the spun-yarn or other line very tight about the rope, to prevent it from being chafed by friction; two or three turns of the spun-yarn for this purpose are wound about the body of the mallet, and while one man passes the spun-yarn ball, another binds the turns of it on the rope, by turning the mallet round it, which draws it very tight.

Caulking MALLET, a mallet used by caulkers to drive oakum into the seams of a ship. See the article CAULKING.

MALLEUS, in anatomy, a bone of the ear, so called from its resemblance to a mallet, and in which is observed the head, the neck and handle, which is joined to the membrane of the tympanum. See EAR.

MALLOW, MALVA, in botany. See the article MALVA.

Vervain-MALLOW. See ALCEA.

MALMSEY, a rich kind of wine, so called, as being brought from Malvasia, in the Morea.

MALT is barley prepared, to fit it for making a potable liquor called beer, or ale, by stopping it short at the beginning of vegetation.

In making malt for barley, the usual method is to steep the grain in a sufficient quantity of water, for two or three days, till it swells, becomes plump, somewhat tender, and tinges the water of a bright brown, or reddish colour. Then this water being drained away, the barley is removed from the steeping cistern to the floor, where it is thrown into what is called the wet couch; that is, an even heap, rising to the height of about two feet. In this wet couch, the capital part of the operation is performed; for here the barley spontaneously heats, and begins to grow, shooting out first the radicle, and if suffered to continue, then the plume, spire or blade. But the process is to be stopped short at the eruption of the radicle, otherwise the malt would be spoiled. In order to stop it, they spread the wet couch thin over a large floor, and keep turning it once in four or five hours, for the space of two days, laying it somewhat thicker each time. After this, it is again thrown into a large heap, and there suffered to grow sensibly hot to the hand, as it usually will in twenty or thirty hours time; then being spread again, and cooled, it is thrown upon the kiln, to be dried crisp without scorching,

This is the general process of malting, in which almost every maltster has his secret, or particular way of working. But to render the operation perfect, the following cautions must be observed: 1. That the barley be newly threshed, or at least newly winnowed. 2. That it be not mixed, or made up of different sorts. 3. That it be not over steeped in the cistern, or so long as to make it soft. 4. That it be well drained. 5. That it be carefully looked after in the wet couch, so as to stop the first tendency of the blade to shooting. 6. Another caution is, to turn the wet couch inside outermost, if the barley comes, and shoots more in the middle of the heap than on the sides. 7. To keep it duly turning, after it is out of the wet couch. 8. To give it the proper heating in the dry heap. 9. To dry and crisp it thoroughly upon the kiln, but without a fierce fire, so as to be several days in drying a kiln of pale malt. And if these directions be carefully observed, the malt will always be good.

The method of malting Indian corn or Virginia-wheat, is much less laborious. For if this corn be buried two or three inches deep in the earth, and covered with the loose mould, dug up to make room for it, in ten or twelve days time the corn will sprout and appear like a green field; at which time being taken up, and washed or fanned from its dirt, it is immediately committed to the kiln, and by this means it becomes good malt. It is observable of this corn, that both its root and blade must shoot to a considerable length, before it will make malt; and perhaps this is the case in all large bodied grain.

The importation of malt from beyond the seas is prohibited: and on its being exported, it is not only freed from paying the excise of 6 d. a bushel, but a bounty is allowed by act of parliament, for which see the article CORN.

Malt-liquors have different names, and different virtues, from the different methods of preparing the malt, whence they are distinguished into pale and brown; and from the various methods taken in brewing the liquors, whence they are divided into ale and beer, strong and small, new and old. See BREWING.

The colour of the liquor, and many of its effects, depend on the manner of drying the malt it is brewed with; that which has the palest tinge, is made with malt but slenderly dried; whereas that which is high coloured, is made with malt that is high dried, or roasted, as it were, in comparison of the other; and amber ale is made of a mixture of both. Another difference in the preparations of malt-liquors consists in the larger quantity of hops in beer, and the smaller in ale; for hops add something of an alkaline nature to the liquor, and not only render it more easy of digestion and secretion in the body, but while it is in the liquor, prevent its running into such cohesions as would make it ropy, vapid, and sour. For this reason Dr. Quincy is of opinion, that for one constitution injured by beer, there are numbers spoiled by ale, which is apt to stuff the vessels with slime and viscidity,

dity, to make the body unwieldy and corpulent, and to pave the way for cachexies, the jaundice, aſthmas, and the dropſy. The different degrees of ſtrength in malt-liquors alſo makes them produce different effects. The ſtronger they are, the more viſcid parts they carry into the blood: they are therefore in general the more wholeſome for being ſmall: that is, of ſuch a ſtrength as to carry ſome degree of warmth into the ſtomach, but not ſo as to prevent their being proper diluters of our neceſſary food. Indeed people of robuſt conſtitutions, who labour very hard, may diſpenſe with reaſonable quantities of the ſtrongeſt; eſpecially as their food is frequently poor and ſlender enough, the deficiencies of which this ſupplies; and their continual exerciſe and ſtrength of body digeſts and breaks the viſcidities of the drink into convenient nouriſhment: though in perſons of another habit and way of living, they would only produce obſtructions and ill humours. As to the age of theſe liquors, it has ſomewhat the ſame effect as hops, for thoſe that are longeſt kept, are certainly leaſt viſcid: for age, by degrees, breaks their viſcid parts, and by rendering them ſmaller, makes them fitter for ſecretion.

MALT-SPIRITS. See the articles DISTILLERY and SPIRITS.

Knights of MALTA, otherwiſe called *Hoſpitallers of St. John of Jeruſalem*, a religious military order, whoſe reſidence is in the iſland of Malta. The order conſiſts of three eſtates, the knights, chaplains, and ſervants at arms: there are alſo prieſts who officiate in the churches, friar-ſervants, who aſſiſt at the offices, and donnes or demicroſſes; but theſe are not reckoned conſtituent parts of the body: the government of the order is mixt, being partly monarchical, and partly ariſtocratical: the grand maſter is ſovereign. The knights formerly conſiſted of eight different languages, but now only ſeven, the Engliſh having withdrawn themſelves. None are admitted into this order but ſuch as are of noble birth: the knights are of two ſorts, thoſe who have a right to be candidates for the dignity of grand maſter, called grand croſſes, and thoſe who are only knights aſſiſtants: they never marry, yet have continued from 1090 to the preſent time. The knights are received into this order either by undergoing the trials preſcribed by ſtatutes, or by diſpenſation.

MALTHA, in antiquity, a kind of cement, of which there were two ſorts, native and factitious; one of the latter ſort, much in uſe, conſiſted of pitch, wax, plaſter, and greaſe. Another kind uſed by the Romans in their aqueducts, was made of lime ſlacked in wine, incorporated with melted pitch, and freſh figs. Natural maltha is a kind of bitumen, wherewith the Aſiatics plaſter their walls; and which being once ſet on fire, water makes it burn more fiercely.

MALVA, common mallow, in botany, a plant with firm branched ſtalks, and roundiſh, notched leaves, ſet alternately on long pedicles: in their boſoms come forth bell-ſhaped monopetalous flowers, deeply divided into five heart-ſhaped ſections of a pale purpliſh or whitiſh colour, variegated with deeper ſtreaks, followed by a number of capſules ſet in form of a flat diſk, and containing each a kidney-ſhaped ſeed: the root is long, ſlender, and whitiſh. It is perennial, common in uncultivated grounds, and found in flower throughout the ſummer.

The leaves and flowers of the mallow are in taſte mucilaginous, and of no remarkable ſmell. The leaves were formerly of ſome eſteem, as an emollient or laxative dietetic, in dry conſtipated habits, in the warmer climates: at preſent, infuſions or decoctions of the leaves and flowers, and a conſerve made by beating the freſh flowers with thrice their weight of fine ſugar, are ſometimes directed in dyſuries, heat and ſharpneſs of urine, and other like complaints; but the principal uſe of the herb is in emollient clyſters, cataplaſms, and fomentations. The roots have been recommended in diſorders of the breaſt, and though now diſregarded may perhaps deſerve ſome notice: they have a ſoft ſweet taſte, without any particular flavour, approaching in ſome degree to that of liquorice: an extract made from them by rectified ſpirit of wine is of a great ſweetneſs.

MALUS, the apple-tree, in botany, is, according to Linnæus, a ſpecies of the pyrus. See APPLE and PYRUS.

MAMALUKES, the name of a dynaſty that reigned in Egypt.

The Mamalukes were originally Turkiſh and Circaſſian ſlaves, bought of the Tartars by Melicſaleh, to the number of a thouſand, whom he bred up to arms, and raiſed ſome to the principal offices of the empire. They killed ſultan Moadam, to whom they ſucceeded.

Others ſay, that the Mamalukes were ordinarily choſen from among the Chriſtian ſlaves, and that they were the ſame thing in a great meaſure with the Janiſſaries among the Turks. They never married. They firſt are ſaid to have been brought from Circaſſia, and ſome have ſuppoſed that they began to reign about the year 869.

MAMMÆ, the breaſts, in anatomy, two eminences, more or leſs round, ſituated in the anterior, and a little towards the lateral parts of the thorax; their middle part lying almoſt oppoſite to the bony extremity of the ſixth rib on each ſide.

In children of both ſexes, and in males of all ages, they are commonly no more than cutaneous tubercles, or ſoft verrucæ of a reddiſh colour, called papillæ, or nipples; each of them being ſurrounded by a ſmall, thin, and pretty broad circle, more or leſs of a browniſh colour, and an uneven ſurface termed areola.

In females, when come to the age of puberty, which is ſometimes ſooner, ſometimes later, a third part is joined to the two former, which is a convex protuberance more or leſs round, of about five or ſix fingers in breadth, the papilla and areola being ſituated near the middle of the convex ſurface. This is what is properly termed the mamma, and it may be called the body of the breaſt, when compared with the other two parts. It increaſes with age, and is very large in women with child, and in thoſe that give ſuck. In old age it decreaſes and becomes flabby, loſing its natural conſiſtence and ſolidity.

The body of the breaſt is partly glandular, and partly made up of fat; or it is a glandular ſubſtance, mixed with portions of the membrana adipoſa, the cellulous pellicles of which ſupport a great many blood-veſſels, lymphatics, and ſerous or lactiferous ducts, together with ſmall glandular moleculæ, which depend on the former; all of them being cloſely ſurrounded by two membranes, continued from the pelliculæ.

The innermoſt of theſe two membranes, which is, in a manner, the baſis of the body of the mamma, is thick and almoſt flat, adhering to the muſculus pectoralis major. The ſecond or external membrane is thinner, forming a particular integument for the body of the breaſt, more or leſs convex, and adhering cloſely to the ſkin.

The corpus adipoſum of the breaſt in particular is a ſpongy cluſter, more or leſs interlarded with fat, or a collection of membranous pelliculæ, which, by the particular diſpoſition of their outſides, form a kind of membrane in ſhape of a bag, in which all the reſt of the corpus adipoſum is contained. The anterior or outer portion of this bag, or that which touches the ſkin, is very thin; but that ſide next the pectoralis major is thick.

The glandular body contains a white maſs, which is merely a collection of membranous ducts, narrow at their origin, broad in the middle, and which contract again as they approach the papillæ, near which they form a kind of circle of communication. They are called ductus lactiferi.

The areola is formed by the ſkin; the inner ſurface of which ſuſtains a great number of ſmall glandular moleculæ, of that kind which Morgagni calls glandulæ ſebaceæ. They appear very plainly all over the areola, even on the outſide, where they form little flat eminences, at different diſtances, quite round the circle.

Theſe tubercles are perforated by ſmall holes, through which a kind of ſebaceous or cheeſy matter, more or leſs liquid, may be ſqueezed out. Sometimes this is a ſerous liquor, ſometimes a milky ſerum, and ſometimes pure milk, eſpecially in nurſes; and I have ſeen both ſerous and milky drops come out at the ſame time.

From thence I am inclined to think, that theſe holes communicate with the lactiferous ducts, and that the tubercles are a kind of auxiliary papillæ added to the true ones. The different liquors that may be ſqueezed from

from the ſame glandular body, give alſo room to think, that the holes in them communicate by their extremities with ſeveral other ſmall holes. The tubercle in the center of the areola is termed papilla, or the nipple: it is of different ſizes, in different ages and conſtitutions, and in the different conditions of females in particular. In women with child, or who give ſuck, it is pretty large, and generally longer and higher than it is thick or broad; and when it happens to be ſhort, it cauſes great uneaſineſs to the child.

The texture of the nipple is ſpongy, elaſtic, and liable to divers changes of conſiſtence. It ſeems to be made up principally of ligamentary faſciculi, the extremities of which form the baſis and apex of the nipple: theſe faſciculi appear to be gently folded or curled, through their whole length; and if, by drawing the fibres out, theſe folds be deſtroyed, they return again as ſoon as that action ceaſes.

Between theſe faſciculi lie ſeven or eight particular tubes, at ſmall diſtances from each other, and all in the ſame direction; theſe tubes end at the baſis of the papilla, in the irregular circle of communication of the lactiferous ducts, and at the apex, in the ſame number of almoſt imperceptible holes; and as they are cloſely united to the elaſtic faſciculi, they are folded in the ſame manner with them.

The body of the papilla is covered by a thin cutaneous production, and by the epidermis; its outer ſurface is uneven, being full of ſmall wrinkles; among which thoſe near the circumference of the nipple ſeem to have a tranſverſe or annular diſpoſition, which, however, is not uniform.

This diſpoſition ſeems to be owing to the elaſtic folds; and from this ſimple ſtructure it is eaſy to explain how infants in ſucking the nipple, and women in drawing the teats of cows, bring out the milk. For the excretory tubes, being wrinkled in the ſame manner as the faſciculi, do by theſe folds, as by ſo many valves, hinder the milk contained in the ducts from flowing out; but when the nipple is elongated the tubes loſe their folds, and the paſſage becomes ſtraight. Beſides this, when they are drawn with a conſiderable force, the whole body of the breaſt is increaſed in length, and contracted in breadth, and thereby the milk is preſſed into the open tubes; and thus, by barely preſſing the body of the breaſt, the milk may be forced toward the nipple, and even through the tubes.

The arteries and veins diſtributed through the mammæ are ramifications of the arteriæ and venæ mammariæ, of which one kind comes from the ſubclaviæ, and are called mammariæ internæ; the other from the axillares, called mammariæ externæ.

Theſe veſſels communicate with each other, with thoſe near them, and with the vaſa epigaſtrica. The nerves come principally from the coſtales, and by means of theſe communicate with the great nervi ſympathetici.

The uſe of the breaſts, in the nouriſhment of children, is well known to the world: but it is not certainly known what the papillæ and areolæ in men can be deſigned for. Milk has been obſerved in them in children of both ſexes. *Winſlow.*

MAMMIFORM, in anatomy, a name given to apophyſes of the bone in the back part of the ſcull, ſo called from their reſembling a breaſt.

MAMMILLARY, MAMMILLARIS, in anatomy, an epithet given to two little protuberances, ſomewhat reſembling the nipples of the breaſt, found under the four ventricles of the brain, and ſuppoſed to be the organs of ſmelling. Theſe are called apophyſes mammillares. There is alſo a muſcle called mammillaris, or maſtoides, ſerving to ſtoop the head.

MAMMOTH's TEETH, in natural hiſtory, certain large foſſile teeth, found in great plenty in Ruſſia, and ſuppoſed to have belonged to elephants.

MAN, *Homo*, in zoology, is juſtly ranked at the head of the animal part of the creation; making a diſtinct genus of that order of quadrupeds, which Linnæus calls anthropomorpha, from their reſemblance to the human form.

The ſame author diſtinguiſhes the race of mankind, according to their different colours, into the Europeans, or white men; the Americans, or copper-coloured men: the Aſiatics, or tawny-coloured men: and thoſe of Africa, or blacks.

Noſce te ipſum, know thyſelf, is a precept worthy of the law-giver of Athens, the ancient ſeat of polite literature; an important branch of knowledge, which may be reduced to the following heads. 1. In a religious view, *theologicè*, that you was created with an immortal ſoul, after the image of God. 2. In a moral ſenſe, *moraliter*, that you alone was bleſſed with a rational ſoul, to be employed to the praiſe of the Creator. 3. With reſpect to the other works of the creation, *naturaliter*, that you are conſtituted their lord, for whoſe uſe they were made. 4. In a phyſiological ſenſe, *phyſiologicè*, the moſt perfect and amazing fabric of your body. 5. With regard to diet, *diætetice*, what things are uſeful, and what hurtful, in this reſpect. 6. In a pathological ſenſe, *pathologicè*, how frail you are, and how ſubject to a thouſand calamities.

Theſe are the heads, which, according to Linnæus, comprehend the knowlege of man, conſidered as an individual; a branch of knowledge ſo eſſential to the human race, that, without it, he ſeems to doubt whether any other characters be ſufficient to entitle one to be ranked among mankind: for he adds, *Hæc ſi noveris*, HOMO *es, et a reliquis animalibus diſtinctiſſimum genus.*

MANATI, in zoology, an animal called by Linnæus thrichechus. See THRICHECHUS.

MANDAMUS, in law, a writ that iſſues out of the King's Bench, ſent to a corporation, commanding them to admit or reſtore a perſon to his office.

MANDARINS, a name given to the magiſtrates and governors of provinces in China, who are choſen out of the moſt learned men, and whoſe government is always at a great diſtance from the place of their birth. Mandarin is alſo a name given by the Chineſe to the learned language of the country; for beſides the language peculiar to every province, there is one common to all the learned in the empire, which is in China what Latin is in Europe; this is called the Mandarin tongue, or the language of the court.

MANDATE, in law, a judicial commandment to do ſomething.

MANDATE, in the canon-law, a reſcript of the pope, commanding an ordinary collator to put the perſon therein named in poſſeſſion of the firſt vacant benefice in his collation.

MANDREL, a kind of wooden pulley, making a member of the turner's lathe, of which there are ſeveral kinds, as the flat mandrels, which have three or more little pegs or points near the verge, and are uſed for turning flat boards on; the pin mandrels are thoſe which have a long wooden ſhank to fit into a large hole made in the work to be turned; hollow mandrels are thoſe hollow of themſelves, and uſed for turning hollow work; ſcrew mandrels for turning ſcrews, &c.

MANE, the hair hanging down from a horſe's neck, which ſhould be long, thin, and fine; and if frizzled, ſo much the better.

MANEGE, or MANAGE, the exerciſe of riding the great horſe, or the ground ſet apart for that purpoſe; which is ſometimes covered, for continuing the exerciſe in bad weather; and ſometimes open, in order to give more liberty and freedom both to the horſeman and horſe.

One way or other, we always ſuppoſe a center in the middle of the manege-ground, for regulating the rounds and volts. Sometimes this center is diſtinguiſhed by a pillar fixed in it, to which they tie the horſe when he begins to learn: upon the ſide of the manege other pillars are placed, two by two, in order to teach horſes to raiſe the fore quarters, by tying them with ropes. See PILLAR.

MANES, in the pagan ſyſtem of theology, a general name for the infernal deities, or gods of hell.

The ancients comprehended under manes not only Pluto, Proſerpine, and Minos, but the ſouls likewiſe of the deceaſed were taken into the number, and eſteemed gods of hell. It was uſual to erect altars and offer libations to the manes of deceaſed friends and relations.

MANGER, in the ſea-language, a ſmall apartment in the fore-part of a ſhip, which is fenced on the after-part by

by a ſort of bulk-head or barrier; the uſe of which is to prevent the water which ruſhes in at the hawſe-holes, or the holes thro, which the cable goes, from running on the lower decks, which would render them extremely uncomfortable to the men, who eat and ſleep there. As ſoon as the water enters at the hawſe-holes, which is always the caſe when the ſhip pitches deep forward, it is conveyed away again through the ſide into the ſea by ſeveral ſmall pipes or channels, called ſcuppers. See the article SCUPPERS.

MANGO *Tree*, in botany, the name of a vaſt tree, forty feet in height, and eighteen in thickneſs, and ſpreads its numerous branches all around at a great diſtance, being always green, and bearing fruit once or twice a year, from ſix or ſeven years old to an hundred. It is propagated by inſition, or ſowing the ſeed, in Malabar, Goa, Bengal, Pegu, and many other countries in the Eaſt-Indies.

The fruit is of a round oblong figure, flat, ſlightly ſinuated, or hollowed at the ſides, and ſhaped much like a kidney, bigger than a gooſe egg, ſmooth, ſhining, firſt green ſpeckled with white, then inclining to yellow, and at laſt of a gold-colour: it has a yellowiſh and ſucculent pulp, not unlike that of a peach; or rather a plum, firſt acid, then acido-dulcid, and pleaſant to the taſte. Within the pulp is contained an oblong, compreſſed, and languanous ſtone, thin, yet very hard and tenacious, and including a callous oblong kernel, very like an oblong almond, and of the ſame bigneſs, and of a bitteriſh, though not unpleaſant taſte.

There are various ſorts of this fruit, as there are of our apples and pears, which are very different, according to the countries where they grow: that ſpecies which is without a ſtone, and is very grateful to the palate, ſeems to us only a variety, or a degenerate fruit. The fruit is cut into ſlices, and eaten either without wine, or macerated in wine; it is alſo candied, in order to its preſervation. Sometimes they open it with a knife, and fill up the middle with freſh ginger, garlic, muſtard, and ſalt, with oil or vinegar, that they may eat it with rice, or after the manner of pickled olives.

As to its temperament, this fruit is cold and moiſt, though the Indian phyſicians affirm the contrary. We make uſe of pickled mangoes, which are imported to us, as we do of pickled cucumbers, for ſauce to roaſted meat. The ſtones roaſted are ſaid to cure a looſeneſs, which Garcias found to be true. The wood of the tree, with cinders, is uſed for burning the carcaſes of the pagans, as being conſecrated to this rite; whence it ſerves alſo for coffins, in which they repoſit their dead; it is but of a ſoft ſubſtance, and of ſhort duration.

The ſtalks ſupply the place of arequa or caunga, in the chewing of betel; the ſame, calcined and reduced to powder, take away warts. Of the tender leaves, with the bark of the avanacoe, that is, the ricinus, the ſeed of cummin and parpadogam, is made a decoction, which is highly beneficial in the cough, aſthma, and other affections of the thorax. The bark of the tree pulveriſed, and taken in chicken-broth, is an excellent diſſolvent of extravaſated and coagulated blood, occaſioned by a fall, in any part of the body. The juice of the bark, with the white of an egg, and a very little opium, taken inwardly, is a preſent remedy againſt the diarrhœa, dyſentery, and teneſmus. Of the gum of the tree, and the flowers of rice, with the addition of a ſmall quantity of opium and pepper, are prepared pills, which alſo cure all ſorts of fluxes of the belly. Of the flower of the dried kernels the natives have the art of preparing various kinds of food.

MANGANESE, MAGNESIA, in natural hiſtory, a poor kind of iron ore. See the article IRON.

It is a denſe, heavy ſubſtance in its fineſt pieces; being compoſed of a number of broad and thick ſtriæ irregularly laid together, and much reſembling thoſe of native antimony; in theſe maſſes it is ſometimes reddiſh, ſometimes of a dark grey, and ſometimes of a fine pale light grey, approaching to the colour of the fineſt poliſhed iron: but there is a leſs perfect kind in which the whole maſs ſeems only to conſiſt of a number of irregularly figured pieces, of a brittle and ſomewhat gloſſy ore, blended very looſely together.

Manganeſe is found in great abundance in the German and Swediſh mines, as alſo in France, Italy, and England; but ours is not equal in beauty or goodneſs to the German. It is recommended by authors as an aſtringent, and ordered to be given after calcination in hæmorrhages: but it is very improper for internal uſe. It is of great ſervice, however, to the glaſſmen, in clearing away the greeniſh colour from their white glaſs while in fuſion. See GLASS.

MANICHEES, in church hiſtory, a ſect of Chriſtian heretics in the third century, the followers of Manes, who made his appearance in the reign of the emperor Probus; pretending to be the Comforter, whom our Saviour promiſed to ſend into the world. He taught that there are two principles, or gods, coeternal and independant on each other, the one the author of all evil, and the other, of all good; a doctrine which he borrowed from the Perſian Magi. He held that our ſouls were made by the good principle, and our bodies by the evil one, and that the ſouls of his followers paſſed through the elements to the moon, and from thence to the ſun, where being purified, they then went to God, and became united with his eſſence; but as for the ſouls of other men, they either went to hell, or were united to other bodies. He alleged that Chriſt had his reſidence in the ſun, the Holy Ghoſt in the air, Wiſdom in the moon, and the Father in the abyſs of light. He is alſo charged with denying the reſurrection, and condemning marriage; with teaching that Chriſt was the ſerpent that tempted Eve; with forbidding the uſe of eggs, cheeſe, milk, and wine, as proceeding from the bad principle; with uſing a different kind of baptiſm from that of the church; with teaching that magiſtrates were not to be obeyed, and with condemning the moſt lawful wars.

MANICORDON, or MANICHORD, a muſical inſtrument in the form of a ſpinnet; the ſtrings of which, like thoſe of the clarichord, are covered with little pieces of cloth, to deaden, as well as to ſoften their ſound; whence it is alſo called the dumb ſpinnet. It is much uſed in nunneries, becauſe the nuns may play upon it without diſturbing that ſilence which they are obliged to obſerve in their cells.

MANIFESTO, a public declaration made by a prince in writing, ſhewing his intentions to begin a war, or other enterprize, with the motives that induce him to it, and the reaſons on which he founds his rights and pretenſions.

MANILLE, in commerce, a large braſs-ring in the form of a bracelet, either plain or engraven, flat or round.

Manilles are the principal commodities which the Europeans carry to the coaſt of Africa, and exchange with the natives for ſlaves. Theſe people wear them as ornaments on the ſmall of the leg, and on the thick part of the arm above the elbow.

MANIPULUS, in Roman antiquity, a body of infantry, conſiſting of two hundred men, and conſtituting the third part of a cohort. See COHORT.

Among phyſicians, the term Manipulus ſignifies a handful of herbs or leaves, or ſo much as a man can graſp in his hand at once; which quantity is frequently denoted by the abbreviature, M, or *m*.

MANNA, in the materia medica, a ſweet juice obtained from certain aſh trees in the ſouthern parts of Europe, particularly in Calabria and Sicily; exuding from the leaves, branches, or trunk of the tree, and either naturally concreted, or exſiccated and purified by art.

Juices of the ſame nature are collected, in the Eaſtern countries, from other trees and ſhrubs: and ſimilar exudations are ſometimes found on different kinds of trees in Europe, as particularly on the larch in the Briançonois in Dauphiny. How far the manna juices of different vegetables differ from one another, is not well known; but this much is certain, that one and the ſame tree affords mannas very conſiderably different, in their colour, in their taſte, and in their diſpoſition to aſſume a ſolid concrete form: that is, in their purity, or the greater or leſs admixture of oily or reſinous matter.

The beſt ſort of the officinal or Calabrian manna is in oblong pieces or flakes, moderately dry, friable, very light,

5 1A 59

Fig. 1. Magnet.

Fig. 4. Magnet.

Fig. 2. Magnet.

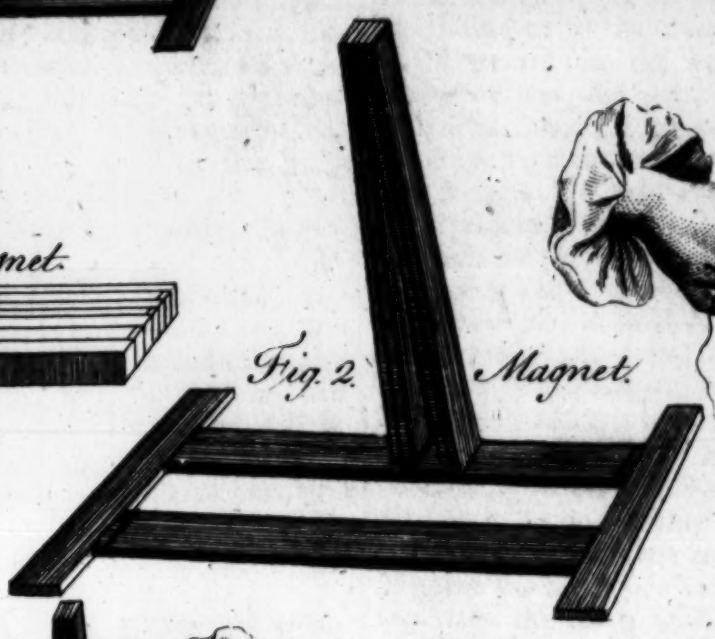
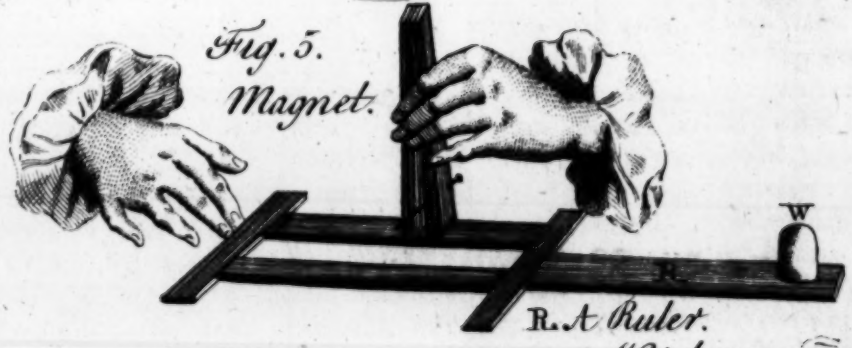


Fig. 3. Magnet.

Fig. 7.

Mantlets.

Fig. 5. Magnet.



R. A Ruler.
W. A Weight.

Fig 6. Magnet.

Fig. 8. Masonry.

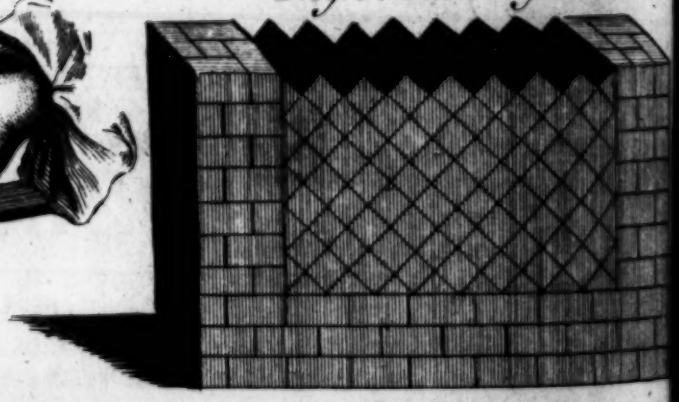


Fig. 9. Masonry.

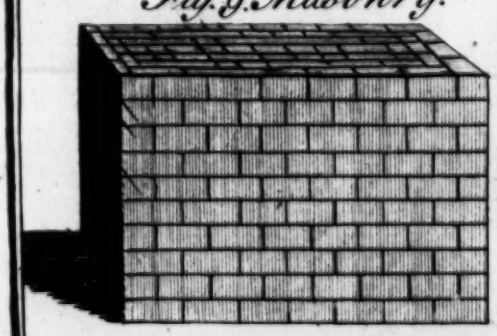


Fig. 10. Masonry.

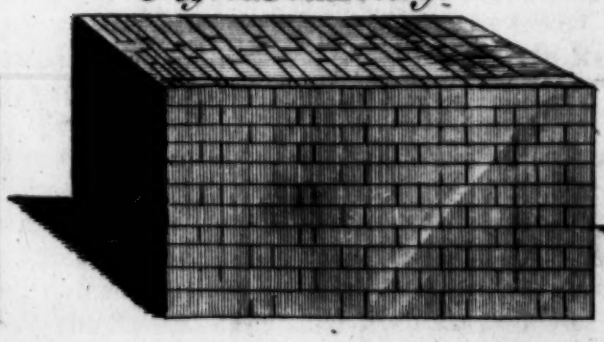
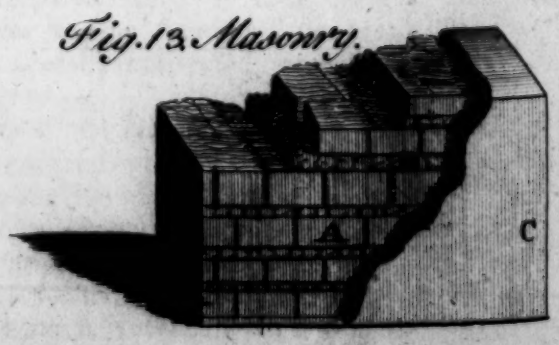


Fig. 11. Masonry.

Fig. 12. Masonry.

Fig. 13. Masonry.



C

Fig. 14. Masonry.

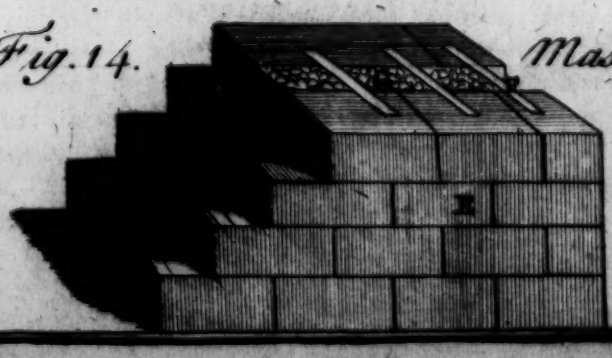
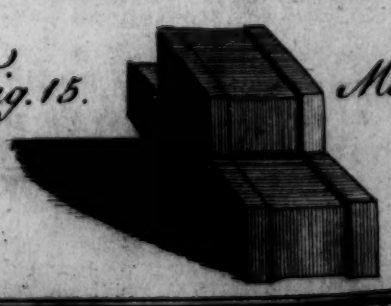


Fig. 15. Masonry.



5 JA 59

Fig. 6. Marquetry.

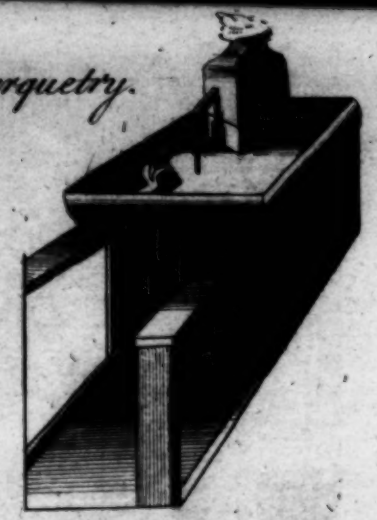
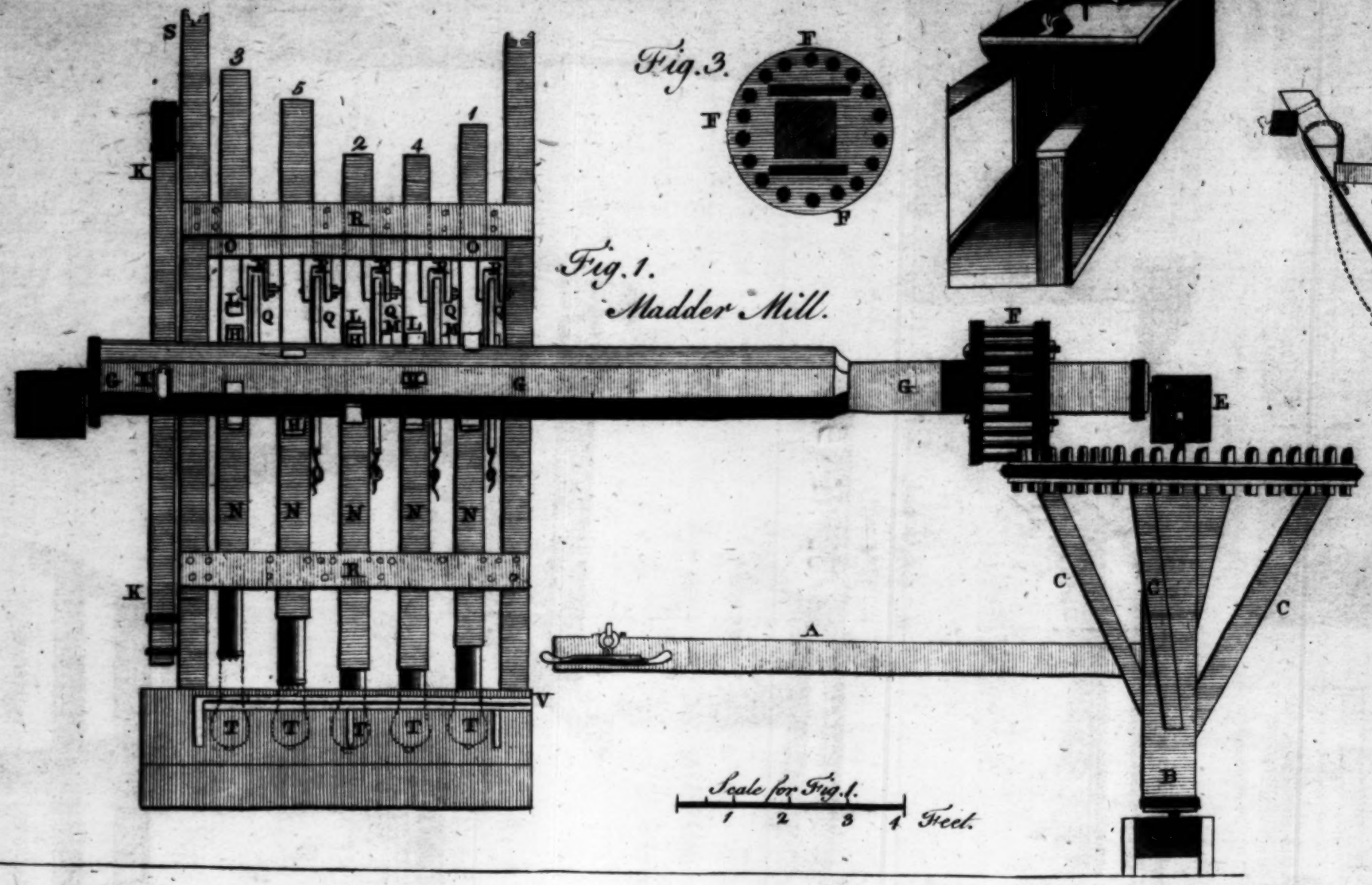


Fig. 3.

Fig. 1.
Madder Mill.



Scale for Fig. 1.
1 2 3 4 Feet.

Fig. 4.

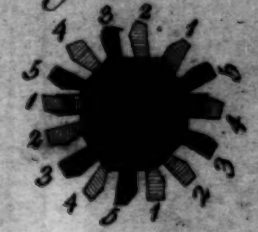


Fig. 5.

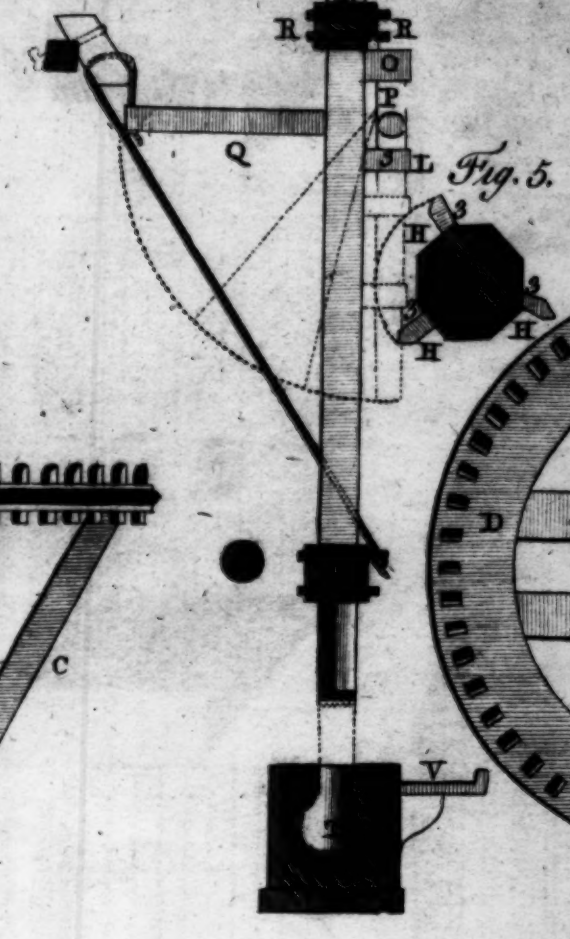
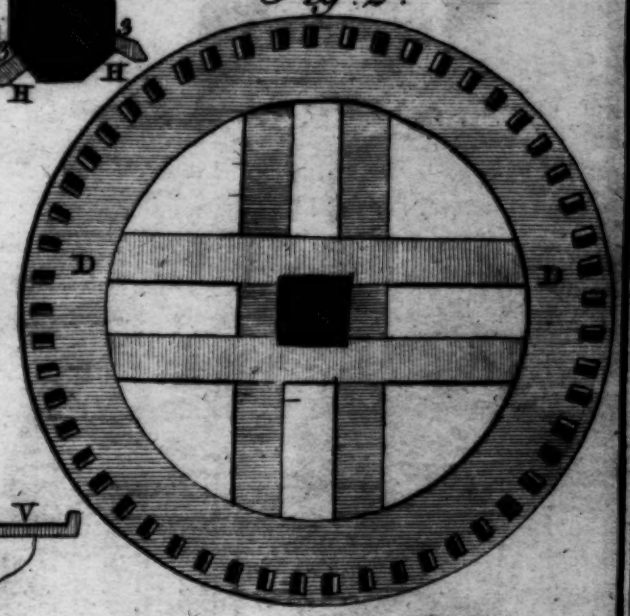
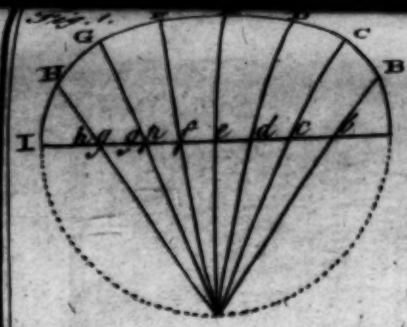


Fig. 2.



Scale for Fig. 5.
1 2 3 4 Feet.

5 JA 59



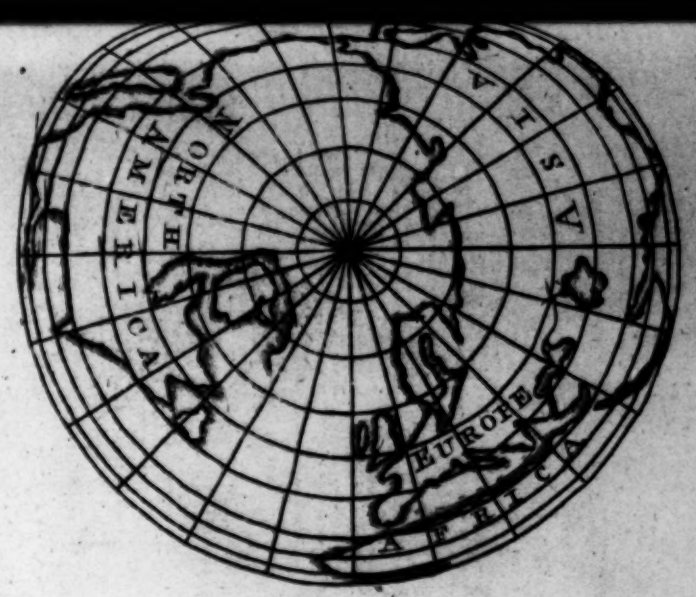


Fig. 2.

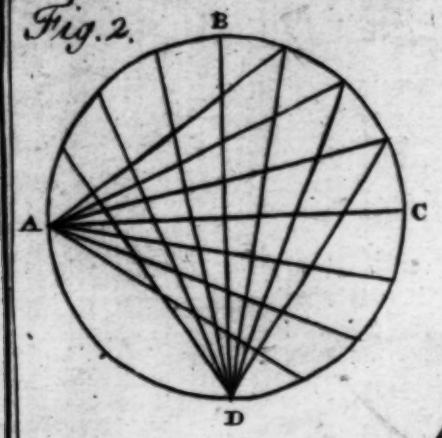


Fig. 7.

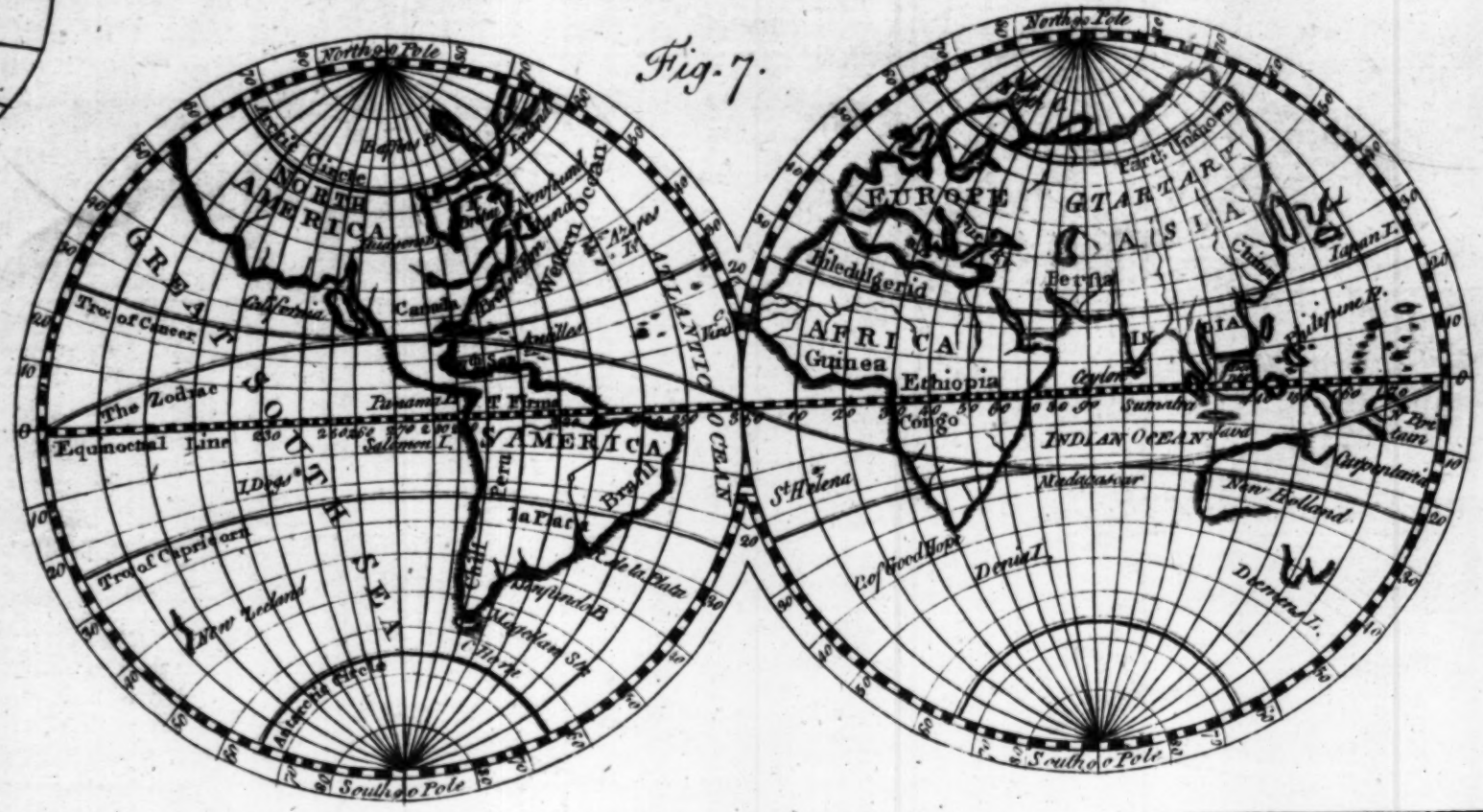


Fig. 6.

light, of a whitiſh or pale yellow colour, and in ſome degree tranſparent. The inferior kinds are moiſt, unctuous, and brown. Both ſorts are ſaid to be ſometimes counterfeited by compoſitions of ſugar, honey, and purgative materials: compoſitions of this kind, in a ſolid or dry form, may be diſtinguiſhed by their weight, compactneſs, and untranſparency; both the dry and moiſt compoſitions may be diſtinguiſhed by their taſte, which is ſenſibly different from that of true manna, and with greater certainty by their habitude to menſtrua.

This juice liquefies in a moiſt air, diſſolves readily in water, and by the aſſiſtance of heat, in rectified ſpirit alſo; the impurities only being left by both menſtrua. On inſpiſſating the watery ſolution, the manna is recovered of a much darker colour than at firſt. From the ſaturated ſpirituous ſolution, great part of it ſeparates as the liquor cools, concreting into a flaky maſs, of a ſnowy whiteneſs, and a very grateful ſweetneſs; the liquor remaining after the ſeparation of this pure ſweet part of the manna, leaves, on being inſpiſſated, an unctuous, dark-coloured, diſagreeable matter, in greater or leſs quantity, according as the manna made uſe of was leſs or more pure.

Manna, in doſes of an ounce and upwards, proves a gentle laxative: it operates in general with great mildneſs, ſo as to be ſafely given in inflammatory or acute diſtempers, where the ſtimulating purgatives have no place. It is particularly proper in ſtomachic coughs, or thoſe which have their origin in the ſtomach; the manna, by its ſweetneſs and unctuoſity, contributing to obtund as well as to evacuate the offending humours: in this intention it is ſometimes made into a linctus or lohoch, with equal quantities of oil of almonds and of ſyrup of violets. See LINCTUS.

In ſome conſtitutions, however, it acts unkindly, eſpecially if given in conſiderable quantity, occaſioning flatulencies, gripes, and diſtenſions of the belly; inconveniencies which may be generally obviated by a ſmall addition of ſome grateful aromatic.

MANNER, in painting, a habitude that a man acquires in the three principal parts of painting, the management of colours, lights, and ſhadows, which is either good or bad, according as the painter has practiſed more or leſs after the truth, with judgment and ſtudy. But the beſt painter is he who has no manner at all. The good or bad choice he makes is called goûte.

MANNERS, in poetry, the inclinations, genius, and humour, which the poet gives to his perſons, and whereby he diſtinguiſhes his characters. See the article CHARACTER.

MANOMETER, or MANOSCOPE, an inſtrument to ſhew or meaſure the alterations in the rarity or denſity of the air. The manometer differs from the barometer in this, that the latter only ſerves to meaſure the weight of the atmoſphere, or of the column of air over it; but the former the denſity of the air in which it is found, which denſity depends not only on the weight of the atmoſphere, but alſo on the action of heat and cold, &c. Authors, however, generally confound the two together, and Mr. Boyle himſelf gives us a very good manometer of his contrivance, under the title of a ſtatical barometer. See BAROMETER.

MANOR, an ancient royalty or lordſhip, formerly called a barony, conſiſting of demeſnes, ſervices, and a court-baron; and comprehending in it meſſuages, lands, meadow, paſture, wood, rents, an advowſon, &c. It may contain one or more villages, or hamlets, or only a great part of a village, &c.

A manor is a noble kind of fee, granted in part to tenants for certain ſervices to be performed, and partly reſerved to the uſe of the lord's family, with juriſdiction over the tenants, for their farms or eſtates.

There are capital manors or honours that have other manors under them; and alſo cuſtomary manors granted by copy of court roll, the lords of which have power to hold courts, and grant copies, &c.

MANSION, in law, is the chief dwelling-houſe of a lord within his fee, or the capital meſſuage or manor-houſe.

MANSLAUGHTER, generally termed homicide, is killing a perſon without premeditated malice.

MANTELETS, in the art of war, a kind of moveable parapets, made of planks about three inches thick, nailed one over another, to the height of almoſt ſix feet, generally caſed with tin, and ſet upon little wheels, ſo that in a ſiege, they may be driven before the pioneers, and ſerve as blinds to ſhelter them from the enemy's ſmall ſhot. See plate LXXXII. *fig* 7.

There are other ſorts of mantelets, covered on the top, of which the miners make uſe to approach the walls of a town or caſtle.

MANTLE, or MANTLE-TREE, in architecture, the lower part of the chimney, or that piece of timber which is laid acroſs the jaumbs, and ſuſtains the compartment of the chimney-piece. See the article CHIMNEY.

MANTLE, or MANTLING, in heraldry, that appearance of folding of cloth, flouriſhing or drapery, that is in any atchievement drawn about the coat of arms. It is ſuppoſed originally to be the repreſentation of a mantle, or military habit, worn by the ancient cavaliers over their armour to preſerve it from ruſt; or, as others hold, a ſhort covering only worn over the helmet, which in after-times was lengthened, and made to hang from the helmet below the whole ſhield.

The mantle is always ſaid in blazonry, to be doubled, that is, lined throughout with one of the furs, as ermin, pean, viary, &c.

MANUFACTURER, one who works up a natural product into an artificial commodity.

MANURE, any thing uſed for fattening and improving land.

There are various kinds of manure uſed in different parts of England for enriching the ſeveral ſoils, ſome of which have been already mentioned under the articles dung, chalk, lime, &c. which ſee: but there are others that might be uſed on many lands with ſucceſs.

All ſorts of marl and clay, ſpread over gravelly and ſandy land, are of vaſt advantage to it, by making it more ſolid and tenacious, as all kinds of ſand are to thoſe ſoils that conſiſt of a ſtiff loam or clay. Theſe kinds of manure are of laſting advantage. See the article SAND.

Tanner's bark, laid in a heap, and rotted, is alſo an excellent manure, eſpecially for ſtiff cold land, and one load of it will improve the ground more, and laſt longer, than two loads of the richeſt dung: when this manure is laid on graſs, it ſhould be done ſoon after Michaelmas, that the winter rains may waſh it into the earth: and where it is uſed for corn-land, it ſhould be ſpread on the ſurface before the laſt plowing, that it may be turned down for the fibres of the corn to reach it in the ſpring. Rotten vegetables of moſt ſorts alſo greatly enrich land, ſo that where other manure is ſcarce, theſe may be uſed with great ſucceſs; thus the weeds of ponds, lakes, and ditches, being dragged out juſt as they begin to flour, and laid on heaps to rot, will make excellent manure: but it is to be obſerved, that in rotting theſe vegetables, it will be proper to mix ſome earth, mud, or any other ſuch like ſubſtance with them, to prevent their taking fire in their fermentation; it will alſo be proper to cover the heaps with earth, mud, or dung, to detain the ſalts, otherwiſe many of the finer parts will evaporate in fermenting. The refuſe of kitchen-gardens, when laid on heaps and rotted, will alſo afford good manure for corn-land: and alſo fern mowed down while it is green and tender, and laid on heaps to rot, will make excellent manure; and by frequently mowing it, this troubleſome plant will be deſtroyed. The aſhes of all kinds of vegetables are alſo good manure for land, ſo that where the ground is over-run with buſhes, brambles, &c. if they are grubbed up in ſummer, ſpread abroad to dry, and then conſumed to aſhes, and ſpread over the land, they will greatly improve it. Rotten wood, and ſaw-duſt, when rotted, are a very good manure for ſtrong land, as are alſo bones, horns, ſhells, woollen rags, &c. and whatever ſerves to looſen its parts.

MANUSCRIPT, in matters of literature, denotes a written book, in contradiſtinction to a printed one. See BOOK.

MAP, a plane figure repreſenting the ſurface of the earth, or a part thereof, according to the laws of perſpective

ſpective; diſtinguiſhing the ſituation of cities, mountains, rivers, &c.

In maps, theſe three things are eſſentially requiſite. 1. That all places have the ſame ſituation and diſtance from the great circles therein, as on the globe, to ſhew their parallels, longitudes, zones, climates, and other celeſtial appearances. 2. That their magnitudes be proportionable to the real magnitudes on the globe. 3. That all places have the ſame ſituation, bearing and diſtance, as on the earth itſelf.

Maps are either univerſal, which exhibit the whole ſurface of the earth; or particular, which exhibit ſome particular part thereof: each kind is called geographical or land-maps, in contradiſtinction to hydrographical or ſea-maps, repreſenting the ſeas and ſea-coaſts, properly called charts.

As a map is a repreſentation of ſome part of the ſurface of the earth delineated upon a plane; the earth being round, no part of the ſpherical ſurface of it can be accurately exhibited upon a plane, and, therefore, ſome have propoſed the making of globular maps; for this purpoſe, a plate of braſs might be hammered, or at a leſs expence a piece of paſte-board might be formed into a ſegment of a ſphere, and covered on its convex ſide with a map projected in the ſame, as the papers of the common globes are: a map made in this method would ſhew every thing in the ſame manner, as it would be ſeen upon a globe of the ſame diameter with the ſphere upon the ſegment of which it was delineated: and, indeed, maps of this ſort would be in effect ſegments of ſuch a globe, but they are not in common uſe.

The ancients deſcribed all the parts of the known earth in one general map; in this view one of them compares the ſhape of the earth to the leather of a ſling, whoſe length exceeds its breadth: the length of the then known parts of the earth from eaſt to weſt was conſiderably greater than from north to ſouth; for which reaſon, the former of theſe was called the longitude, and the other the latitude.

The modern general maps are ſuch as give us a view of an entire hemiſphere, or half of the globe; and are projected upon the plane of ſome great circle, which terminates the projected hemiſphere, and divides it from the other half of the globe, as the equator, or the meridian, or horizon of ſome place: from this circle the projection is denominated, and ſaid to be equatorial, meridional, or horizontal.

Particular maps are ſuch as exhibit to us leſs than an hemiſphere; of this ſort are maps of the great parts into which the earth is divided, as Europe, Aſia, Africa, North-America, South-America; or maps of particular kingdoms, provinces, countries, or of leſſer diſtricts.

The projections of the circles in general maps are of two ſorts, convex and concave: to underſtand which we may imagine the globe upon which the circles are delineated to be of thin glaſs, and that half of it is viewed at a time; now we may be conceived to view this hemiſphere either on the convex or concave ſide, and we may conceive it to be placed at different diſtances from the eye: from which diverſity of our view, there will ariſe different projections, or pictures of it in a map. If the eye be ſuppoſed to be placed in ſome point of the ſurface of the ſphere to view the concave of the oppoſite hemiſphere, it is called the ſtereographic projection.

In this projection, the parts about the middle are a little contracted, ſo as to be too ſmall for the extreme parts, the reaſon whereof will appear from (plate LXXXIV. *fig.* 1.) hence, that if a concave ſemicircle with equal diviſions be viewed with the eye in the plane of it continued, at the diſtance of a ſemi-diameter from its center, the projection will be a ſtraight line unequally divided, the parts appearing leſs the nearer to the center; conſequently, if two ſemicircles cutting one another at right angles, drawn upon a concave hemiſphere, and marked with equal diviſions, be viewed in the manner now deſcribed, the projection of them will be ſtraight lines unequally divided, as A C and B D (*fig.* 2.) the parts appearing leſs the nearer to the center. The ſtereographic projection is either equatorial, meridional, or horizontal.

The equatorial projection ſuppoſes the eye to be ſituated in one of the poles of the earth, and from thence to view the oppoſite concave hemiſphere, with its circles, projected upon a plane of glaſs paſſing through the equator. Thus the eye is ſuppoſed to be in the north pole, in order to view the ſouthern hemiſphere; and in the ſouth pole to view the northern hemiſphere. Thus *fig.* 3. is a map of the northern hemiſphere upon that projection: here the meridians are all ſtraight lines, and the parallels are compleat circles.

The meridional projection ſuppoſes the eye to be in ſome point of the equator, and from thence to view the oppoſite concave hemiſphere, projected upon a glaſs plane paſſing through ſome meridian, which a meridian drawn through the eye cuts at right angles. Thus *fig.* 7. is a map of the earth in two hemiſpheres, projected upon the plane of a meridian paſſing through one of the Canary-iſlands called Ferro. This meridian is made choice of, becauſe, by making the projection thereon, one hemiſphere contains Europe, Aſia, and Africa; and the other North and South America. Here all the meridians are arches of circles, except that drawn through the eye, which is a ſtraight line; and all the parallels are arches of circles, and the equator is a ſtraight line.

M. de la Hire has invented another meridional projection, which comes the neareſt of all to the nature of the globe, becauſe the meridians are placed therein at equal diſtances, the parallels alſo are nearly equidiſtant, and conſequently the ſeveral parts of the earth have their proper proportion of magnitude, diſtance, and ſituation, nearly the ſame as on the globe itſelf. As this ſort of projections is very uſeful, and at the ſame time not very common, we have here added a theory thereof, and alſo a map of the two hemiſpheres of the earth delineated on theſe principles. See plate LXXXV. *fig.* 2.

A determination of the moſt perfect globular projections neceſſary for conſtructing geographical maps.

Let I B L be a ſemi-circle (*fig.* 1.) D the place of the eye in the diameter B C produced, through the center A draw L A I perpendicular to B C. Now if we ſuppoſe the ſemi-circle I B L to be divided into indefinitely ſmall equal parts as F *f*, *f* H, &c. and from D we draw the rays D F, D *f*, D H, &c. cutting the plane of projection L I in the points E, *e*, *b*, the parts E *e*, *e b*, are to be as nearly equal as poſſible, that is, their difference is to be leſs than if the rays had been drawn from any other point as *d*, in the diameter B C produced. This being premiſed, it will follow, that the ſum of the differences of all the parts into which A I is divided by the viſual rays drawn from D to the ſeveral points H, *f* F, &c. in the circumference of the ſemicircle, will be the leaſt poſſible, becauſe if the parts E *e*, *e b*, &c. could be perfectly equal, the ſum of their differences would entirely vaniſh.

Now in order to determine the point D, put the radius A B $= a$, A D $= u$, and imagine E *e* to be the greateſt of all the diviſions that can be made by two rays drawn from the point D to the correſponding points F, *f*, in the circumference. From F draw F G S parallel to I L, and join the points A, F. Call A G, x, and put s for the arch B F, whence G *g* or F M $= \dot{x}$, F *f* $= \dot{s}$; and therefore E A $= \frac{u\sqrt{a^2-x^2}}{x+u}$, which put $= z$; conſequently

E *e* $= \dot{z} = \frac{\overline{aa+ux} \times u\dot{x}}{\overline{u+x}^2 \times \sqrt{a^2-x^2}}$. But A F : F G :: *f* F : F M, which algebraically expreſſed gives $\dot{x} = \frac{\dot{s}}{a} \times \sqrt{a^2-x^2}$; ſubſtitute this value of $\dot{x}$ in the above value of $\dot{z}$, and we ſhall have $\dot{z} = \frac{\overline{aa+ux} \times u\dot{s}}{\overline{u+x}^2 \times a}$, and by taking the fluxion of this expreſſion with u and $\dot{s}$ invariable, we ſhall have $\overline{2u^2-2a^2-ru} \times \frac{u\dot{r}\dot{s}}{r^3 a} = 0$ (wherein $r = u+x$); therefore $\frac{u^2-2a^2}{u} = r = u+x$, and $u - \frac{2a^2}{u} = x$, the part E *e* being the greateſt of all others for the ſame value of u and $\dot{s}$.

If we now conſider the eye as placed at D, it will be eaſy to conceive that the laſt parts next to A and I reſpectively, cannot be determined from the fluxion of E *e*; it is alſo clear that the ſum of the parts E *e*, *e b*, is equal to

to the difference between the greateſt E e, and the neareſt to A, together with the difference between the ſame E e and that neareſt to I. It therefore only now remains to find an expreſſion for theſe extreme parts correſponding to the ſame value of u and $\dot{t}$: in order to which, let a be wrote for x in the value of E e, and then the laſt part next to the center A will become $\frac{\overline{a+u} \times a u \dot{t}}{a \times u \times a}$ or $\frac{u \dot{t}}{a+u}$, and by making $x = 0$, in the ſaid value, we ſhall have $\frac{a \dot{t}}{u}$ for the part next the point I. Now let $u - \frac{2aa}{u}$ be ſubſtituted for x in the above value of $\dot{z}$, viz. $\frac{\overline{aa+ux} \times u \dot{t}}{\overline{u+x} \times a}$; and after due reduction being made, we ſhall have $\frac{u^3 \dot{t}}{4au^2 - 4a^3}$ for the middle or mean part E e, correſponding to the extreme parts already found, namely, $\frac{u \dot{t}}{a+u}$ and $\frac{a \dot{t}}{u}$. If from the double of the mean particle E e we ſubtract the ſum of thoſe extremes, the remainder will give the ſum of their differences; that is, how much they differ from equality among themſelves, and which muſt, by the hypotheſis, be the leaſt poſſible: therefore $\frac{u^3 \dot{t}}{2au^2 - 2a^3} - \frac{u \dot{t}}{a+u} - \frac{a \dot{t}}{u}$ muſt be a minimum; this expreſſion being put into fluxions, with $\dot{t}$ invariable, and made equal to nothing, will produce $u^6 - 3a^2u^4 + 4a^3u^3 - 6a^4u^2 + 2a^6 = 0$, wherein if we take $a = 100$, u will become 160 very near.

Let IBLG now repreſent a ſphere; it is required to determine the point O in the diameter BC produced, from whence equal parts of the ſurface ſhall upon the plane of projection I L appear as nearly equal as poſſible among themſelves.

From O draw O S at pleaſure, and O s infinitely near it, cutting I A L in X and x. Put A B $= a$, A T $= x$, A X $= x$, A O $= u$, and c for the periphery of a circle, whoſe radius is a; then will $\mathrm{AX} = \dot{z} = \frac{u \times \sqrt{a^2 - x^2}}{u+x}$, and X x or $\dot{z} = \frac{\overline{aa+ux}}{\overline{x+u}^2} \times \frac{u \dot{x}}{\sqrt{a^2-x^2}}$. The periphery of the circle whoſe radius is G S is $\frac{c}{a} \times \sqrt{a^2-x^2}$, whence $\dot{z} + u : u :: \frac{c}{a} \times \sqrt{aa-xx} : \frac{uc \times \sqrt{aa-xx}}{\overline{x+u} \times a}$, which being multiplied by $\dot{z}$, gives $\frac{\overline{aa+ux}}{\overline{x+u}^3} \times \frac{u^2 c \dot{x}}{a}$, which, by ſubſtituting r for $u + x$, will become $\frac{\overline{a^2+ur-u^2} \times u^2 c \dot{x}}{r^3 \times a}$. Now as all the ſpherical zones are ſuppoſed equal to each other, it is evident that if the laſt expreſſion be put into fluxions with $\dot{r}$ conſtant, and made equal to nothing, there will ariſe an equation, from whence ſuch a value of AT may be found, as will determine the greateſt circular zone poſſible, correſponding to the equal ones upon the ſurface of the ſphere; hence, by taking the fluxion of $\frac{a^2+ur-u^2}{r^3 \times a} \times u^2$, and equating it as before directed, we get $3u^2 - 2ru = 3a^2$, or $r = \frac{3u}{2} - \frac{3a^2}{2u}$, and $\mathrm{AT} = \frac{u}{2} + \frac{3a^2}{2u}$. Having proceeded thus far, let the general expreſſion for the circular zone, viz. $\frac{\overline{a^2+ux} \times u^2 c \dot{x}}{\overline{x+u}^3 \times a}$ be again reſumed, and therein x made $= 0$; it will then become $\frac{ac\dot{x}}{u}$, an expreſſion for the zone next the point L; and again, if in the ſame general value $\frac{\overline{a^2+ux} \times u^2 c \dot{x}}{\overline{x+u}^3 \times a}$ we make $x = a$, there will ariſe $\frac{\overline{u^2 c \dot{x}}}{\overline{a+u}^2}$ for the zone next the point A; and laſtly, if for x we put its value, viz. $\frac{u}{2} - \frac{3a^2}{2u}$, when the zone is the greateſt it can be, we ſhall have $\frac{4u^5 c \dot{x}}{\overline{u^2-a^2}^2 \times 27a}$ for the value thereof; and conſequently the ſum of the differences found as before, by ſubtracting the ſum of the extremes from double the mean, will be expreſſed by $\frac{8u^5 c \dot{x}}{\overline{u^2-a^2}^2 \times 27a} - \frac{u^2 c \dot{x}}{\overline{a+u}^2} - \frac{ca\dot{x}}{u}$, which muſt be the leaſt poſſible, in fluxions, with $\dot{x}$ conſtant and u variable, gives $\frac{8\dot{u}}{27a} \times \frac{5a^4u^4 - 6a^2u^6 + u^8}{\overline{u^2-a^2}^4} = \frac{\overline{2au+a}}{\overline{a+u}^3} \times \frac{\dot{u}}{u^2}$, which may be farther reduced to $8u^8 - 121a^2u^6 + 162a^3u^5 - 81a^4u^4 + 54a^5u^3 - 81a^6u^2 + 27a^8 = 0$, from whence (making $a = 100$) u will be found equal to 210.5 very near: and conſequently the point O is determined.

In the horizontal projection the eye is ſuppoſed to be in that point of the ſurface of the globe, which is diametrically oppoſite to the place upon the horizon of which the projection is made, and from thence to view the oppoſite concave hemiſphere, with its circles projected upon a glaſs plane paſſing through that horizon. Thus, if we project any map of this ſort upon the horizon of London, the eye is ſuppoſed to be in the place of the antipodes to London, and from thence to view the concave hemiſphere. There is great variety in this ſort of projection; for if the place, the horizon it is upon, be under the pole, the horizontal projection is the ſame with the equatorial already deſcribed. If the place be under the equator, it is the ſame with the meridional: if the place be in an oblique ſphere, the projection will be different, according to the different latitude of the place; for it will approach nearer to an equatorial or meridional projection, according as the place is ſituated nearer to one of the poles, or to the equator. Plate LXXXIV. *fig.* 4. is a map projected upon the horizon of London, whoſe latitude is 51° 32′. The chief advantage of this kind of maps is this, that the place upon the horizon on which the map is projected is always in the center of it, and we may ſee the bearings of places from it.

A particular map is a part of a general one, and may be made upon the ſame principles, as by projecting a large hemiſphere, and taking ſo much of it as the map is deſigned to contain. When we are to delineate a map of a ſmaller part of the earth, if it be near the equator, the meridians and parallels may be repreſented by equidiſtant right-lines. If at ſome diſtance from the equator, the parallels may be equidiſtant ſtraight-lines, and the meridians ſtraight-lines, a little converging towards the neareſt pole: or the meridians may be ſtraight-lines, converging towards the neareſt pole, and the parallels circular.

When we are to make a map of a very ſmall diſtrict, as of a county or hundred, whatever part of the earth it be in, the meridians and parallels may be equidiſtant ſtraight-lines, drawn through every minute, &c. of longitude, according as the largeneſs of the map will allow. See PLOTTING and SURVEYING.

If the eye be ſuppoſed to view the hemiſphere at an infinite diſtance, the projection of its circles, whether it be viewed on the convex or concave ſide, is called orthographic. In this projection, the parts about the middle are very well exhibited, but the extreme parts are very much contracted. See *Orthographic* PROJECTION *of the Sphere*.

Fig. 5. is a general map of the northern hemiſphere projected orthographically upon the plane of the equator. Here the meridians are all ſtraight-lines, and the parallels are compleat circles. *Fig.* 6. is a general map of an hemiſphere projected orthographically on the plane of the meridian. Here all the meridians are projected into ſemi-ellipſes, except that which is perpendicular

cular to the plane of projection, and which becomes a ſtraight-line thereon. This projection has one advantage not to be found in any other general map; namely, that the decreaſe of the parallels from the equator to the poles, appears therein in true proportion.

The orthographic horizontal projection has great variety, according to the different latitude of places, and is pretty difficult to execute. Plate LXXXV. *fig.* 3. is a map of this kind, whoſe center is Ur of the Chaldees, and therefore projected on the horizon of that place.

The great contraction of the extreme parts in the orthographic projection makes it ſo deficient in the ſecond quality required in maps, that it is ſeldom uſed, except when the diſk of the earth, in a ſolar eclipſe, is to be exhibited.

The uſe of maps is obvious from their conſtruction. The degrees of the meridians and parallels ſhew the longitude and latitude of places; their bearings from each other appear from inſpection; and their diſtances may be meaſured by the diviſions on the meridian, equator, &c.

MAPLE, *Acer*, in botany, a genus of plants, the flower of which is compoſed of five oval petals; the fruit conſiſts of a number of capſules, which grow together at the baſe; and are compreſſed, roundiſh, and each terminated by a very large membranous ala; the ſeeds are ſingle and roundiſh.

Great MAPLE, *acer majus*, improperly called ſycamore, a large tree with pentangular ſerrated leaves; producing ſmall greeniſh flowers, and a fruit compoſed of two capſules, including, each, a whitiſh ſeed at the end where they are joined, and ſpreading at the oppoſite end into a membranous wing. It is a native of the mountains of Switzerland and Auſtria, and now common in England.

Theſe trees are propagated by ſowing the ſeeds, ſoon after they are ripe, in an open bed of common earth, covering them about half an inch thick, with ſandy light earth: the ſpring following they will appear above ground, and, if kept clear from weeds, will grow above a foot high the firſt ſummer: the Michaelmas following, if they are thick in the ſeed-bed, you may take out a part of them, and tranſplant into a nurſery, in rows at three feet diſtance, and two feet aſunder in the rows; in which place they may remain three or four years, when they will be large enough to plant out for good. The timber of the common maple is far ſuperior to the beech for all uſes of the turner, particularly diſhes, cups, trenchers, and bowls; and when it abounds with knots, as it very often doth, it is highly eſteemed by the joiners for inlayings, &c. and alſo, for the lightneſs of the wood, is often employed by thoſe that make muſical inſtruments; and, for the whiteneſs of the wood, is in great requeſt for tables.

All the parts of the maple contain a ſweet ſaccharine juice; which exuding on the ſurface of the leaves, renders them ſubject to be preyed on by inſects. The roots, trunk, or branches, wounded early in the ſpring, bleed a large quantity of clear liquor; which, in its dilute ſtate, taſtes ſomewhat ſweetiſh; and, on being inſpiſſated, yields a brown coloured concrete ſugar, with a ſyrupy matter reſembling melaſſes.

The juice, unboiled, has been drank as an antiſcorbutic. The ſugar and melaſſes, which are leſs ſweet than thoſe extracted from the ſugar-cane, and whoſe ſweetneſs is likewiſe ſomewhat different in kind, are ſuppoſed to be more medicinal in diſorders of the breaſt. Conſiderable quantities of this ſugar, made from a ſpecies of maple in Canada, are imported for that uſe into ſome parts of Europe, particularly France.

MARBLE, *Marmor*, in natural hiſtory, a genus of foſſils, being bright and beautiful ſtones, compoſed of ſmall ſeparate concretions, moderately hard, not giving fire with ſteel, fermenting with and ſoluble in acid menſtrua, and calcining in a ſlight fire.

The colours of marbles being a very obvious and ſtriking character, they are arranged according to them, in the following diviſions. 1. Of the white plain marbles there are two ſorts; the Parian marble of the ancients, and ſtatuary marble of the moderns, an extremely bright and elegant marble; and the Carrara marble; a very fine marble, more compact and cloſe than the former, but leſs bright. 2. Of the plain yellowiſh marbles there is only one ſort, which is a hard, pale yellow, and gloſſy marble, found in many parts of Italy. 3. Of the bluiſh and black marbles there are a great many ſpecies, as the Chian marble, Baſaltes, &c. 4. Of the plain green marbles there is only one kind, the Lacedemonian marble of the ancients. 5. The pale-coloured or whitiſh brown, commonly called Darby-marble. 6. The green marbles with ſhells. 7. The black Coralloide marble, with and without ſhells. 8. Of the white variegated marble there are a great many ſpecies, variegated with purple, brown, red, blue, &c. 9. Of the brown variegated marbles there are likewiſe ſeveral ſorts, ſome with red veins, others with white, black, or brown veins. 10. Of the yellow veined and variegated marbles ſome are veined with purple, and others with blue. 11. Of the black variegated marbles, ſome are veined with white, and others with blue, yellow, red, &c. 12. The green variegated marbles are likewiſe diſtinguiſhed by the colour of their veins. 13. The grey ſpotted marbles are variegated, ſome with black and others with green ſpots. 14. The red variegated marble is the Brocatello of the Italians, with white and gold veins.

Poliſhing of MARBLE is performed by firſt rubbing them well with a free-ſtone, or ſand, till the ſtrokes of the axe are worn off, then with pumice-ſtone, and afterwards with emery.

Colouring of MARBLE.—The colouring of marble is a nice art, and in order to ſucceed in it, the pieces of marble, on which the experiments are tried, muſt be well poliſhed, and clear from the leaſt ſpot or vein. The harder the marble is, the better it will bear the heat neceſſary in the operation; therefore, alabaſter and the common ſoft white marble are very improper to perform theſe operations upon.

Heat is always neceſſary for the opening the pores of the marble, ſo as to render it fit to receive the colours; but the marble muſt never be made red-hot, for then, the texture of the marble itſelf is injured, and the colours are burnt, and loſe their beauty. Too ſmall a degree of heat is as bad as too great; for, in this caſe, though the marble receive the colour, it will not be fixed in it, nor ſtrike deep enough. Some colours will ſtrike even cold, but they are never ſo well ſunk in as when a juſt degree of heat is uſed. The proper degree is that which, without making the marble red, will make the liquor boil upon its ſurface. The menſtruums uſed to ſtrike in the colours, muſt be varied according to the nature of the colour to be uſed. A lixivium made with horſe's or dog's urine, with four parts quick-lime, and one part pot-aſhes, is excellent for ſome colours; common ley of wood-aſhes does very well for others: for ſome, ſpirit of wine is beſt; and, finally, for others, oily liquors, or common white-wine.

The colours which have been found to ſucceed beſt with the peculiar menſtruums, are theſe: ſtone-blue diſſolved in ſix times the quantity of ſpirit of wine, or of the urinous lixivium; and that colour which the painters call litmouſe, diſſolved in common ley of wood-aſhes. An extract of ſaffron, and that colour made of buckthorn berries, and called by the painters ſap green, both ſucceed well diſſolved in urine and quick-lime, and tolerably well in ſpirit of wine. Vermilion, and a fine powder of cochineal, ſucceed alſo very well in the ſame liquors. Dragon's blood ſucceeds very well in ſpirit of wine, as does alſo a tincture of logwood, in the ſame ſpirit. Alkanet root gives a fine colour, but the only menſtruum to be uſed for this is oil of turpentine; for neither ſpirit of wine, nor any lixivium, will do with it. There is another kind of ſanguis draconis called dragon's blood in tears, which, mixed with urine alone, gives a very elegant colour. *Philoſ. Tranſact.* N°. 268.

Beſides theſe mixtures of colours and menſtruums, there are ſome colours which are to be laid on dry and unmixed. Theſe are dragon's blood, of the pureſt kind, for a red; gamboge for a yellow; green-wax for a green; common brimſtone, pitch, and turpentine, for a brown colour. The marble, for theſe experiments, muſt be made conſiderably hot, and then the colours are to be rubbed on dry in the lump. Some of theſe colours, when once

once given, remain immutable; others are eaſily changed or deſtroyed. Thus the red colour given by dragon's blood, or by a decoction of logwood, will be wholly taken away by oil or tartar, and the poliſh of the marble not hurt by it.

A fine gold colour is given in the following manner: take crude ſal armoniac, vitriol, and verdigreaſe, of each equal quantities; white vitriol ſucceeds beſt, and all muſt be thoroughly mixed in fine powder.

The ſtaining of marble to all the degrees of red or yellow, by ſolutions of dragon's blood or gamboge, may be done by reducing theſe gums to powder, and grinding them, with the ſpirit of wine, in a glaſs mortar; but, for ſmaller attempts, no method is ſo good as the mixing a little of either of theſe powders with ſpirit of wine, in a ſilver ſpoon, and holding it over burning charcoal. By this means a fine tincture will be extracted, and, with a pencil dipped in this, the fineſt traces may be made on the marble, while cold, which, on the heating it afterwards, either on ſand, or in a baker's oven, will all ſink very deep, and will remain perfectly diſtinct in the ſtone. It is very eaſy to make the ground colour red or yellow by this means, and leave white veins in it. This is to be done by covering the places where the whiteneſs is to remain, with ſome white paint, or even with two or three doubles only of paper, either of which will prevent the colour from penetrating in that part. All the degrees of red are to be given to marble by means of this gum alone; a ſlight tincture of it, without the aſſiſtance of heat to the marble, gives only a pale fleſh colour, but the ſtronger tinctures give it yet deeper; to this the aſſiſtance of heat adds yet greatly; and, finally, the addition of a little pitch to the tincture gives it a tendency to blackneſs, or any degree of deep red that is deſired.

A blue colour may be given alſo to marble by diſſolving turnſol in a lixivium of lime and urine, or in the volatile ſpirit of urine; but this has always a tendency to purple, whether made by the one or the other of theſe ways. A better blue, and uſed in a eaſier manner, is furniſhed by the Canary turnſol, a ſubſtance well known among the dyers: this needs only to be diſſolved in water, and drawn on the place with a pencil; this penetrates very deep into the marble, and the colour may be increaſed by drawing the pencil, wetted afreſh, ſeveral times over the ſame lines. This colour is ſubject to ſpread and diffuſe itſelf irregularly; but it may be kept in regular bounds, by circumſcribing its lines with beds of wax, or any other ſuch ſubſtance. It is to be obſerved, that this colour ſhould be always laid on cold, and no heat given even afterwards to the marble; and one great advantage of this colour is, that it is therefore eaſily added to marble already ſtained with any other colours, and it is a very beautiful tinge, and laſts a long time. *Mem. Acad. Par.* 1732.

Arundel MARBLES, ancient marbles with a chronicle of the city of Athens inſcribed on them, many years before our Saviour's birth; preſented to the univerſity of Oxford by Thomas earl of Arundel, whence the name.

MARBLING, the method of preparing and colouring the marbled paper.

There are ſeveral kinds of marbled paper; but the principal difference of them lies in the forms in which the colours are laid on the ground: ſome being diſpoſed in whirles or circumvolutions; ſome in jagged lengths; and others only in ſpots of a roundiſh or oval figure. The general manner of managing each kind is, nevertheleſs, the ſame; being the dipping the paper in a ſolution of gum-tragacanth, or, as it is commonly called, gum-dragon; over which the colours, previouſly prepared with ox-gall and ſpirit of wine, are firſt ſpread.

The peculiar apparatus neceſſary for this purpoſe, is a trough for containing the gum tragacanth, and the colours; a comb for diſpoſing them in the figure uſually choſen; and a burniſhing ſtone for poliſhing the paper. The trough may be of any kind of wood; and muſt be ſomewhat larger than the ſheets of paper, for marbling which it is to be employed; but the ſides of it need only riſe about two inches above the bottom; for by making it thus ſhallow, a leſs quantity of the ſolution of the gum will ſerve to fill it. The comb may be alſo of wood, and five inches in length; but ſhould have braſs teeth, which may be about two inches long, and placed at about a quarter of an inch diſtance from each other. The burniſhing ſtone may be of jaſper, or agate; but as thoſe ſtones are very dear, when of ſufficient largeneſs, marble or glaſs may be uſed, provided their ſurface be poliſhed to a great degree of ſmoothneſs.

Theſe implements being prepared, the ſolution of gum-tragacanth muſt be made, by putting a ſufficient proportion of the gum, which ſhould be white, and clear from all foulneſſes, into clean water; and letting it remain there a day or two, frequently breaking the lumps and ſtirring it, till the whole ſhall appear diſſolved, and equally mixed with the water. The conſiſtence of the ſolution ſhould be nearly that of ſtrong gum-water, uſed in miniature painting; and if it appear thicker, water muſt be added, or if thinner, more of the gum. When the ſolution is thus brought to a due ſtate, it muſt be paſſed through a linen cloth, and being then put into the trough, it will be ready to receive the colours.

The colours employed for red are carmine, lake, roſe-pink, and vermilion; but the two laſt are too hard and glaring, unleſs they be mixed with roſe-pink, or lake, to bring them to a ſofter caſt: and with reſpect to the carmine and lake, they are too dear for common purpoſes: —for yellow, Dutch pink and yellow oker may be employed: — for blue, Pruſſian blue and verditer may be uſed: — for green, verdigriſe, a mixture of Dutch pink and Pruſſian blue, or verditer, in different proportions: — for orange, the orange-lake, or a mixture of vermilion, or red lead, with Dutch pink: — for purple, roſe-pink and Pruſſian blue.

Theſe ſeveral colours ſhould be ground with ſpirit of wine till they be of a proper fineneſs; and then, at the time of uſing them, a little fiſh-gall, or in default of it, the gall of a beaſt ſhould be added, by grinding them over again with it. The proper proportion of the gall muſt be found by trying them; for there muſt be juſt ſo much as will ſuffer the ſpots of colour, when ſprinkled on the ſolution of the gum-tragacanth, to join together, without intermixing or running into each other.

When every thing is thus prepared, the ſolution of the gum-tragacanth muſt be poured into the trough; and the colours, being in a ſeparate pot, with a pencil appropriated to each, muſt be ſprinkled on the ſurface of the ſolution, by ſhaking the pencil, charged with its proper colour, over it; and this muſt be done with the ſeveral kinds of colour deſired, till the ſurface be wholly covered.

When the marbling is propoſed to be in ſpots of a ſimple form, nothing more is neceſſary; but where the whirles or ſnail-ſhell figures are wanted, they muſt be made by means of a quill; which muſt be put among the ſpots to turn them about, till the effect be produced. The jagged lengths muſt be made by means of the comb above deſcribed, which muſt be paſſed through the colours from one end of the trough to the other; and will give them that appearance; but if they be deſired to be pointed both ways, the comb muſt be again paſſed through the trough in a contrary direction; or if ſome of the whirles or ſnail-ſhell figures be required to be added, they may be yet made by the means before directed.

The paper ſhould be previouſly prepared for receiving the colours, by dipping it over night in water; and laying the ſheets on each other with a weight over them. The whole being thus ready, the paper muſt be held by two corners, and laid in the moſt gentle and even manner on the ſolution covered with the colours; and there ſoftly preſſed with the hand, that it may bear every where on the ſolution. After which it muſt be raiſed and taken off with the ſame care, and then hung to dry acroſs a proper cord, ſubtended near at hand for that purpoſe: and in that ſtate it muſt continue, till it be perfectly dry. It then remains only to give the paper a proper poliſh; in order to which it is firſt rubbed with a little ſope; and then muſt be thoroughly ſmoothed by the glaſs poliſhers, ſuch as are uſed for linen, and called the calender glaſſes. After which it ſhould be again rubbed by a burniſher of jaſper or agate; or, in default of them, of glaſs ground to the higheſt poliſh: for on the perfect poliſh of the paper depends in a great meaſure its beauty and value.

Gold or ſilver powders may be uſed, where deſired, a long with the colours; and require only the ſame treatment as them, except that they muſt be firſt tempered with gum-water.

Marbling of books or paper is performed thus: diſſolve four ounces of gum-arabic into two quarts of fair water; then provide ſeveral colours mixed with water in pots or ſhells, and with pencils peculiar to each colour, ſprinkle them by way of intermixture upon the gum-water, which muſt be put into a trough, or ſome broad-veſſel; then with a ſtick curl them, or draw them out in ſtreaks, to as much variety as may be done. Having done this, hold your book or books cloſe together, and only dip the edges in, on the top of the water and colours, very lightly; which done, take them off, and the plain impreſſion of the colours in mixture will be upon the leaves; doing as well the ends as the front of the book in the like manner.

Marbling a book on the covers is performed by forming clouds with aqua fortis, or ſpirit of vitriol mixed with ink, and afterwards glazing the covers. See the article BOOK-BINDING.

MARCASITES, *Marchaſitæ*, in natural hiſtory, are defined to be compound inflammable metallic bodies, of a hard and ſolid ſubſtance, of an obſcurely and irregularly foliaceous ſtructure, of a bright glittering appearance, naturally conſtituting whole ſtrata, though ſometimes found in detached maſſes; very freely giving fire with ſteel; not fermenting with acid menſtruums; and when put into the fire, yielding a blue ſulphureous flame, and afterwards calcining into a purple powder.

There are only three known ſpecies of this genus: 1. The ſilver-coloured marcaſite, found in vaſt abundance in lead and tin-mines. 2. The gold-coloured marcaſite. 3. The heavy pale-white marcaſite.

Marcaſites were at firſt ſuppoſed to be almoſt all pure gold or ſilver, according to their colour; but experience has ſhewn, that if they contain any metal at all, no method has hitherto been found of working them to advantage. In Germany, indeed, they extract ſulphur and vitriol from the ſilver marcaſite, which two ſubſtances are always contained in it; and beſides theſe, it has uſually a quantity of arſenic. It has been recommended as a ſtyptic, after being calcined; but as the arſenic may not be all carried off by that operation, its uſe as a medicine ſeems extremely dangerous.

MARCGRAVE, or MARGRAVE, a degree of honour in Germany anſwering to our marquis. See the article MARQUIS.

MARCH, in chronology, the third month of the year, conſiſting of thirty-one days. See the articles MONTH and YEAR.

MARCIONITES, Chriſtian heretics in the ſecond century, thus denominated from their leader Marcion, who maintained, that there were two principles or Gods, a good and a bad one. Origen affirms, that he held there was a God of the Jews, a God of the Chriſtians, and a God of the Gentiles. It is ſaid that he denied the reſurrection of the body, condemned marriage, and taught that our Saviour, when he deſcended into hell, diſcharged Cain, the Sodomites, and other impious wretches out of that place of torment. He rejected all the Old Teſtament, and received only part of St. Luke's Goſpel, and ten of St. Paul's epiſtles, in the New.

MARCOSIANS, a ſect of Chriſtian heretics in the ſecond century, ſo called from their leader Marcus, who repreſented the ſupreme God as conſiſting not of a trinity, but a quaternity, viz. the ineffable, ſilence, the father, and truth. He held two principles, denied the reality of Chriſt's ſufferings, and the reſurrection of the body, and had the ſame fancies concerning the æons as Valentinus. See the articles ÆONS and VALENTINIANS.

The Marcoſians, it is ſaid, made pretences to greater perfection than either St. Paul or St. Peter; and being perſuaded that nothing could hinder their ſalvation, freely indulged themſelves in the practice of vice.

MARDIKERS, or TOPASSES, a mixed breed of Dutch, Portugueſe, Indians, and other nations, incorporated with the Dutch at Batavia, in the Eaſt-Indies.

MARE, the female of the horſe-kind. See the article HORSE.

Such mares as are deſigned for breeding, ought to be as free from defects as poſſible, and ſhould, no more than the ſtallions, have either moon-eyes, watery-eyes, or blood-ſhot eyes; they ſhould have no ſplint, ſpavin, or curb, nor any natural imperfection; for the colts will take after them: but choice ſhould be made of the beſt and ableſt, the moſt high-ſpirited, beſt coloured, and fineſt ſhaped; and the natural defects that may be in the ſtallion, ſhould be amended in the mare, as well as that which is amiſs in the mare ſhould be amended in the ſtallion.

As for her age, ſhe may be covered when three years old; but the moſt convenient time is after four, when ſhe will nouriſh her colt beſt; and though ſhe may breed till ſhe is thirteen, yet ſhe is not fit for it when ſhe is paſt ten, for the colt of an old mare is commonly heavy. Before a mare is covered, ſhe ſhould be in the houſe about ſix weeks, during which time ſhe ſhould be well fed with good hay and oats well ſifted; and in order to render her conception the more certain, near a quart of blood may be taken from each ſide of her neck, about five or ſix days before covering. Another method to bring a mare in ſeaſon, and make her retain, is to give her, for the ſpace of eight days before you bring her to the horſe, about two quarts of hemp-ſeed in the morning, and as much at night; and if ſhe refuſes to eat it, to mingle it with a little bran or oats, or elſe to let her faſt for a while: and if the ſtallion alſo eat of it, it will greatly contribute to generation.

Mares go with foal eleven months and as many days as they are years old; and therefore the propereſt time for covering them is in the beginning of June, that ſhe may foal the May following, when there will be plenty of graſs, which will afford the mares a great abundance of milk for nouriſhing their foals: but a mare ſhould never be covered while ſhe is bringing up her foal, becauſe the foal to which ſhe is giving ſuck, as well as that in her belly, will be prejudiced by it, and ſhe herſelf ſooner ſpent. After covering, let her, for three weeks or a month, have the ſame diet as before, and be kept clean in the ſtable till the middle of May, with her feet well pared and thin ſhod: take her in again about the latter end of September, if not before, and keep her to the end of her foaling. If ſhe cannot readily bring forth, hold her noſtrils ſo as to ſtop her taking wind; and if that will not do, diſſolve madder, to the quantity of a walnut, in a pint of ale, and give it her warm. In caſe ſhe cannot void her ſecundine, or after-burden, boil two or three handfuls of fennel in running-water, then put half a pint of that liquor into as much ſack, or, for want thereof, into a pint of ale, with a fourth part of ſallad-oil, mixed together, and pour it luke-warm into her noſtrils, holding them cloſe for ſome time: otherwiſe give her green wheat, or rye, the laſt of which is beſt.

If the mare has but little milk, boil as much as you can get from her, with the leaves of lavender and ſpike, and bathe the udder with it warm, till the knobs and knots are diſſolved. She ſhould now drink only white water, which is bran put into water; give her alſo ſweet maſhes: and a month after foaling let her have a maſh with ſome brimſtone or ſavin in it.

MARJORAM, *Majorana*, in botany, &c. See MAJORANA.

MARITIME, ſomething relating to, or bounded by the ſea: thus, a maritime province, or country, is one bounded by the ſea; and a maritime kingdom, or ſtate, is one that makes a conſiderable figure, or is very powerful at ſea.

MARK, in commerce, a certain note which a merchant puts upon his goods, or upon the caſk, hogſhead, &c. that contains them, in order to diſtinguiſh them from others.

St. MARK *the Evangeliſt's Day*, a feſtival of the Chriſtian church, obſerved April 25.

St. MARK's *Goſpel*, a canonical book of the New Teſtament, being one of the four Goſpels.

St. Mark wrote his Goſpel at Rome, where he accompanied St. Peter, in the year of Chriſt 44. Tertullian and others pretend, that St. Mark was no more than an amanuenſis to St. Peter, who dictated this Goſpel to him; others affirm, that he wrote it after St. Peter's death. Nor

are the learned leſs divided as to the language this Goſpel was wrote in; ſome affirming it was compoſed in Greek, others in Latin. Several of the ancient heretics received only the Goſpel of St. Mark; others among the Catholics rejected the twelve laſt verſes of this Goſpel. The Goſpel of St. Mark is properly an abridgment of that of St. Matthew.

Canons of St. MARK, a congregation of regular canons founded at Mantua, by Albert Spinola, a prieſt, towards the end of the twelfth century. Spinola made a rule for them, which was approved, corrected, and confirmed by ſeveral ſucceeding popes. About the year 1450, they were reformed, and followed only the rule of St. Auguſtine. This congregation having flouriſhed for the ſpace of four hundred years, declined by little and little, and is now become extinct.

Knights of St. MARK, an order of knight hood in the republic of Venice, under the protection of St. Mark the evangeliſt. The arms of the order are, gules, a lion winged or, with this device, PAX TIBI MARCE EVANGELISTA. This order is never conferred but on thoſe who have done ſignal ſervice to the commonwealth.

MARK, or MARC, alſo denotes a weight uſed in ſeveral ſtates of Europe, and for ſeveral commodities, eſpecially gold and ſilver. In France, the mark is divided into eight ounces, or ſixty-four drams, or one hundred and ninety-two deniers, or penny-weights, or one hundred and ſixty eſterlines, or three hundred mailles, or ſix hundred and forty ſelins, or four thouſand ſix hundred and eight grains. In Holland, the mark-weight is alſo called troy-weight, and is equal to that of France. When gold and ſilver are ſold by the mark, it is divided into twenty-four carats. See the article CARACT.

MARK is alſo uſed among us for a money of account, and in ſome other countries for a coin.

The Engliſh mark is two thirds of a pound ſterling, or thirteen ſhillings and fourpence; and the Scotch mark is of equal value in Scotch money of account. The mark-lubs, or Lubeck mark, uſed at Hamburg, is alſo a money of account, equal to one third of the rix-dollar, or to the French livre; each mark is divided into ſixteen ſols-lubs. Mark-lubs is alſo a Daniſh coin equal to ſixteen ſols-lubs. Mark is alſo a copper and ſilver coin in Sweden. See the article EXCHANGE.

MARKET, a public place in a city or town in which live cattle, proviſions, or other goods, are ſet to ſale; and alſo a privilege, either by grant or preſcription, by which a town is enabled to keep a market.

MARLE, *Marga*, a kind of dry, ſoft, foſſile earth, uſed for manuring land.

The word is derived from the old Celtic *marga*, mentioned by Pliny, and afterwards called margilla.

The principal ſorts of marle are the white and red. Too much of it thrown on the ground is found to burn it. Marle is burnt like other ſtone for making of lime.

It is a very material circumſtance in the marling of land, to find out how much the land requires of this manure; and, till experience has thoroughly ſhewn this, it is better to err in laying on too little, than too much; becauſe the latter is a fault not to be remedied. It is to be obſerved alſo, that marle never makes ſo great an improvement on land the firſt year, as it does afterwards.

In Staffordſhire they lay two hundred loads of marle upon an acre of land of the common kind; but where the ſoil is black, looſe, and ſandy, or full of worms, they will lay on three or four hundred loads to an acre; it being a rule with them, that this ſort of ſoil cannot be marled too much. If the mould be thin, the leſs marle does; if deep, it muſt have the more.

It is beſt ſowing of marled lands under furrow; becauſe if theſe lands are well huſbanded, they will be very mellow and hollow, which will occaſion the earth's ſinking from the roots of the corn, if it ſtand too high. If marle fattens land, or makes it ſtiff or binding, it muſt be well dunged, and laid down for graſs. In Staffordſhire, after their land is marled, their way is to take the crops following. After the firſt crop of wheat is off, they plow in the wheat ſtubble in December, and if the weather proves froſty, to mellow it, they do not plow it again till April. They then ſow it with barley, allowing three buſhels of ſeed to an acre. The common produce of this is thirty buſhels. After this they ſow peaſe, for which they plow once in the February following, allowing only three buſhels of ſeed to an acre, as in the barley. Next after this, if they intend ſix crops, they ſow wheat again upon the peaſe-crop; the fifth crop is barley again; and the ſixth year's is red oats. Some ſow two or three crops more, when the ground has been well marled, but that is much better let alone.

In digging for the marle they uſe in manuring the lands, in Ireland, they meet with foſſil horns, and other curious foſſils. The marle always lies in the bottom of low bogs. It is never met with in any other places, and is found by boring with augres made for that purpoſe. It uſually lies at five, ſeven, or nine feet depth. The obtaining it in many places is attended with very conſiderable expences, in draining off the water. The manner of digging it is this: they employ ſix able labourers and a ſupernumerary; and theſe cut up a hole of twelve feet ſquare; which is ſuppoſed a pit that this number of men can manage in a day. Two men dig, two throw it up, and two throw it by, and the ſupernumerary ſupplies defects on all occaſions. For the firſt three feet they dig through a fuzzy earth, fit for making a turf for fuel. Under this lies a ſtratum of gravel, of about half a foot. Under this often, for three feet more, there is a more kindly moſs, which would make better fuel. This lower ſtratum of turf is always full of foſſil wood, which is uſually ſo ſoft, that the ſpade cuts as eaſily through it, as through the earth it lies in. Under this, for about three inches, is found a ſeries of leaves, principally of the oak; theſe appear very fair to the eye, but fall to pieces on touching; and this ſtratum is ſometimes interrupted with vaſt heaps of ſeed, which ſeem to be of the broom or furze. In ſome places there appear berries of different kinds; and in others, ſeveral ſpecies of ſea plants, all lying in the ſame confuſed manner as the oak leaves. Under this vegetable ſtratum, there lies one of blue clay, half a foot thick, and uſually full of ſea ſhells. This blue clay is not ſo tough as the common ſort, but is thrown carefully up, and uſed as marle in ſome places. Under this always appears the right marle; the ſtratum of this is uſually from two to four feet thick, and ſometimes much more. *Philoſophical Tranſactions.* N°. 394.

Dice MARLE, in huſbandry, a name given by the people of Staffordſhire to a reddiſh marle, that breaks into ſmall ſquare pieces like dice, or elſe into thin flakes, in the manner of lead ore, and looks ſmooth on the ſurface.

MARLINE, amongſt ſeamen, a ſmall cord or line, uſed to faſten the ſtrops of blocks, &c. See BLOCK.

MARLINE-SPIKE, a kind of iron pin, with a large head, and tapering at the other end to a point. It is employed to penetrate the twiſts or ſtrands of rope in the time of ſplicing, &c. which is joining the end of one rope to another. See the article SPLICE.

The marline-ſpike is alſo uſeful for many other purpoſes of a ſimilar nature.

MARMALADE, a confection of plums, apricots, quinces, &c. boiled with ſugar to a proper conſiſtence.

MARMOR, *marble.* See MARBLE.

MARMOTTE, in zoology, the largeſt animal of the mus or rat kind, with a long naked tail and tawney body; it is near as big as a hare, and breeds only on the tops of mountains in Switzerland. Its feet are ſomewhat like thoſe of a bear.

MARONITES, in church-hiſtory, a ſect of chriſtians near mount Libanus in Syria, who are in communion with the church of Rome, and have their patriarch, archbiſhops, biſhops, &c.

MARQUE, or *Letters of* MARQUE, in military affairs, are letters of repriſal, granting the ſubjects of one prince or ſtate liberty to make repriſals on thoſe of another.

Letters of marque, among us, are extraordinary commiſſions granted by authority, for reparation to merchants, taken and deſpoiled by ſtrangers at ſea; and repriſals is only the retaking, or taking of one thing for another.

MARQUETRY, or INLAID-WORK, is a curious work compoſed of ſeveral fine pieces of wood, of various colours,

colours, faſtened in thin ſlices on a ground, and ſometimes enriched with other matters, as ſilver, braſs, tortoiſe-ſhell, and ivory; with theſe aſſiſtances the art is now capable of imitating any thing; whence it is by ſome called the art of painting in wood.

The ground on which the pieces are to be arranged and glued, is uſually of well-dried oak or deal, and is compoſed of ſeveral pieces glued together, to prevent its warping. The wood to be uſed in marquetry is reduced into leaves of the thickneſs of a line, or the twelfth part of an inch, and is either of its natural colour, or ſtained, or made black to form the ſhades by other methods: this ſome perform by putting it in ſand heated very hot over the fire; others, by ſteeping it in lime water and ſublimate; and others, in oil of ſulphur. The wood being of the proper colours, the contours of the pieces are formed according to the parts of the deſign they are to repreſent: this is the moſt difficult part of marquetry, and that which requires the moſt patience and attention.

The two chief inſtruments uſed in this work, are a ſaw and a wooden vice, which has one of its chaps fixed, and the other moveable, which is open and ſhut by the foot, by means of a cord faſtened to a treddle. See plate LXXXIII. *fig.* 6.

The leaves to be formed, of which there are frequently three, four, or more joined together, are, after they have been glued on the outermoſt part of the deſign, whoſe profile they are to follow, put within the chaps of the vice; then the workman preſſing the treddle, and thus holding faſt the piece, with his ſaw runs over all the out-lines of his deſign. By thus joining or forming three or four pieces together, not only time is ſaved, but alſo the matter is the better enabled to ſuſtain the effort of the ſaw, which, how fine ſoever it may be, and how ſlightly ſoever it may be conducted by the workman, except this precaution were taken, would be apt to raiſe ſplinters, and ruin the beauty of the work. All the pieces having been thus formed by the ſaw, and marked, in order to their being known again, each is vaneered, or faſtened in its place, on the common ground, with the beſt Engliſh glue; and this being done, the whole is ſet in a preſs to dry, planed over, and poliſhed with the ſkin of the ſea-dog, wax, and ſhave-graſs, as in ſimple vaneering, and the fine branches and more delicate parts of the figures are touched up and finiſhed with a graver.

MARQUIS, a title of honour, next in dignity to that of duke, firſt given to thoſe who commanded the marches, that is, the borders and frontiers of countries.

Marquiſſes were not known in England till king Richard II. in the year 1337, created his great favourite, Robert Vere, the earl of Oxford, marquis of Dublin; ſince which time there have been many creations of this ſort, though at preſent there is but one Engliſh and two Scotch marquiſſes. The manner of creating a marquis differs in nothing from that of a duke, except the difference of the titles, and the marquis's being conducted by a marquis and an earl, while a duke is led by a duke and a marquis; he is alſo girt with a ſword, has a gold verge put into his hand, and his robe or mantle is the ſame as thoſe of a duke, with only this difference, that a duke's mantle has four guards of ermine, and a marquis's only three and a half. The title given him, in the ſtyle of the heralds, is moſt noble and potent prince. His cap is the ſame as a duke's, and the difference between their coronets conſiſts in the duke's being adorned with only flowers or leaves, while the marquis's has flowers and pyramids with pearls on them, intermixed, to ſhew that he is a degree between a duke and an earl.

MARRIAGE, a contract both civil and religious, between a man and a woman, by which they engage to live together in mutual love and friendſhip, for the ends of procreation, &c.

MARROW, *Medulla*, in anatomy, has various ſignifications: the white ſubſtance of the brain, in contradiſtinction from the cortical part, is called the ſpinal marrow; but, properly, marrow denotes that ſoft oleaginous ſubſtance contained in the cavity of the bones.

Every bone in the body, of any conſiderable thickneſs, has either a large cavity, or is full of little cells; in both the one and the other is marrow contained in proper veſicles that open into one another.

In the larger bones this fine oil, by the gentle heat of the body, enters ſome narrow paſſages, which lead to certain fine canals excavated in the ſubſtance of the bone; and from theſe other croſs paſſages, not directly oppoſite to the former, carry the marrow ſtill farther into more longitudinal canals placed nearer the ſurface of the bone. All this contrivance is, that the marrow may ſupple the fibres of the bones, and render them leſs apt to break.

By latter obſervations, blood-veſſels have been found in the bones, ſo that they are nouriſhed in the ſame manner as the other parts of the body. Beſides, we find that many bones grow, and yet have no marrow in them, as the horns of deer, lobſters claws, &c.

All marrows are mollifying, rarefying, give relief by friction under laſſitudes, and incarnate ulcers.

MARRUBIUM, hoar-hound and baſtard dittany, in botany, a genus of plants, with a monopetalous ringent flower, the upper lip of which is erect, ſemibifid, and acute, and the under lip reflex and ſemitrifid: the ſeeds are four, and contained in the cup.

Hoar-hound is reputed attenuant and reſolvent, and accordingly preſcribed in moiſt aſthmas, and in all diſeaſes of the breaſt and lungs. Formerly there uſed to be kept a compound ſyrup of it in the ſhops, but it is now out of uſe.

MARS, in aſtronomy, one of the ſuperior planets, moving round the ſun in an orbit between thoſe of the earth and Jupiter. See the article PLANET.

For the diameter of this planet, and its mean diſtance from the ſun, ſee the articles DIAMETER and DISTANCE.

The character of this planet is ♂; the excentricity of its orbit is 141, ſuppoſing the diſtance of the earth from the ſun 1000 equal parts; the inclination of its orbit to that of the earth is 1° 51′; the periodical time in which it performs its revolution round the ſun, is 686 days, 23 hours, 27′ 30″; its revolution round its own axis 24 hours, 40′; and its parallax, 30″. See the articles CHARACTER, EXCENTRICITY, &c.

In the achronical riſing of this planet, that is, when it is in oppoſition to the ſun, its is found twice as near the earth as the ſun, which is a phænomenon that has greatly diſcredited the Ptolemaic hypotheſis. This planet, as well as the reſt, borrows its light from the ſun, and has its increaſe and decreaſe of light like the moon; and it may be ſeen almoſt biſſected when in its quadratures with the ſun, or in its perigæon; but is never corniculated or falcated, as the inferior planets.

Dr. Hook, in 1665, obſerved ſeveral ſpots in this planet, which having a motion, he concluded the planet to have a turbinated motion round its center. In 1666, M. Caſſini obſerved ſeveral ſpots in the two hemiſpheres of Mars, which, by continuing his different obſervations very diligently, he found to move by little and little from eaſt to weſt, and to return in the ſpace of 24 hours 40′ to their former ſituation. Whence both the motion and period or natural day of that planet were determined. See the article MACULÆ.

Mars always appears with a ruddy troubled light, whence we conclude that it is encompaſſed with a thick cloudy atmoſphere, which by diſturbing the rays of light in their paſſage and re-paſſage through it, occaſion that appearance. Beſides the ruddy colour of Mars, we have another argument of his being encompaſſed with an atmoſphere, and it is this, that when any of the fixed ſtars are ſeen near his body, they appear extremely obſcured and almoſt extinct; and if this be the caſe, a ſpectator in Mars would ſcarce ever ſee Mercury, unleſs perhaps in the ſun at the time of conjunction, when Mercury paſſes over his diſk, as he ſometimes appears to us in form of a ſpot. An eye in Mars will ſee Venus at about the ſame diſtance from the ſun as Mercury appears to us, and the earth about the ſame diſtance from the ſun that Venus appears to us; and when the earth is found in conjunction with and very near the ſun, the eye in Mars will ſee the earth horned or falcated, and its attendant, the moon, of the ſame figure, and at its utmoſt diſtance from the earth

earth not above fifteen minutes of a degree: and as this planet's diſtance from the ſun is to the diſtance of the earth and ſun as 1 ½ to 1; therefore a ſpectator in Mars would ſee the ſun's diameter leſs by one third than it appears to us, and conſequently the degree of light and heat which Mars receives from the ſun, is leſs by one third than that received by the earth; this proportion will, however, admit of a ſenſible variation, on account of the great excentricity of this planet.

Though the period or year of this planet, as has been already obſerved, is nearly twice as long as ours, and his natural day, or the time in which the ſun appears above his horizon, ſetting aſide the conſideration of twilight, is almoſt every where equal to his night; yet it appears that in one and the ſame place, on his ſurface, there will be but very little variety of ſeaſons, or ſcarce any difference of ſummer and winter: and the reaſon is, that the axis of his diurnal rotation is nearly at right angles with the plane of his orbit. It will be found, notwithſtanding, that places ſituated in different latitudes, that is, at different diſtances from his equator, will have very different degrees of heat, on account of the different inclination of the ſun's rays to the horizon, as it is with us when the ſun is in the equinoxes.

From this conſideration Dr. Gregory endeavours to account for the appearance of the faſciæ in Mars, which are certain ſwaths or fillets ſeen in this planet, and poſited parallel to his equator; for as among us, the ſame climate has at different ſeaſons very unequal degrees of heat, but as in Mars it is otherwiſe, the ſame parallel having always a pretty equable degree of heat, it follows, that theſe ſpots may probably be formed in Mars, or in his atmoſphere, as ſnow and clouds are in ours, viz. by the conſtant different intentions of heat and cold in the different parallels, and ſo come to be extended in circles or belts parallel to his equator, or the circle of his diurnal motion. And this ſame principle may, perhaps, ſolve the phœnomenon of Jupiter's belts, that planet, like Mars, having a perpetual equinox. See the article JUPITER.

MARS, among chemiſts, denotes iron, as being ſuppoſed to be under the influence of that planet. See the article IRON.

Crocus of MARS. See CROCUS MARTIS.

MARINE implies in general the whole navy of a kingdom or ſtate, comprehending all the royal dock-yards, and the officers, artificers, ſeamen, ſoldiers, &c. employed therein, as well as the ſhipping employed by the merchants for military or commercial purpoſes, together with whatever relates to navigation, ſhip-building, ſailors, and marines.

The hiſtory of the marine affairs of any one ſtate is a very comprehenſive ſubject, much more that of all nations. Thoſe who would be informed of the maritime affairs of Great Britain, and the figure it has made at ſea in all ages, may find abundance of curious matter in Selden's *Mare Clauſum*, and from his time to ours, we may trace a ſeries of facts in Lediard's and Burchet's Naval Hiſtory; but above all in the Lives of the Admirals by the accurate and judicious Dr. Campbell.

Not only the preſervation of that ſhare of commerce we at preſent poſſeſs, but its future advancement, and even the very being of Britain, as an independent empire, and a free people, depend no leſs on the good condition and the wiſe regulation of our affairs of the marine, than on the ſuperiority of its naval power. The Delphian oracle being conſulted by the Athenians, on the formidable armament and innumerable forces of Xerxes, returned for anſwer, "that they muſt ſeek their ſafety in wooden walls." To which we may affirm, that whenever this nation in particular has recourſe to her floating bulwarks for her ſecurity and defence, ſhe will find ſtrength, wealth, and glory, to be the happy and infallible conſequence.

That the legiſlature has ever been attentive to this great and important object will appear from the following account of the laws that have been enacted relating to the affairs of the Britiſh marine.

So early as 5 Rich. II. c. 3. it was enacted, that none of the king's ſubjects ſhould bring in or carry out any merchandize, but in Engliſh ſhips, on pain of forfeiting all the merchandize otherwiſe conveyed, or the value thereof; but 6 Rich. II. ordains, that the above ſtatute ſhall only take place where able ſhips belonging to the king's ſubjects are to be found; for where they are not to be had, the merchants are allowed to hire other ſhips. By 4 Hen. VII. c. 10. it was enacted, that no Gaſcoign or Guienne-wines, &c. ſhould be imported into this realm but in Engliſh veſſels: and that none ſhould freight any merchandize in any ſtranger's ſhip, if he could have ſufficient freight in a denizen's ſhip, under the penalty of forfeiting all merchandize not thus ſhipped, to be divided between the king and the ſeizer: but this act, ſo far as it related to the above wines, was repealed by the ſtatute 32 Hen. VIII. c. 14. and a rate was ordered of what ſhould be paid for the freight of the ſeveral ſorts of merchandize in ſhips, from the port of London to other places, and from thence to London. By 1 Eliz. c. 13. it was enacted, that if the owner of any merchandize ſhould, in the time of peace, embark or unload any part thereof, (maſts, pitch, tar, and corn, only excepted) out of, or into any foreign ſhip, he ſhould pay cuſtom as an alien.

By the act of navigation, 12 Car. II. c. 18. it is enacted, that no goods ſhall be imported into, or exported out of, any territories belonging to, or that may hereafter belong to his majeſty, his heirs and ſucceſſors, in Aſia, Africa, or America, in any other ſhips beſides ſuch as belong to the people of England, Ireland, Wales, or the town of Berwick upon Tweed, and whereof the maſter and three-fourths of the mariners are Engliſh, on pain of forfeiting both the ſhip and lading, one third part to the king, another to the governor of the country where ſuch default ſhall be, if ſeized there, otherwiſe that third alſo to the king, and the other third to him that will ſeize or ſue for the ſame. And commanders at ſea, having the king's commiſſion, are to bring in as prize all ſuch ſhips, and on their being condemned, one moiety is to be for the uſe of ſuch commanders and their companies, and the other moiety to the king. No goods of the growth or manufacture of Muſcovy, or of the produce of the Turkiſh empire, ſhall be imported into England, Ireland, &c. in any ſhip or veſſel not Engliſh built, or not belonging to the people of England, Ireland, &c. and navigated as aforeſaid; except veſſels built at the place from whence the goods came, or of ſuch port where they can only be, and uſually are ſhipped, on pain of forfeiting the ſhip and goods; and all wines of the growth of France and Germany, and divers goods and merchandize from Spain, Portugal, Ruſſia, &c. which ſhall be imported into the places aforeſaid, in any other ſhip than what doth belong to England, Ireland, &c. and are navigated as aforeſaid, ſhall be deemed aliens goods, and pay accordingly. And no foreign-built veſſel ſhall paſs as a ſhip belonging to England, Ireland, Wales, &c. till the owner makes it appear to the chief officer of the cuſtoms, in the port next to the place of his abode, that he is not an alien, and take an oath that it was *bona fide* bought of ſuch perſons, expreſſing the ſum given, and the time and place when and where, &c. and that no foreigner has a ſhare in it. Alſo none ſhall load in any bottom, if ſtrangers are owners, part-owners, or maſter, and of which three-fourths of the mariners at leaſt are not Engliſh, any goods whatſoever from one port or creek of England, Ireland, Wales, Guernſey, Jerſey, or the town of Berwick, to another port of the ſame, on pain of forfeiting ſuch goods and veſſel.

The 22 and 23 Car. II. c. 11. ordains, that where any goods ſhall be laden on board any Engliſh ſhip of the burden of two hundred tons, or upwards, and mounted with ſixteen guns, or more, if the maſter yields up ſuch ſhip or goods to any Turkiſh veſſel, or any pirate, without fighting, upon proof thereof in the admiralty, he ſhall be incapable of taking charge of any Engliſh veſſel: and maſters of Engliſh ſhips, though not of that burden, nor mounted as aforeſaid, that ſhall yield without fighting to a Turkiſh ſhip or pirate, that has not at leaſt double the number of guns, ſhall be liable to the penalties of this act. If any inferior officers or mariners of a ſhip, ſhall refuſe to fight when commanded, or utter words to diſcourage others, they ſhall loſe all their wages due, and be impriſoned not exceeding ſix months; and mariners laying violent hands on their commanders, to hinder them

from fighting in defence of their ſhips, ſhall ſuffer death as felons. When any Engliſh ſhip ſhall have been defended by fight, and brought to her port, in which fighting any of her men have been wounded or ſlain, the judge of the admiralty, or his ſurrogate, &c. where ſhe ſhall arrive, upon the petition of the maſter and ſeamen, may call ſo many as he ſhall be informed are the adventurers and owners, and by adviſing with them, levy upon the reſpective owners ſuch ſums as he himſelf, and the major part of them preſent, ſhall judge reaſonable, not exceeding two per cent. of the ſhip and goods; which money ſhall be diſtributed among the maſter, officers, and ſeamen, or the widows and children of the ſlain, according to the direction of the judge, with the approbation of three or more of the adventurers. By the 5th and 6th of Will. and Mary, c. 24. every perſon who ſhall build, or cauſe to be built, any ſhip of three decks, containing 450 tons, and mounted with thirty-two pieces of ordnance, having ammunition, &c. proportionable, ſhall for the firſt three voyages which the ſaid ſhip ſhall make to any foreign parts, receive a tenth of the cuſtoms called the ſubſidy of tonnage and poundage, payable for merchandize exported and imported in ſuch ſhips; but if after the end of the three firſt voyages, ſhips ſo built, ſhall be altered ſo as to become leſs defenſible than they were at firſt, then they ſhall be forfeited and loſt.

By 2 Ann. c. 9. owners of ſhips might navigate during the war with France, with maſters, and only one half of the mariners Engliſh: and by 3 and 4 Ann. c. 13. any ſhips might be navigated by foreign ſeamen; and foreigners ſerving on board any Engliſh ſhip for two years, were to be deemed natural-born ſubjects, &c.

By 4 Geo. I. c. 12. and 11 Geo. I. c. 29. if any officer or mariner belonging to any ſhip or veſſel, ſhall wilfully caſt away, burn, or deſtroy the ſhip to which he belongeth, or in any-wiſe direct or procure the ſame to be done, with intent to prejudice a perſon that ſhall have granted any inſurance thereon, or any merchant who ſhall load goods therein, or any owner of ſuch veſſel, the perſons offending ſhall on conviction be adjudged guilty of felony without benefit of clergy.

The 5th of Geo. II. c. 20. enacts, that no commander of any ſhip outward-bound ſhall receive on board any gun-powder, either as merchandize or ſtores for the voyage, except for his majeſty's ſervice, before ſuch ſhip ſhall be at Blackwall, in the river Thames; and all maſters of ſhips coming into the river, ſhall put on ſhore all powder either before the arrival of their ſhips at the ſaid place, or within twenty-four hours after they come to anchor there, upon pain of forfeiting 5 l. for every 50 pounds weight of gun-powder on board, and in the like proportion for a leſs quantity. And no guns ſhall be kept loaded with ſhot in merchant ſhips between London bridge and Blackwall, or fired before the riſing, or after the ſetting of the ſun, under the penalty of 5 l. and for every gun ſo fired, 10 s. And if any pitch, tar, roſin, or other combuſtible matter ſhall be heated or melted by fire in any ſhips, every perſon ſo offending, ſhall, for every offence, forfeit 5 l. And ſhips are liable to be ſearched by an elder brother, appointed by the maſter, wardens, and aſſiſtants of the Trinity-houſe at Deptford. In caſe any ſhip ſhall be moored in the mouth or any other part of St. Saviour's dock, except ſuch ſhips as ſhall be loading or delivering their cargoes, and others, not exceeding two at a time, that ſhall lie at ſhipwright-yard, at the north-weſt corner of the ſaid dock, during the time they ſhall be repairing, the maſter of ſuch ſhip ſhall forfeit 20 s. for every day ſhe ſhall continue to be laid up and moored.

By 6 Geo. II. c. 29. maſters of ſhips lying in the river Thames who have occaſion for ballaſt, ſhall pay 1 s. per ton colliers, other ſhips 1 s. 3 d. and foreign ſhips 1 s. 7 d. per ton, to the corporation of the Trinity-houſe at Deptford; who ſhall pay ballaſt-men 9 d. a ton, for raiſing and carrying it, &c. and it ſhall be lawful for any maſter of a ſhip to appoint two perſons to go on board any lighter bringing ballaſt to ſuch ſhip, to inſpect the marks thereof; and every ballaſt-man ſhall immediately before the delivery of ballaſt to any ſhip, trim ſuch lighter, ſo as to make it ſwim at equal marks at the ſtem and ſtern, and pump all the water out, &c. and the maſter, wardens, and aſſiſtants of the Trinity-houſe, are to make good to the maſter, the quantity or value of the ballaſt which ſhall be found deficient, or forfeit 50 l. one moiety to the poor, and the other to the perſon ſuing for it. The 7th of Geo. II. c. 15. ordains, that no owners of ſhips ſhall be liable to any loſs by reaſon of embezzlement by the maſter or mariners, of any goods or merchandize ſhipped on board, or for any act done by them, without the privity or knowledge of ſuch owners, further than the value of the ſhip, and amount of the freight during the voyage, in which ſuch embezzlement of the maſter or mariners ſhall be committed; and if ſeveral perſons ſhall ſuffer damage by the means aforeſaid, and the value of the ſhip and cargo ſhould not be ſufficient to make compenſation; then the freighters ſhall receive ſatisfaction in average, in proportion to their reſpective loſſes, to be aſcertained on a bill in equity, exhibited for a diſcovery thereof, and of the value of ſuch ſhip and freight. But nothing in this act ſhall diſcharge any remedy, which any perſon may have againſt the maſter and mariners, in reſpect of an embezzlement. See the articles FREIGHT, INSURANCE, &c.

MARINES, or MARINE FORCES, a body of ſoldiers raiſed for the ſea-ſervice, and trained to fight either in a naval engagement, or in an action aſhore.

The great ſervice of this uſeful corps was manifeſted frequently in the courſe of the late war, particularly at the ſiege of Belleiſle, where they acquired a great character, although lately raiſed and hardly exerciſed in military diſcipline. At ſea they are incorporated with the ſhip's crew, of which they make a part, and many of them learn in a ſhort time to be excellent ſeamen, to which their officers are ordered by the admiralty to encourage them, although no ſea-officer is to order them to go aloft againſt their inclination. In a ſea-fight their ſmall arms are of very great advantage in ſcouring the decks of the enemy; and when they have been long enough at ſea to ſtand firm when the ſhip rocks, they muſt be infinitely preferable to ſeamen if the enemy attempts to board, by fraiſing a battalion with their fixed bayonets to oppoſe him. See the article BOARDING.

The marine forces of Great-Britain in the time of peace are ſtationed in three diviſions; one of which is quartered at Chatham, one at Portſmouth, and another at Plymouth. By a late regulation they are ordered to do duty at the ſeveral dock-yards of thoſe ports, to prevent embezzlement of the king's ſtores, for which a captain's guard mounts every day; which certainly requires great vigilance, as ſo many abuſes of this kind have been committed, that many of the inhabitants, who have been long uſed to an infamous traffic of this kind, expect theſe conveyances at certain periods, as their due, and of courſe reſent this regulation in the higheſt degree as an infringement of their liberty as Engliſhmen.

MARSHAL, in its primary ſignification, means an officer who has the command or care of horſes; but it is now applied to officers who have very different employments, as earl-marſhal, knight-marſhal, or marſhal of the king's houſe, &c.

MARSHAL, or MARESCHAL, *of France*, an officer of the greateſt dignity in the French armies. When two or more mareſchals are in the army, the eldeſt commands.

MARSHALLING a coat, in heraldry, is the diſpoſal of ſeveral coats of arms belonging to diſtinct families, in one and the ſame eſcutcheon or ſhield, together with their orhaments, parts, and appurtenances.

MARSHMALLOW, *Althæa*, in botany and medicine. See ALTHÆA.

MARSHY LANDS, thoſe liable to be overflowed by the ſea, or large rivers, for the draining of which, ſee the articles DITCH, DRAIN, &c.

MARSUPIALIS MUSCULUS, in anatomy, a muſcle otherwiſe called the internal obturator. See OBTURATOR.

MARTIAL, among phyſicians, an appellation given to the preparations of iron.

MARTIAL LAW is the law of war, which entirely depends on the arbitrary power of the prince, or of thoſe to whom he has delegated it: for though the king can make no laws in time of peace without the conſent of parliament, yet in time of war he uſes an abſolute power over the army.

MARTIN,

MARTIN, *Martes*, in zoology, a ſpecies of muſtela, of a blackiſh brown colour, and with a pale throat: it is about the ſize of the common cat, but more ſlender. See MUSTELA.

MARTIN is alſo the name of a bird of the hirundo kind, of a black colour, and with the throat white.

MARTINGALE, in the manege, a thong of leather faſtened to one end of the girths under the belly of a horſe, and at the other end to the muſs-roll, to keep him from rearing.

MARTLETS, in heraldry, little birds repreſented without feet, and uſed as a difference or mark of diſtinction for younger brothers, to put them in mind that they are to truſt to the wings of virtue and merit, in order to raiſe themſelves, and not to their feet, they having little land to ſet their feet on.

MARTYR, in the Chriſtian ſenſe of the word, is one who lays down his life for the Goſpel, or ſuffers death for the ſake of his religion.

The feſtivals of the martyrs are of very ancient date in the Chriſtian church, and may be carried back at leaſt till the time of Polycarp, who ſuffered martyrdom about the year of Chriſt 168. On theſe days the Chriſtians met at the graves of the martyrs, and offered prayers and thankſgivings to God for the examples they had afforded them; they celebrated the euchariſt, and gave alms to the poor; which, together with a panegyrical oration or ſermon, and reading the acts of the martyrs, were the ſpiritual exerciſes of theſe anniverſaries.

MARTYROLOGY, in the church of Rome, is a catalogue or liſt of martyrs, including the hiſtory of their lives and ſufferings for the ſake of religion.

MARVEL *of Peru*, in botany, a name uſed by ſome for jalap. See JALAP.

MARUM SYRIACUM, Syrian herb-maſtich, in botany, a low ſhrubby plant, with ſmall oval leaves, pointed at each end, ſet in pairs, without pedicles, of a dilute green colour above, and hoary underneath: in their boſoms appear ſolitary, purple, labiated flowers, wanting the upper lip; the lower lip is divided into five ſegments, the middleſt of which is larger than the reſt, and hollowed like a ſpoon; each flower is followed by four roundiſh ſeeds incloſed in the cup. It is ſaid to be a native of Syria, and of one of the Hieres iſlands, on the coaſt of Provence: in our climate it does not well bear ſevere winters without ſhelter.

The leaves of marum have a bitteriſh, aromatic, very pungent taſte; and when rubbed a little, yield a quick piercing ſmell, which provokes ſneezing. They have been chiefly made uſe of as an ingredient in ſternutatory powders, though, from their ſenſible qualities, they promiſe to be applicable to more important purpoſes, and to have no ill title to the ſtimulating, attenuating, deobſtruent, antiſeptic virtues aſcribed to them by Wedelius in a diſſertation on this plant: they ſeem particularly well adapted as an ingredient in the volatile oily aromatic ſpirits with which their agreeable pungency in a great degree coincides.

The marum loſes but little of its pungency on being dried, and in this reſpect it differs remarkably from many other acrid herbs, as thoſe called antiſcorbutic.

MARY MAGDALEN's DAY, a feſtival of the Romiſh church, obſerved on the twenty-ſecond of July.

MARYGOLD, or MARSH-MARYGOLD, a plant called by botaniſts caltha. See CALTHA.

Corn MARYGOLD, chryſanthemum. See the article CHRYSANTHEMUM.

French MARYGOLD, in botany, tagetes. See TAGETES.

MASCULINE, or MASCULINE-GENDER, among grammarians, that belonging to the male. See GENDER.

MASON, a perſon employed under the direction of an architect, in the raiſing of a ſtone-building.

The chief buſineſs of a maſon is to make the mortar, raiſe the walls from the foundation to the top, with the neceſſary retreats and perpendiculars; to form the vaults, and employ the ſtones as delivered to him. When the ſtones are large, the buſineſs of hewing or cutting them belongs to the ſtone-cutters, though theſe are frequently confounded with maſons: the ornaments of ſculpture are performed by carvers in ſtone or ſculptors. The tools or implements principally uſed by them are the ſquare, level, plumb-line, bevel, compaſs, hammer, chiſſel, mallet, ſaw, trowel, &c. See SQUARE, &c.

MASONRY, in general, a branch of architecture, conſiſting in the art of hewing or ſquaring ſtones, and cutting them level or perpendicular, for the uſes of building; but in a more limited ſenſe, maſonry is the art of aſſembling and joining ſtones together with mortar.

Hence ariſes as many different kinds of maſonry, as there are different forms and manners for laying or joining ſtones. Vitruvius mentions ſeveral kinds of maſonry uſed among the ancients, three of hewed ſtone, viz. that in form of a net, that in binding, and that called the Greek maſonry; and three of unhewed ſtones, viz. that of an equal courſe, that of an unequal courſe, and that filled up in the middle; and the ſeventh was a compoſition of all the reſt, each in their order.

Net-maſonry, called by Vitruvius reticulatum, from its reſemblance to the meſhes of a net, conſiſts of ſtones ſquared in their courſes, and ſo diſpoſed as that their joints go obliquely; and their diagonals are the one perpendicular, and the other level. This is the moſt agreeable maſonry to the eye, but it is very apt to crack. See plate LXXXII. *fig.* 8.

Bound maſonry, that in which the ſtones were placed one over another, like tiles; the joints of their beds being level, and the mounters perpendicular, ſo that the joint that mounts and ſeparates two ſtones, always falls directly over the middle of the ſtone below. This is leſs beautiful than the net-work; but it is more ſolid and durable. See *fig.* 9.

Greek maſonry, according to Vitruvius, is that where after we have laid two ſtones, each of which makes a courſe, another is laid at the end, which makes two courſes, and the ſame order is obſerved throughout the building; this may be called double binding, in regard the binding is not only of ſtones of the ſame courſe with one another, but likewiſe of one courſe with another courſe. See *fig.* 10.

Maſonry by equal courſes, called by the ancients iſodomum, differs in nothing from the bound maſonry, but only in this, that its ſtones are not hewn. See *fig.* 11.

Maſonry by unequal courſes, called pſeudiſodomum, is alſo made of unhewed ſtones, and laid in bound work; but then they are not of the ſame thickneſs, nor is there any equality obſerved, excepting in the ſeveral courſes; the courſes themſelves being unequal to each other. See *fig.* 12.

Maſonry filled up in the middle, called by the ancients emplection, is likewiſe made of unhewed ſtones, and by courſes; but the ſtones are only ſet in order as to the courſes.

Fig. 13. A, the courſes; B, the parts filled up; C, a coat of plaſter.

Compound maſonry is of Vitruvius's propoſing, ſo called, as being formed of all the reſt. In this the courſes are of hewed ſtone; and the middle being left void, is filled up with mortar and pebbles thrown in together: after this the ſtones of one courſe are bound to thoſe of another courſe with cramp irons faſtened with melted lead.

Fig. 14. E, the ſtones cramped; F, the cramps; G, the middle part filled up.

Fig. 15. repreſents another ſort of compound maſonry, the middle of which is ſtone, and the edges boards.

All the kinds of maſonry now in uſe may be reduced to theſe five, viz. bound maſonry; that of brick-work, where the bodies and projectures of the ſtones incloſe ſquare ſpaces or pannels, &c. ſet with bricks; that de moilon, or ſmall work, where the courſes are equal, well ſquared, and their edges or beds ruſticated; that where the courſes are unequal; and that filled up in the middle with little ſtones and mortar.

MASQUE, or MASK, a cover for the face, with ſuitable apertures for the eyes and mouth.

MASQUES, in architecture, denotes certain groteſque

faces, uſed to fill vacant places, as friezes, pannels of doors, keys of arches, &c.

MASQUERADE, an aſſembly of perſons maſked, and dreſſed in peculiar habits, meeting to dance and divert themſelves.

MASS, *Miſſa*, in the church of Rome, the office or prayers uſed at the celebration of the euchariſt; or in other words, conſecrating the bread and wine into the body and blood of Chriſt, and offering them ſo tranſubſtantiated, as an expiatory ſacrifice for the quick and the dead. As the maſs is in general believed to be a repreſentation of the paſſion of our bleſſed Saviour, ſo every action of the prieſt, and every particular part of the ſervice, is ſuppoſed to allude to the particular circumſtances of his paſſion and death.

MASSALIANS, a ſet of enthuſiaſts who ſprang up about the year 361, in the reign of the emperor Conſtantius, who maintained that men have two ſouls, a celeſtial and a diabolical, and that the latter is driven out by prayer. They pretended to prophecy, and affirmed that they could ſee the Trinity with their corporeal eyes; and believed that the Holy Ghoſt deſcended viſibly upon them, eſpecially at the time of their ordination, when they trod the devil under foot, and danced upon him.

MASSETER, in anatomy, a muſcle which has its origin in the lower and interior part of the jugum, and its end at the external ſuperficies of the angle of the jaw. The ductus Stenonianus, or ſalival duct of Steno, paſſes over this muſcle.

MASSIVE, among builders, an epithet given to whatever is too heavy and ſolid: thus a maſſive column is one too ſhort and thick for the order whoſe capital it bears; and a maſſive wall is one whoſe openings or lights are too ſmall in proportion.

MASSORA, in matters of literature, a critical work, containing remarks on the verſes, words, letters, and vowel-points of the Hebrew text of the Bible; a work more laborious than uſeful, ſuch poor obſervations being beneath the notice of men of learning.

MAST, in ſhip-building, a large ſtrong poſt, or pole, of timber, ſtanding erect in a ſhip to carry ſail, whereby ſhe is enabled to make her progreſs through the ſea.

Among the ancient Grecians every ſhip had ſeveral maſts: we are nevertheleſs informed by Ariſtotle, that at firſt there was only one maſt, which being fixed in the middle of the ſhip, the hole into which the foot of it was inſerted, μεσοδμη, in Latin, *modius*, and in Engliſh, the *ſtep*. The parts of the maſt were theſe: πτερνα, or the foot Λινας; or, according to Athenæus, λινον, or τραχηλον, to which the ſail was fixed. Καρχησιον, the pulley by which the ropes were turned round. Θωρακιον, built in the manner of a turret for ſoldiers to ſtand upon and caſt their darts; above this was a piece of wood, called ἱκριον, the extremity of which was termed πλακατη, on which hung a ribband, called from its continual motion επισειων, turning round with the wind; this is termed in Engliſh, the *vane*.

With regard to the moderns, the maſts of their ſhips generally conſiſt of three pieces, joined together lengthwiſe, viz. the lower-maſt, the top-maſt, and the top-gallant-maſt. The top maſt ſtands at the head of the lower-maſt, and the top-gallant-maſt at the head of the top-maſt in the ſame manner, and either of the two latter can be occaſionally taken down; but the lower-maſt, as it is ſettled on the keel of the ſhip, can only be removed by hoiſting it out or cutting it away.

A little below the head of the lower-maſt is fixed the frame of the top, which reſts upon the hounds of the maſt; through this frame the top-maſt is hoiſted, after which the head of it paſſes through the cap, which is a block of wood with two holes in it, one of which reſts on the head of the lower-maſt, and the other ſerves as above, to keep the top-maſt ſteady. When the top-maſt is thus hoiſted up to its utmoſt extent, and kept ſteady above by the cap, and below by the top-frame, a large bar of wood or iron is thruſt through a ſquare hole in the heel of it, cut for that purpoſe; and this bar extending acroſs the middle of the top-frame, the whole weight of the top-maſt reſts upon it; as does the top-gallant-maſt in the ſame manner at the head of the top-maſt.

As every maſt is compoſed of three pieces, it will be alſo neceſſary to inform our readers that all ſhips, properly ſo called, are furniſhed with three maſts, viz. the main-maſt, the fore-maſt, and mizen-maſt. Thoſe which have only two or one maſt, are not called ſhips by ſeamen, but vary their names according to their method of rigging. Of two maſts, there are ſnows, brigs, bilanders, ketches, buſſes, ſchooners, and hermaphrodites, among the Engliſh. Among the Spaniards and Italians, ſettees, barco-longas, feluccas, &c. Thoſe of one maſt are ſloops, tartans, bean-cods, ſhallops, &c.

In the Britiſh navy, maſts are proportioned to the extreme breadth of the ſhip from out to out.

Proportion for the length of maſts, Anno 1745.

			Guns.
1000 : breadth in feet ::	748 :	main-maſt in yards	100
	756 :		90
	753 :		80
	741 :		70 & 60
	740 :		50
	747 :		44
	760 :		24
1000 : main-maſt ::	895 : 901 :	fore-maſt	100, 90, 80, & all the reſt.
1000 : main-maſt ::	870 866	mizen-maſt	100, 90, 80, & all the reſt.
1000 : main-maſt ::	640 613	bowſprit	100, 90, 80, & all the reſt.
1000 : main-maſt ::	600 : 605 : 613 :	main-top-maſt	100,90,80, 70,60,50, 40, 24.
1000 : main-top-maſt ::	900 : 910 :	fore-top-maſt	100,90,80 all the reſt.
1000 : main-top-maſt ::	710 : 717 :	miz. top-maſt	100,90,80, all the reſt.
1000 : main-top-maſt ::	480 : 508 :	main-top-gallant-maſt	100,90,80, all the reſt.
1000 : fore-top-maſt ::	480 : 505 :	fore-top-gallant maſt	100,90,80, all the reſt.

The proportion for maſting ſhips in the merchants ſervice is generally regulated by the judgment and experience of the commander.

The main and fore-maſt in all ſhips down to 60 guns, one inch diameter to every yard in length.

For 50 and 40 guns, twenty-ſeven twenty-eighths of an inch diameter to one yard in length.

For 24 guns, twelve thirteenths of an inch in diameter to one yard in length.

All top-maſts are nine tenths of an inch in diameter to one yard in length.

The fore-top-maſt as big as the main-top-maſt.

The top-gallant-maſt one inch to a yard.

The mizen-maſt $\frac{15}{22}$ of an inch to one yard in length.

The mizen-top-maſt five-ſixths of an inch to one yard in length.

The bowſprit an inch and an half to one yard.

The jib-boom ſeven-eighths of an inch to a yard. See the articles BOWSPRIT and JIB-BOOM.

MASTER, *Magiſter*, in general, is a title of authority; as the grand maſter of Malta, the maſter of St. Lazarus, &c.

MASTER *of a Ship of War*, an officer who has the charge of navigating the ſhip from port to port, under the direction of the captain; the management and diſpoſition of the ſails, the conducting the ſhip in all extremities of danger, and directing her motions in the time of action more particularly belongs to him, as alſo to ſuperintend the proviſions, and ſee that none are permitted to come aboard but ſuch as are wholeſome and ſweet: he is alſo to take care that they are ſafely ſtowed by his mates and quarter-maſters; theſe are alſo employed to ſuperintend the navigation when he is off the deck, and to aſſiſt wherever his duty is concerned.

MASTER *of a Merchant Ship*, the officer who commands and directs her courſe, manages her lading, and all other affairs.

MASTER *at Arms*, in the marine, an officer whoſe buſineſs it is to confine and plant centries over the priſoners

in a ſhip of war; to obſerve that all the lights and fire are put out when the evening gun fires, only ſuch as are allowed by proper authority, or which are under the inſpection of centries: he is alſo to attend the ſide when any boats come aboard, and ſearch carefully that no ſpirituous liquors are brought into the ſhip, but what are permitted by the commanding officer. He is likewiſe to teach the ſeamen the exerciſe of the ſmall arms, to which they have generally a great averſion; for this purpoſe, in large ſhips, the maſter at arms has ſeveral corporals under him to aſſiſt in his office, and relieve the centries and each other. See the article CORPORAL.

MASTER *Attendant*, in the king's dock-yards, an officer whoſe duty it is to obſerve that all the ſhips, which are laid up, or ſaid to be in ordinary, are properly moored, cleaned, and kept in order; for which purpoſe he is often to viſit and examine them; he alſo attends the muſters in the dock-yard, to obſerve that all the men regiſtered on the books do their duty: he has likewiſe the charge of the moorings, which are fixed in the river or harbour where he reſides, and theſe he is always to keep in good repair, that they may be ready to moor the ſhips of war when neceſſary, which employment he muſt alſo ſee ſecurely performed: he removes the ſhips from one place to another in the harbour, and pilots them into and out of the docks, &c. See the articles DOCK-YARD, ORDINARY, and MOORINGS.

MASTER *Shipwright*. See the article SHIPWRIGHT.

MASTER *of Arts* is the firſt degree taken up in foreign univerſities, and for the moſt part in thoſe of Scotland; but the ſecond in Oxford and Cambridge; candidates not being admitted to it till they have ſtudied ſeven years in the univerſity. See the article DEGREE.

MASTERS *in Chancery*, in ordinary, of which there are twelve, the maſter of the rolls being chief, are uſually choſen out of the barriſters of the common law, and ſit in chancery, or at the rolls, as aſſiſtants to the lord chancellor and maſter of the rolls.

MASTER-GUNNER. See GUNNER.

MASTER *of the Horſe*, a great officer of the crown, who orders all matters relating to the king's ſtables, races, breed of horſes; and commands the equerries and all the other officers and tradeſmen employed in the king's ſtables. His coaches, horſes, and attendants, are the king's, and bear the king's arms and livery.

MASTER *of the Ordnance*, a great officer who has the chief command of the king's ordnance and artillery.

MASTER *of the Revels*, an officer who orders all things relating to the performance of plays, maſks, balls, &c. at court.

MASTER *of the Rolls*, a patent officer for life, who has the cuſtody of the rolls of parliament and patents which paſs the great ſeal, and of the records of chancery, as alſo commiſſions, deeds, recognizances, which, being made of rolls of parchment, gave riſe to the name.

MASTERWORT, in botany. See the article IMPERATORIA.

MASTICH, in the materia medica, a concrete reſin, obtained in the iſland Chio from the Lentiſk tree, brought over in ſmall yelloviſh tranſparent grains or tears. From tranſverſe inciſions made in the bark of the tree, about the beginning of Auguſt, the reſin exudes in drops, which running down, and concreting on the ground, are thence ſwept up. The tree is raiſed alſo in ſeveral parts of Europe; but no reſin has been obſerved to iſſue from it in theſe climates; nor do all the trees of this ſpecies in the iſland Chio itſelf, afford this commodity. See the article LENTISCUS.

This reſin has a light agreeable ſmell, eſpecially when rubbed or heated: in chewing, it firſt crumbles, ſoon after ſticks together, and becomes ſoft and white, like wax, without impreſſing any conſiderable taſte.

Maſtich is recommended, in doſes of from half a ſcruple to half a dram, as a mild corroborant and reſtringent, in old coughs, hemoptyſes, diarrhœas, weakneſs of the ſtomach, &c. It is given either in ſubſtance, divided by other materials; or diſſolved in ſpirit, and mixed with ſyrups; or diſſolved in water into an emulſion by the intervention of gum arabic or almonds: the decoctions of it in water, which ſome have directed, have little or nothing of the virtue of the maſtich. It is ſaid that this reſin is commonly employed as a maſticatory in Chio, and among the Turkiſh women, for ſweetening the breath, and ſtrengthening the gums and teeth; and that when thus uſed, by procuring a copious excretion of ſaliva, it proves ſerviceable in catarrhous diſorders.

MASTICATION, *Maſticatio*, in medicine, the action of chewing, or of agitating the ſolid parts of our food between the teeth, by means of the motion of the jaws, the tongue, and the lips, whereby it is broken into ſmall pieces, impregnated with ſaliva, and ſo fitted for deglutition, and a more eaſy digeſtion.

MASTICATORIES, in medicine, ſuch remedies as are taken in at the mouth; and chewed in order to promote the evacuation of the ſalival humour, as tobacco, ginger, pepper, ſage, roſemary, thyme, maſtich, &c.

MASTIGADOUR, MASTICADOUR, or SLABBERING BIT, in the manege, a ſnaffle of iron, all ſmooth, and of a piece, guarded with paternoſters, and compoſed of the halfs of great rings, made into demi-ovals, of unequal bigneſs; the leſſer being incloſed within the greater, which ought to be about half a foot high. See the article BIT.

MASTOIDES, in anatomy, the ſame with mammillaris; being applied to ſuch proceſſes in the body as have the appearance of breaſts or dugs, ariſing in a broad baſis, and terminating in an obtuſe top. Maſtoides is ſometimes applied to the muſcle which ſtoops the head, proceeding from the neck-bone and breaſt-bone, and terminating in the proceſs of the mammiformis.

MAT, among ſailors, a ſort of web or texture, formed of a variety of foxes, each of which conſiſts of a certain number of rope-yarns twiſted together; the foxes are conſequently larger or ſmaller, in proportion to the ſize of the mat required.

Mats are uſed to faſten on the outſides of the ſhrouds, and backſtays, to prevent them from being chafed or fretted by the motion of other ropes which bear againſt them; alſo to laſh on ſeveral blockſtrops, &c. for the ſame purpoſe; the largeſt ſort of them are called panches. See the article PANCH.

MATCH, a kind of rope ſlightly twiſted, and prepared to retain fire for the uſes of the artillery, mines, fireworks, &c.

It is made of hempen tow, ſpun on the wheel like cord, but very ſlack; and is compoſed of three twiſts, which are afterwards again covered with tow, ſo that the twiſts do not appear: laſtly, it is boiled in the lees of old wines. This, when once lighted at the end, burns on gradually and regularly, without ever going out, till the whole be conſumed: the hardeſt and drieſt match is generally the beſt.

MATCHING, in the wine-trade, the preparing veſſels to preſerve wines and other liquors, without their growing ſour or vapid. The method of doing it, as directed by Dr. Shaw, is as follows: melt brimſtone in an iron ladle, and when thoroughly melted, dip into it ſlips of coarſe linnen-cloth; take theſe out, and let them cool: this the wine-coopers call a match; take one of theſe matches, ſet one end of it on fire, and put it into the bung-hole of a caſk; ſtop it looſely, and thus ſuffer the match to burn nearly out: then drive in the bung tight, and ſet the caſk aſide for an hour or two. At the end of this time examine the caſk, and you will find that the ſulphur has communicated a violent pungent and ſuffocating ſcent to the caſk, with a conſiderable degree of acidity, which is the gas and acid ſpirit of the ſulphur. The caſk may after this be filled with a ſmall wine, which has ſcarce done its fermentation, and bunging it down tight, it will be kept good and will ſoon clarify: this is a common and very uſeful method, for many poor wines could ſcarce be kept potable even a few months without it.

MATE *of a Ship of War*, an officer under the maſter, whoſe duty it is to obſerve the navigation of the ſhip, and to keep the log ſtrictly marked; to trim the ſails in the fore-part of the ſhip, and to ſuperintend all affairs relating to the cables, moorings, and riding of the ſhip; to command the boats in which proviſions and water are brought to the ſhip, and aſſiſt in ſtowing them after they arrive aboard. See the articles LOG, MASTER, and TRIM.

MATE *of a Merchant Ship*, the officer who commands the ſhip in abſence of the commander, and ſhares the duty with him.

The number of mates both in ſhips of war and merchant-men, is in proportion to the ſize of a ſhip: a firſt rate man of war has ſix mates, and an Eaſt-India-man the ſame number.

MATERIA SUBTILIS denotes a fine ſubtile matter which the Carteſians ſuppoſe to pervade and penetrate freely the pores of all bodies, to fill up all their pores ſo as not to leave the leaſt vacuity or interſtice between them; they had recourſe to this machine to ſupport the doctrine of an abſolute plenum, and to make it conſiſtent with the phænomenon of motion, &c. See CARTESIAN PHILOSOPHY.

MATERIA CHEMICA, a term uſed by authors to expreſs ſuch bodies as are the peculiar objects of chemical experiments.

MATERIA MEDICA comprehends all the ſubſtances either uſed in medicine in their natural ſtate, or which afford preparations that are ſo; theſe belong partly to the animal, partly to the vegetable, and partly to the foſſile kingdom.

MATHEMATICS, that ſcience which conſiders magnitudes either as they are computable or meaſurable; that part which relates to number only, is called arithmetic; and that which relates to meaſure in general, whether length, breadth, depth, motion, force, &c. is called geometry.

The word is Greek, μαθηματικη, ſignifying the ſame thing, which is derived from μαθητης, a diſciple, and that from μανθανω, to teach.

The firſt who cultivated mathematics after the flood were the Aſſyrians and Chaldeans, from whom, ſays Joſephus, they were carried by Abraham to the Egyptians, and among theſe Ariſtotle fixes the firſt riſe of mathematics. From Egypt, 584 years before Chriſt, they paſſed into Greece through the hands of Thales; after him came Pythagoras, who paid a particular regard to arithmetic, fetching the greateſt part of his philoſophy from numbers; he firſt, according to Laertius, abſtracted geometry from matter; and to him we owe the doctrine of incommenſurable magnitude, the five regular bodies, beſides the principles of muſic and aſtronomy. To him ſucceeded Anaxagoras, Oenopides, Briſo, Antipho, and Hippocrates of Scio, who all applied to the quadrature of the circle, duplicature of the cube, &c. but the laſt with moſt ſucceſs, and Proclus mentions him as the firſt compiler of mathematical elements.

Democritus excelled in mathematics as well as phyſics. The next is Plato, who not only improved geometry, but introduced it into phyſics. Out of his ſchool proceeded a croud of mathematicians, among whom was Leodamus, who improved the analyſis firſt invented by Plato; Theætetus, who wrote on elements, and Archytas, who firſt applied mathematics to uſe in life. Theſe were ſucceeded by Neocles and Theon. Eudoxus excelled in arithmetic and geometry, and was the firſt founder of a ſyſtem of aſtronomy. Menechonus improved the elements.

Ariſtotle's works are ſtored with mathematics; out of whoſe ſchool came Eudemus and Theophraſtus; the firſt wrote of numbers, geometry, and inviſible lines; the latter a mathematical hiſtory. To Ariſteus, Iſidorus, and Hypſicles, we owe the books of ſolids, which, with the other books of elements, were improved and methodiſed by Euclid, who died 284 years before Chriſt.

An hundred years after Euclid, came Eratoſthenes and Archimedes; cotemporary with the latter was Conon. Soon after came Apollonius Pergæus, whoſe conics are ſtill extant. Hipparchus and Menelaus wrote on the ſubtenſes in a circle, the latter on ſpherical triangles. Theodoſius's three books of ſpherics are ſtill extant.

In the year 70, Ptolemy of Alexandria was born; he was ſucceeded by Plutarch the philoſopher; after him came Eutocius, who commented on Archimedes, and occaſionally mentions ſeveral inventions on the duplicature of the cube. To Cteſebes of Alexandria we owe our pumps, and Geminus came ſoon after, whom Proclus prefers to Euclid himſelf.

Diophantus of Alexandria was a great maſter of numbers, and firſt inventor of algebra. Nicomachus is celebrated for his arithmetical, geometrical, and muſical works; Serenus, for his books on the ſection of the cylinder; Proclus, for his comments on Euclid: and Theon is, by ſome, thought to be the author of Euclid's Elements. Pappus of Alexandria flouriſhed in the year 400, and his books of Mathematical Collections are ſtill extant.

Dr. Barrow gives a moſt elegant deſcription of the excellence and uſefulneſs of mathematical knowledge, in his Inaugural Oration, upon being appointed profeſſor of mathematics at Cambridge.

The mathematics, he obſerves, effectually exerciſe, not vainly delude, nor vexatiouſly torment ſtudious minds with obſcure ſubtilties; but plainly demonſtrate every thing within their reach, draw certain concluſions, inſtruct by profitable rules, and unfold pleaſant queſtions. Theſe diſciplines likewiſe enure and corroborate the mind to a conſtant diligence in ſtudy; they wholly deliver us from a credulous ſimplicity, moſt ſtrongly fortify us againſt the variety of ſcepticiſm, effectually reſtrain us from a raſh preſumption, moſt eaſily incline us to a due aſſent, perfectly ſubject us to the government of right reaſon. While the mind is abſtracted and elevated from ſenſible matter, diſtinctly views pure forms, conceives the beauty of ideas, and inveſtigates the harmony of proportions; the manners themſelves are ſenſibly corrected and improved, the affections compoſed and rectified, the fancy calmed and ſettled, and the underſtanding raiſed and excited to more divine contemplations.

Mathematics are commonly diſtinguiſhed into pure and ſpeculative, which conſider quantity abſtractedly; and mixed, which treat of magnitude as ſubſiſting in material bodies, and conſequently are interwoven every where with phyſical conſiderations.

Mixed mathematics are very comprehenſive; ſince to them may be referred aſtronomy, optics, geography, hydrography, hydroſtatics, mechanics, fortification, navigation, &c. See the articles ASTRONOMY, OPTICS, &c.

Pure mathematics have one peculiar advantage, that they occaſion no diſputes among wrangling diſputants, as in other branches of knowledge; and the reaſon is, becauſe the definitions of the terms are premiſed, and every body that reads a propoſition has the ſame idea of every part of it. Hence it is eaſy to put an end to all mathematical controverſies, by ſhewing either that our adverſary has not ſtuck to his definitions, or has not laid down true premiſes, or elſe that he has drawn falſe concluſions from true principles; and in caſe we are able to do neither of theſe, we muſt acknowledge the truth of what he has proved.

MATRICARIA, FEVERFEW, in botany. See FEVERFEW.

MATRICULA, a regiſter kept of the admiſſion of officers and perſons entered into any body or ſociety, of which a liſt is made.

MATRIX, *Uterus*, the womb, in anatomy, that part of the female of any kind, where the fœtus is conceived and nouriſhed till the time of its delivery. See UTERUS.

MATRIX alſo denotes a place proper for the generation of vegetables, minerals, and metals.

MATRIX, in letter foundery. See the article FOUNDERY.

MATRONALIA, a feſtival of the ancient Roman matrons, from whom it had its name. It was celebrated on the kalends of March in honour of the god Mars: and was to the Roman ladies what the feſtival of the Saturnalia was to their huſbands; for at this time they ſerved their women ſlaves at table, and received preſents from their huſbands.

MATROSSES are ſoldiers in the train of artillery, who are next to the gunners, and aſſiſt them in loading, firing, and ſpunging the great guns. They carry firelocks, and march along with the ſtore-waggons, both as a guard, and to give their aſſiſtance in caſe a waggon ſhould break down.

MATTER, *Materia*, in phyſiology, whatever is extended and capable of making reſiſtance: hence, becauſe all bodies, whether ſolid or fluid, are extended, and do reſiſt, we conclude that they are material, or made up of matter.

matter. The Carteſians, it is true, make matter to conſiſt in extenſion alone; but extenſion, without reſiſtance, is nothing but mere ſpace. That matter is one and the ſame thing in all bodies, and that all the variety we obſerve ariſes from the various forms and ſhapes it puts on, ſeems very probable, and may be concluded from a general obſervation of the procedure of nature in the general formation and deſtruction of bodies. Thus, for inſtance, water, rarefied by heat, becomes vapour; great collections of vapours form clouds; theſe condenſed deſcend in the form of hail or rain; part of this collected on the earth conſtitutes rivers; another part mixing with the earth enters into the roots of plants, and ſupplies matter to, and expands itſelf into various ſpecies of vegetables. In each vegetable it appears in one ſhape in the root, another in the ſtalk, another in the flowers, another in the ſeeds, &c. From hence various bodies proceed; from the oak, houſes, ſhips, &c. from hemp and flax we have thread; from thence our various kinds of linnen; from thence garments; theſe degenerate into rags, which receive from the mill the various forms of paper; hence our books; which by fire are converted partly into water, partly into oil, another part into air, a fourth part into ſalt, and a fifth into earth; which are called the elements of bodies; and which, mixed with common earth, are again reſuſcitated in various forms of bodies.

Sir Iſaac Newton thinks it highly probable, that God in the beginning formed matter into ſolid, maſſy, impenetrable, moveable particles, or atoms, of ſuch ſizes and figures, and with ſuch other properties, and in ſuch proportion to ſpace, as moſt conduced to the end for which he formed them; and that theſe primitive particles being ſolids, are incomparably harder than any porous bodies compounded of them, even ſo hard as never to wear or break in pieces; no ordinary power being able to divide what God himſelf made one in the firſt creation. While theſe particles continue entire, they may compoſe bodies of one and the ſame nature and texture in all ages; but ſhould they wear away, or break in pieces, the nature of things depending on them may be changed. Water and earth, compoſed of old worn particles and fragments of particles, would not be of the ſame nature and texture now, with water and earth compoſed of entire particles in the beginning; and therefore, that nature may be laſting, the changes of corporeal things are to be placed only in the various ſeparations and new aſſociations of motions of theſe permanent particles, compound bodies being apt to break, not in the midſt of ſolid particles, but where theſe particles are laid together, and only touch in a few points. See the article ATOM.

MATTER *in Deed*, in law, ſignifies a particular matter of fact to be proved by ſome deed, and is frequently mentioned with matter of record; as where a man, during his abſence abroad in the king's ſervice, is ſued to an exigent; in which caſe, if ſuch perſon would take advantage of this matter in deed, he muſt alledge it before a ſcire facias for execution is awarded againſt him, otherwiſe he can have no relief but from matter of record; that is, ſome error in the proceedings appearing upon the face of the record.

MATTHEW, *or Goſpel of St.* MATTHEW, a canonical book of the New Teſtament.

St. Matthew wrote his Goſpel in Judea, at the requeſt of thoſe he had converted, and it is thought he began it in the year 41, eight years after Chriſt's reſurrection. It was written, according to the teſtimony of all the ancients, in the Hebrew or Syriac language, which was then common in Judea; but the Greek verſion of it, which now paſſes for the original, is as old as the apoſtolical times. St Matthew's view in writing his Goſpel, was chiefly to ſhew the royal deſcent of Jeſus Chriſt, and to repreſent his life and converſation among men. No one of the Apoſtles enters ſo far into the particulars of the actions of Jeſus Chriſt, or has given ſo many rules for the conduct of life. If we compare him with the other three evangeliſts, we may obſerve a remarkable difference in the order and ſucceſſion of our Saviour's actions, from chap iv. to chap. xiv. 13. Some have imputed this variation of St. Matthew to mere chance; and others to choice and deſign: however, it can be no prejudice to the truth of the facts, which are the eſſential part of the goſpel; and as to the order of time, the ſacred authors were not always ſolicitous about it.

St. MATTHEW *the Evangeliſt's Day*, a feſtival of the Chriſtian church, obſerved on September the twenty-firſt.

St. MATTHIAS's *Day*, a feſtival of the Chriſtian church, obſerved on the twenty-fourth of February.

MATTINS, the firſt canonical hour, or the firſt part of the daily ſervice in the Romiſh church.

MATURATION, in ſurgery, the ſame with ſuppuration. See SUPPURATION.

MAUNCH, in heraldry, the figure of an ancient coat ſleeve, borne in many gentlemen's eſcutcheons.

MAUNDY-THURSDAY is the Thurſday in Paſſion-week, which was called Maunday or Mandate Thurſday, from the command which our Saviour gave his Apoſtles to commemorate him in the Lord's Supper, which he this day inſtituted; or from the new commandment which he gave them to love one another, after he had waſhed their feet as a token of his love to them.

Our Saviour's humility in waſhing his diſciples feet, is commemorated on this day by moſt Chriſtian kings, who waſh the feet of a certain number of poor people, not indeed with their own royal hands, but by the hands of their lord almoner, or ſome other deputy.

MAUSOLEUM, a magnificent tomb, or funeral monument. The word is derived from Mauſolus, king of Caria, to whom Artemiſia, his widow, erected a moſt ſtately monument, eſteemed one of the wonders of the world, and called it, from his name, Mauſoleum.

MAXILLA, the jaws, or thoſe parts of an animal in which the teeth are ſet.

The jaws are ſhorter in the human frame than in that of any other animal, in proportion to the ſize of the body; and this is a circumſtance that adds greatly to the beauty of the face. The upper jaw is compoſed of thirteen bones, twelve of which are in pairs: theſe are, 1. the lachrymal; 2. the naſal; 3. the jugal; 4. the maxillar; 5. the ſpongioſum inferius; 6. the palatine: the thirteenth is an odd bone, and is called the vomer. Theſe ſeveral bones of the upper maxilla are united to one another by a kind of juncture, which appears equal and even, and is called by anatomiſts *juncture per harmoniam*.

The maxilla inferior, or lower jaw, is that moveable bone of the head which contains the lower ſeries of teeth; this is compoſed of two bones which unite in the middle of the chin, by the intervention of a cartilage, which hardens as the child grows, and at length becoming bony, joins the two bones into a continued one, reſembling the Greek υ. It conſiſts of two tables, between which there is a ſpongy ſubſtance, which in children is medullary. The fore part is ſhallow, and juſt ſufficient to contain the ſockets of ſixteen teeth. It has two proceſſes, the coronoide and condyloides; four foramina or holes for the paſſage of blood-veſſels and nerves, and ſix pair of muſcles, of which two are depreſſors, and four elevators; the depreſſors are called the platyſma myoides, and the biventer; and the four pair of elevators are, the crotaphites, the maſſeters, and the internal and external pterygoidæi, which ſee under their ſeveral names. There is alſo the maxillary gland, ſituated on the inſide under the lower jaw bone. See the article GLAND.

MAXIMUM, in mathematics, the greateſt quantity attainable in any given caſe, and ſo ſtands oppoſed to minimum.

Methodus de MAXIMIS *et Minimis*, in mathematics, a method ſo called, whereby the greateſt or leaſt poſſible quantity attainable in any caſe is arrived at.

Thus (plate LXXXV. *fig.* 4.) if the ordinate BC, flowing according to the direction AF, continually increaſes till it arrives at a certain place DE, after which it begins to diminiſh, the ordinate DE, in this caſe, is called the greateſt ordinate, or a maximum.

On the contrary, if (*fig.* 5.) the ordinate BC, flowing according to the direction AF, continually decreaſes, till it come into the place DE, and after that it begins to increaſe, the ordinate DE, in this caſe, is called the leaſt ordinate, or a minimum.

And how to determine the greateſt or leaſt ſtate; that is, how to find the value of the correſpondent abſciſſe AD,

from the equation expreſſing the nature of the curve, is the proper buſineſs of the method de maximis and minimis.

And, to this end, we muſt obſerve that the fluxion of the ordinate BC is to the fluxion of the abſciſſe AB, as the ordinate BC is to the ſubtangent VB. Let us now ſuppoſe the ordinate BC (*fig.* 4.) in a flowing ſtate moving according to the direction AF, it is manifeſt that, the nearer the ordinate BC approaches the ordinate DE, the greater will be the ſubtangent BV, till when the ordinate BC arrives at, or is coincident with the ordinate DE, the tangent HEI to the point E, will be parallel to the axis AF; conſequently the ſubtangent BV will become infinite, in reſpect to the ordinate DE, and the fluxion of the ordinate itſelf will vaniſh, or become equal to nothing.

Whence to find the value of the correſpondent abſciſſe, in this caſe let the fluxionary value of the ordinate, deduced from the equation expreſſing the nature of the curve, be put equal to 0, or nothing; by which means all thoſe members of the equation in which it is found will vaniſh, and thoſe that remain will determine the place of the maximum.

For example in (*fig.* 4.) let $AB = x$, $BC = y$, $AF = 2a$. Let us ſuppoſe the equation of the curve to be $2ax - xx = yy$, and let it be required to find the greateſt ordinate, or, which is the ſame thing, the length of its correſpondent abſciſſe AB. Now becauſe $2a\dot{x} - 2x\dot{x} = 2y\dot{y}$, whence $a\dot{x} - x\dot{x} = y\dot{y}$, we ſhall have $\dot{y} = \frac{a\dot{x} - x\dot{x}}{y}$, which being put equal to nothing, we ſhall have $\frac{a\dot{x} - x\dot{x}}{y} = 0$; whence $a\dot{x} - x\dot{x} = 0$, and $a - x = 0$; conſequently $a = x$; that is, AD will be equal to half AF.

Again, let us now ſuppoſe the ordinate BC (*fig.* 6.) to move according to the direction AD; it is likewiſe manifeſt that, the nearer the point B approaches to the point D, the leſſer will be the ſubtangent BV; till at laſt when the point B arrives at, or is coincident with the point D, the ſubtangent BV will vaniſh, and the fluxion of the ordinate will become infinite.

Whence to find the value of the abſciſſe in this caſe, let the fluxionary value of the ordinate be made equal to infinite, then will the infinitely ſmall terms vaniſh, and the remainder will determine the minimum.

For example, let us ſuppoſe $y - a = x^{\frac{1}{3}} \times \overline{a - x^{\frac{2}{3}}}$ to be the equation of the curve (having firſt ſuppoſed $AB = x$, and $BC = y$) then will $\dot{y} = -\frac{2\dot{x} \times \overline{a,^{\frac{1}{3}}}}{3\overline{a - x^{\frac{1}{3}}}}$ which being put equal to an infinite quantity, we ſhall have $3\overline{a - x^{\frac{1}{3}}} = 0$ (for the numerator $-2\dot{x} \times \overline{a^{\frac{1}{3}}}$ in this caſe vaniſhes) whence $a - x = 0$, and $a = x$, that is, $AB = x$ becomes equal to AD, whence AD is the correſpondent abſciſſe.

And hence we are taught a direct method to determine the maximum or minimum in any caſe whatſoever.

MAY, *Maius*, the fifth month of the year, conſiſting of thirty-one days. See the articles MONTH and YEAR.

MAYOR, the chief magiſtrate of a city or town, choſen annually out of the aldermen.

MEAD, a liquor made of honey, and held in great eſtimation by moſt of the northern nations, but perhaps not eſteemed here ſo much as it might deſerve if due care was taken to prepare it properly.

All the writers who have hitherto treated of this ſubject, have given into a capital error with regard to the ſtrength of this liquor, by directing too great a proportion of honey to be diſſolved in the water. The uſual practice of making it ſo ſtrong as to bear an egg, is very wrong. The liquor is thereby rendered a mere ſtum, and this bad quality is ſtill increaſed by the long boiling generally practiſed. It is ſcarcely poſſible to procure honey ſo pure, but that ſome bee-bread, wax, or other ſubſtance is mixed with it, and this cannot be perfectly ſeparated from it, but by boiling. On this account the boiling of mead ſeems indiſputably neceſſary. In order the more effectually to ſeparate theſe impurities from the liquor, it will be adviſeable to mix ſome whites of eggs with it before it is put on the fire, and it will be particularly neceſſary to ſkim off the thick ſcum that riſes, the moment the liquor begins to boil; and this muſt be attentively continued ſo long as it boils. The only method of boiling being here to ſeparate the impurities, and to make a perfect union of the water and the honey, both which purpoſes are very ſoon obtained, it evidently appears that the boiling need be of but very ſhort duration. This becomes here more peculiarly neceſſary, becauſe the liquor will be the leſs diſpoſed to ferment kindly, the longer the boiling has been continued. It is perhaps owing to the ſingle article of long boiling, that mead has hitherto lain under ſo great diſcredit; becauſe it then never fermented ſufficiently to take off its luſcious ſweetneſs; whereas had it undergone a due fermentation, that ſweetneſs would have gone off, and the mead would have attained a fine racy flavour.

Some notable houſewifes have added hops to their mead. This helps to take off its ſweetneſs, and, as the bitterneſs of the hop goes off, gives it a pleaſant flavour. A ferment is here, as in all liquors that are boiled, generally wanted to bring on a perfect fermentation: but as the leaſt taint in the ferment is communicated to the whole liquor, particular care ſhould be taken that it be very ſweet and good. Mead, judiciouſly manag'd on theſe principles, will keep for years, and be improved by age.

MEADOW, in its general ſignification, means paſture, or graſs-land, annually mown for hay; but is more particularly applied to lands that are ſo low as to be too moiſt for cattle to graze upon them in winter, without ſpoiling the ſward. Too much or too little water is almoſt equally prejudicial to meadows, but the beſt land for meadows is a rich ſoil, that has a moiſt bottom, eſpecially where a ſmall brook may be brought over it, and where there is ſuch a deſcent, that the water will not lodge: theſe are better than thoſe by great rivers, where the crops are often loſt. Thoſe that may be overflowed at pleaſure, are called water meadows; theſe ſhould never be overflowed till the end of March, except once or twice in winter, when there are ſuch floods as bring down a great deal of ſoil from the upper-lands, and if the ſeaſon ſhould prove dry, it will be of great ſervice to the graſs, if the meadows are overflowed again; but then the cattle ſhould not be turned in till the ſward is dry enough to bear their weight. Miller recommends the weeding of meadows in April and October, with a ſpaddle, and rolling them with a heavy rollet in ſpring and autumn. See PASTURE.

MEAN, in general, denotes the middle between two extremes: thus we ſay, mean diſtance, mean proportion &c. See the articles DISTANCE, PROPORTION, &c.

MEASLES, in medicine, a cutaneous diſeaſe, attended with a fever, in which there is an appearance of eruptions that do not tend to a ſuppuration. The meaſles begin with chillneſs and ſhivering, and heat and cold ſucceed by turns. The next day the fever comes on, with great ſickneſs, thirſt, and loſs of appetite; the tongue is white, but not dry; there is a little cough, a heavineſs of the head and eyes, and a continual ſleepineſs; then follows a ſneezing, and ſwelling of the eye-lids, and a ſerous humour often diſtils from the noſe and eyes, which are certain ſigns that the eruption is at hand. In the face, the ſpots are ſmall, but on the breaſt broad and red. The patient vomits, but oftener has a looſeneſs with greeniſh ſtools. Theſe ſymptoms continue and increaſe till the fourth, and ſometimes the fifth day, at which time the ſpots, which are like flea bites, increaſe in number and magnitude, but riſe little above the ſkin. The ſymptoms do not immediately vaniſh after the eruption, as in the ſmall-pox, except the vomiting. The cough and fever increaſe, with difficulty of breathing. About the ſixth day, the ſkin of the face and forehead begins to grow rough, and the cuticle breaking, the puſtules die away; and on the eighth day the ſpots diſappear in the face, and are ſcarce viſible any where elſe; on the ninth they quite vaniſh, and fine, thin, light ſcales, fall from the ſkin.

The meaſles are in general not dangerous, unleſs from an inſalubrious epidemical conſtitution of the year, which ſometimes renders them malignant: which may be known

PLATE LXXXV.

Facing Maximum.

Fig. 1. Globular Map.

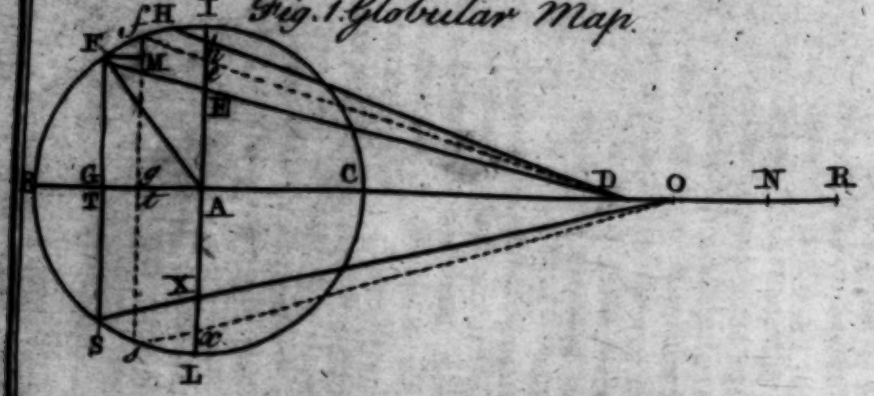


Fig. 4. Maximum.

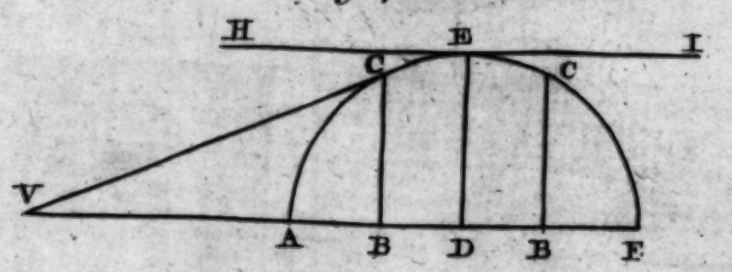


Fig. 3. Map.

Fig. 2. THE GLOBULAR MAP.

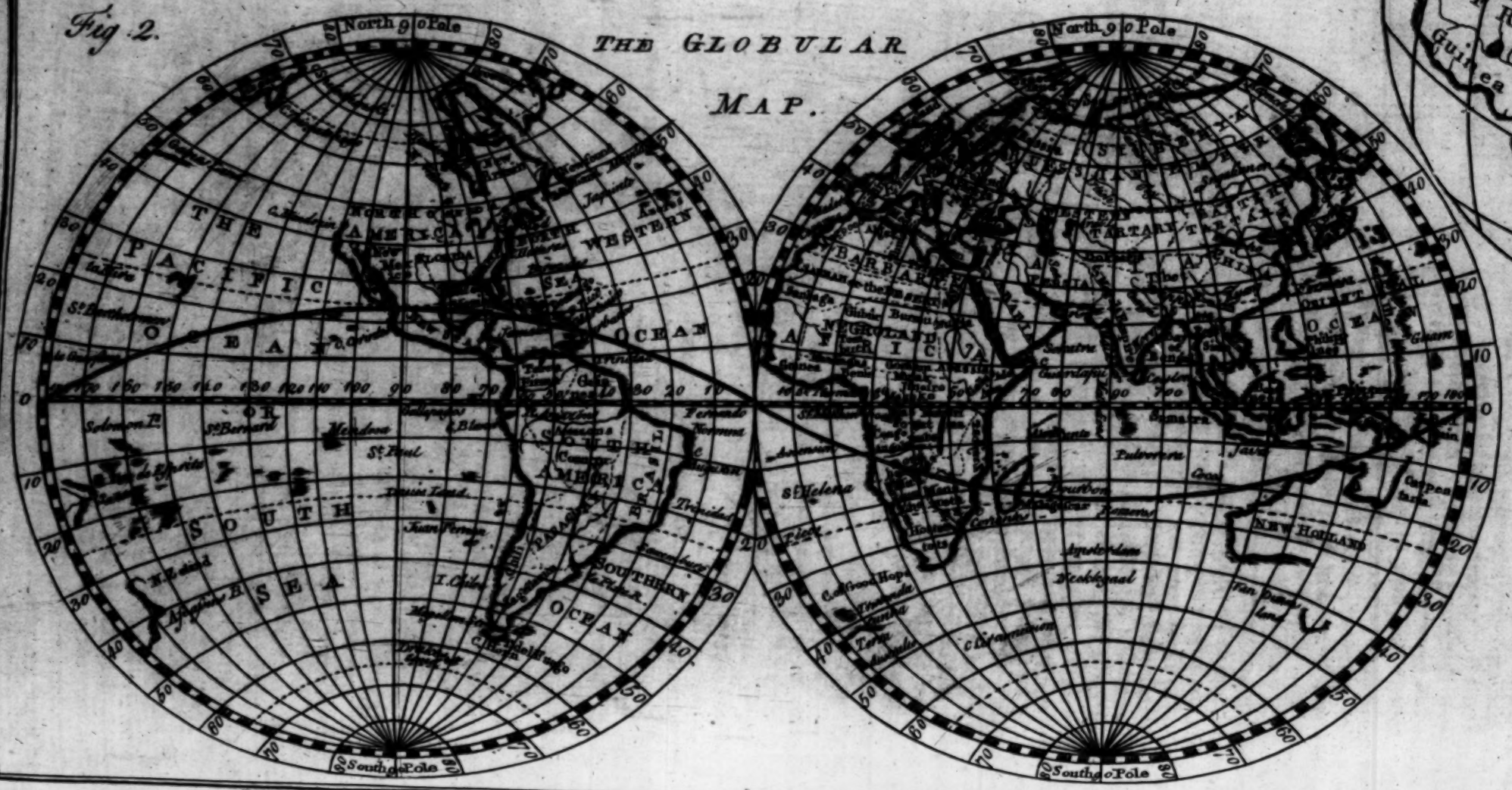


Fig. 5. Maximum.

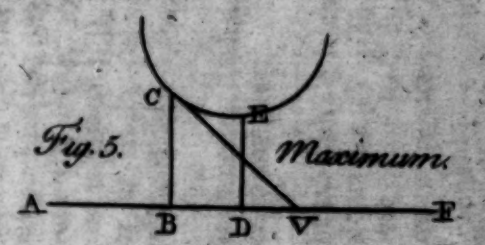
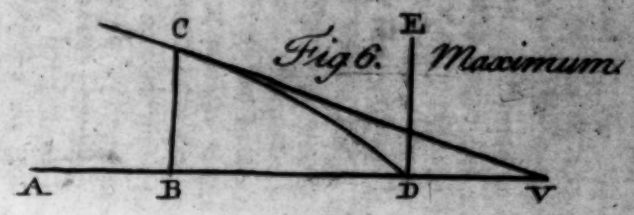


Fig. 6. Maximum.



5 JA 59

by a ſudden loſs of ſtrength, coldneſs of the extreme parts, great reſtleſſneſs, and a delirium. Thoſe who die of the meaſles are generally ſuffocated on the ninth day. Some have a looſeneſs, which continues ſeveral weeks, and brings on a mortal tabes. Some have a ſlow fever, with an atrophy and a ſwelling of the abdomen, which are fatal; and when a cough and hoarſeneſs remain after the diſeaſe, a conſumption will follow without ſpeedy aſſiſtance.

If children are ſuſpected to abound with crudities in the inteſtines, it will be proper to evacuate with half a grain of tartar emetic, and ſyrup of ſuccory with rhubarb. When there are worms, anthelmintics ſhould be given. In adults abounding with blood, phlebotomy is neceſſary on the firſt days; and as ſoon as the eruption is ended a gentle cathartic is proper: in a cough, nothing is better than oil of almonds freſh drawn, mixt with ſyrup of capillaire; half a ſpoonful of which ſhould be often given in water-gruel. The patient ſhould keep his bed for two days after the firſt eruption, and take abſorbent and diaphoretic powders, to which half a grain of ſaffron may be added; theſe ſhould be taken every night from the firſt onſet of the diſeaſe, till the patient recovers, encreaſing or diminiſhing the doſe according to his age. If after the meaſles diſappear, they ſhould be followed by a difficulty of breathing, a fever, and other ſymptoms of an inflammation of the lungs, let blood be taken freely from the arm, once, twice, or three times, as occaſion ſhall require, leaving a due ſpace between each bleeding, and give oil of ſweet almonds, and about twelve days from the invaſion let the patient be purged. The diet ought to be the ſame as in the ſmall-pox, taking particular care that the body be kept lax rather than bound up, through the courſe of the diſtemper. See Pox.

MEASURE, *Menſura*, in geometry, denotes any quantity aſſumed as one, or unity, to which the ratio of other homogeneous or ſimilar quantities is expreſſed. This definition is ſomewhat more agreeable to practice than that of Euclid, who defines meaſure, a quantity which being repeated any number of times, becomes equal to another. This latter definition anſwers only to the idea of an arithmetical meaſure, or quota-part.

MEASURE *of an Angle* is an arch deſcribed from the vertex in any place between its legs.

Hence angles are diſtinguiſhed by the ratio of the arches, deſcribed from the vertex between the legs to the peripheries. Angles then are diſtinguiſhed by thoſe arches; and the arches are diſtinguiſhed by their ratio to the periphery: thus an angle is ſaid to be ſo many degrees as there are in the ſaid arch. See the article ANGLE.

MEASURE *of a Figure*, or plane ſurface, is a ſquare whoſe ſide is one inch, foot, yard, or ſome other determinate length. Among geometricians, it is uſually a rod called a ſquare rod, divided into ten ſquare feet, and the ſquare feet into ten ſquare digits.

MEASURE *of a Line*, any right line taken at pleaſure, and conſidered as unity. The modern geometricians uſe a decempeda, or perch divided into ten equal parts, called feet; the feet they ſubdivide into ten digits, and the digit into ten lines, &c.

MEASURE *of the Maſs, or Quantity of Matter*, in mechanics, is its weight; it being apparent that all the matter which coheres and moves with a body, gravitates with it, and it being found by experiment, that the gravities of homogeneal bodies are in proportion to their bulks; hence, while the maſs continues the ſame, the weight will be the ſame, whatever figure it put on: by which is meant its abſolute weight, for as to its ſpecific, that varies as the quantity of the ſurface varies. See the article GRAVITY and MOMENT.

MEASURE *of a Number*, in arithmetic, ſuch a number as divides another without leaving any fraction: thus 9 is a meaſure of 27.

MEASURE *of a Solid*, is a cube whoſe ſide is one inch, foot, yard, or any other determinate length. In geometry, it is a cubic perch, divided into cubic feet, digits, &c. hence cubic meaſures, or meaſures of capacity. See the articles SPHERE, CUBE, &c.

MEASURE *of Velocity*, in mechanics, the ſpace paſſed over by a moving body in a given time. To meaſure a velocity therefore, the ſpace muſt be divided into as many equal parts as the time is conceived to be divided into; the quantity of ſpace anſwering to ſuch an article of time is the meaſure of the velocity. See the article VELOCITY.

MEASURE, in a legal and commercial ſenſe, denotes a certain quantity or proportion of any thing bought, ſold, valued, or the like. Meaſures are then various, according to the various kinds and dimenſions of the things meaſured. Hence ariſe lineal or longitudinal meaſures, for lines or lengths; ſquare meaſures, for areas or ſuperficies; and ſolid or cubic meaſures, for bodies and their capacities. All which again are very different in different countries, and in different ages, and even many of them for different commodities. Whence ariſe other diviſions of ancient and modern meaſures, domeſtic and foreign ones, dry meaſures, liquid meaſures, &c.

Long MEASURES, or MEASURES *of Application*. The Engliſh ſtandard long meaſure for commerce, or that whereby the quantities of things are ordinarily eſtimated in the way of trade, is the yard, containing three Engliſh feet. Its diviſions are the foot, ſpan, palm, inch, and barley-corn; its multiples the pace, fathom, pole, furlong, and mile. The proportions theſe ſeverally bear to each other, are expreſſed in the following table.

English MEASURES of Length.

	Barley-corns	Inch	Palm	Span	Foot	Cubit	Yard	Pace	Fathom	Pole	Furlong	Mile.
Barley-corns	3											
Inch	9	3										
Palm	27	9	3									
Span	36	12	4	1⅓								
Foot	54	18	6	2	1½							
	108	36	12	4	3	2						
	180	60	20	6⅔	5	3⅓						
	216	72	24	8	6	4	1⅓					
	594	198	66	22	16½	11	3⅔	2¾				
	23760	7920	2640	880	660	440	220	165	40			
	190080	63360	21120	7040	5280	3520	1760	1320	320	8		
								1056	256	6⅖	1	
									880	22	3⅔	1

Scripture-MEASURES of Length reduced to Engliſh.

							Eng. feet.	inch.	Dec.
Digit	—	—	—	—	—	—	0		0.912
4	Palm	—	—	—	—	—	0		3.648
12	3	Span	—	—	—	—	0		10.944
24	6	2	Cubit	—	—	—	1		9.888
96	24	8	4	Fathom	—	—	7		3.552
144	36	12	6	1½	Ezechiel's reed	—	10		11.328
192	48	16	8	2	1¼	Arabian pole	—	14	7.104
1920	480	160	80	20	13⅓	10	Schœnus, or meaſ. line.	145	11.04

The Longer Scripture-MEASURES.

						Engliſh miles	paces	feet.
Cubit	—	—	—	—	—	0	0	1.824
400	Stadium	—	—	—	—	0	145	4.6
2000	5	Sab. day's journey	—	—	—	0	729	3.000
4000	10	2	Eaſtern mile	—	—	1	403	1.000
12000	30	6	3	Paraſang	—	4	153	3.000
96000	240	48	24	8	a day's journey	33	172	4.000

A Table of the MEASURES of Length of the principal Places in Europe, compared with the Engliſh Yard.

		Eng. yard.
100	Aunes or ells of England equal to — —	125
100	of Holland or Amſterdam — —	75
100	of Brabant or Antwerp — — —	76
100	of France — — — —	128¼
100	of Hamburgh, Francfort, &c. —	62½
100	of Breſlau — — — — — —	60
100	of Dantzick — — — — —	66⅔
100	of Bergen and Drontheim — —	68¾
100	of Sweden or Stockholm — — —	65¾
100	of St. Gall, for linnens — — —	87½
100	of ditto, cloths — — — — —	67
100	of Geneva — — — — —	124¾
100	Canes of Marſeilles and Montpelier —	214½
100	of Toulouſe and High Languedoc —	200
100	of Genoa, of 9 palms — — —	245¼
100	of Rome — — — — —	227¼
100	Varas of Spain — — — —	93¾
100	of Portugal — — —	123
100	Cavidos of Portugal — — — — —	75
102	Braſſes of Venice — — — — — —	73½
100	of Bergamo, &c. — — — —	71¼
100	of Florence and Leghorn — — —	64
100	of Milan — — — — — —	58½

N. B. The aunes or ells of Amſterdam, Haerlem, Leyden, the Hague, Rotterdam, and other cities of Holland, as alſo that of Nuremberg, being all equal, are comprehended under that of Amſterdam; as thoſe of Oſnabrug are under thoſe of France; and thoſe of Bern and Baſil are equal to thoſe of Hamburg, Francfort, and Leipſic.

For the ſubdiviſions and multiples of each of theſe meaſures of length, ſee the article AUNE, &c.

For the proportion of the feet of the principal nations in Europe, compared with the Engliſh foot, ſee the article FOOT.

Square, or *Superficial* MEASURES. Engliſh ſquare or ſuperficial meaſures are raiſed from the yard of 36 inches multiplied into itſelf, and thus producing 1296 ſquare inches in the ſquare yard: the diviſions of this are ſquare feet and inches; and the multiples, poles, roods, and acres, as in the following table.

English Square-MEASURES.

Inches	Feet	Yards	Paces	Poles	Rood	Acre.
144						
1296	9					
3600	25	2⅞				
39204	272¼	30¼	10.89			
1568160	10890	1210	435.6	40		
6272640	43560	4840	1743.6	160	4	

Grecian ſquare-meaſures were the plethron, or acre, by ſome ſaid to contain 1444, by others 10000 ſquare feet; and the aroura, the half of the plethron. The aroura of the Egyptians was the ſquare of 100 cubits.

Cubical MEASURES, or *Meaſures of Capacity for Liquids.* — The Engliſh meaſures were originally raiſed from troy-weight; it being enacted by ſeveral ſtatutes that eight pounds troy of wheat, gathered from the middle of the ear, and well dried, ſhould weigh a gallon of wine-meaſure, the diviſions and multiples whereof were to form the other meaſures; at the ſame time it was alſo ordered, that there ſhould be but one liquid meaſure in the kingdom: yet cuſtom has prevailed, and there having been introduced a new weight, viz. the avoirdupois, we have now a ſecond ſtandard-gallon adjuſted thereto, and therefore exceeding the former in the proportion of the avoirdupois weight to troy weight. From this latter ſtandard are raiſed two ſeveral meaſures, the one for ale, the other for beer.

The ſealed gallon at Guildhall, which is the ſtandard for wines, ſpirits, oils, &c. is ſuppoſed to contain 231 cubic inches; and on this ſuppoſition the other meaſures raiſed therefrom, will contain as in the following table: yet by actual experiment, made in 1688, before the lord-mayor and the commiſſioners of exciſe, this gallon was found to contain only 224 cubic inches: it was however agreed to continue the common ſuppoſed contents of 231 cubic inches; ſo that all computations ſtand on their old footing. Hence as 12 is to 231, ſo is 14$\frac{43}{56}$ to 281 ½ the cubic inches in the ale-gallon: but in effect the ale-quart contains 70 ½ cubic inches, on which principle the ale and beer-gallon will be 282 cubic inches. The ſeveral diviſions and multiples of theſe meaſures, and their proportions, are exhibited in the following tables.

Engliſh MEASURE of Capacity for Liquids.

Wine-meaſure.

Solid inches	Pint	Gallon	Rundlet	Barrel	Tierce	Hogſhead	Puncheon	Butt	Tun.
28⅞	Pint								
231	8	Gallon							
4158	144	18	Rundlet						
7276½	252	31½	1¾	Barrel					
9702	336	42	2⅓	1⅓	Tierce				
14553	504	63	3½	2	1½	Hogſhead			
19279	672	84	4⅔	2⅔	2	1⅓	Puncheon		
29106	1008	126	7	4	3	2	1½	Butt	
58212	2016	252	14	8	6	4	3	2	Tun.

Ale-Meaſure.

Pints	Gallon	Firkin	Kilderkin	Barrel	Hogſhead.
8	Gallon				
64	8	Firkin			
128	16	2	Kilderkin		
256	32	4	2	Barrel	
384	48	6	3	1½	Hogſhead.

Beer-Meaſure.

Pints	Gallon	Firkin	Kilderkin	Barrel	Hogſhead.
8	Gallon				
72	9	Firkin			
144	18	2	Kilderkin		
288	36	4	2	Barrel	
533	54	6	3	1½	Hogſhead.

Jewiſh MEASURES of Capacity for Liquids, reduced to Engliſh Wine-meaſure.

						Gall.		Solid Inches.
Caph						0	0½	0.177
1⅓	Log					0	0⅔	0.211
5⅓	4	Cab				0	3⅓	0.844
16	12	3	Hin			1	2	2.533
32	24	6	2	Seah		2	4	5.067
96	72	18	6	3	Bath, or Epha	7	4	15.2
960	720	180	60	30	10	Coron or Chomer	75	5	7.61

In the modern liquid-meaſures of foreign nations, it is to be obſerved, that their ſeveral veſſels for wine, vinegar, &c. have alſo various denominations, according to their different ſizes, and the places wherein they are uſed. The Woeders of Germany, for holding Rhenish and Moſelle wines, are different in their gauges; ſome containing 14 aumes of Amſterdam meaſure, and others more or leſs. The aume is reckoned at Amſterdam to 8 ſteckans or 20 verges, or for ⅛ of a ton of 2 pipes; or 4 barrels of France or Bourdeaux, which ⅛ at this last place is called tiercon, becauſe 3 of them make a pipe or 2 barrels, and 6 the ſaid ton. The ſteckan is 16 mingles, or 3 pints; and the verge is, in reſpect of the ſaid Rhenish and Moſelle and ſome other ſorts of wine, of 6 mingles; but in meaſuring brandy, it conſiſts of 6 ⅛ mingles. The aume is divided into 4 anckers, and the ancker into 2 ſteckans or 32 mingles. The ancker is taken ſometimes for ⅛ of a ton, or 4 barrels, on which footing the Bourdeaux barrel ought to contain at Amſterdam (when the caſk is made according to the juſt gauge) 12 ½ ſteckans, or 200 mingles, wine and lees; or 12 ſteckans, or 192 mingles racked wine; ſo that the Bourdeaux ton of wine contains 50 ſteckans, or 800 mingles, wine and lees; and 48 ſteckans, or 768 mingles of pure wine. The barrels or poinçons of Nantes and other places on the river Loire contain only 12 ſteckans Amſterdam meaſure. The wine-ton of Rochelle, Cognac, Charente, and the Iſle of Rhé, differs very little from the ton of Bourdeaux, and conſequently from the barrels and pipes. A ton of wine of Chaloſſe, Bayonne, and the neighbouring places, is reckoned 60 ſteckans, and the barrel 15, Amſterdam meaſure.

The muid of Paris contains 150 quarts, or 300 pints, wine and lee; or 280 pints clear wine; of which muids 3 make a ton, and the fractions are,

The muid	containing	36 ſetiers
The ſetier		4 quarts
The quart		2 pints
The pint		2 chopins
The chopin		2 demi-ſetiers
The demi-ſetier		2 poiſſons.

The muid is alſo compoſed of pipes, or poinçons, quarteaux, queves, and demiqueves: theſe poinçons of Paris and Orleans contain about 15 ſteckans Amſterdam-meaſure, and ought to weigh with the caſk 666 lb. a little more or leſs. In Provence they reckon by milleroles, and the millerole of Toulon contains 66 Paris-pints, or 100 pints of Amſterdam, nearly; and the Paris-pint is nearly equal to the Engliſh wine-quart.

The butts or pipes from Cadiz, Malaga, Alicant, Benecarlo, Saloe, and Mataro, and from the Canaries, from Liſbon, Oporto, and Fayal, are very different in their gauges, tho' in affreightments they are all reckoned two to the ton.

Vinegar is meaſured in the ſame manner as wine; but the meaſures for brandies are different: theſe ſpirits from France, Spain, Portugal, &c. are generally ſhipped in large caſks called pipes, butts, and pieces, according to the places from whence they are exported, &c. In France, brandy is ſhipped in caſks called pieces at Bourdeaux, and pipes at Rochelle, Cognac, the Iſle of Rhé, and other neighbouring places, which contain ſome more and ſome leſs: even from 60 to 90 Amſterdam-verges or veertels, according to the capacity of the veſſels, and the places they come from, which being reduced into barrels, will ſtand as follows, viz.

At Rochelle, Cognac, the Iſle of Rhé, and the country of Aunis —	27 veertels	per barrel.
At Nants, and ſeveral places of Bretagne and Anjou — —	29 veertels	
At Bourdeaux, and different parts of Guienne — —	32 verges	
At Amſterdam, and other cities of Holland — —	30 veertels	
At Hamburgh and Lubeck —	30 verges	
At Embden — —	27 verges	

In Provence and Languedoc, brandy is ſold by the quintal, the caſks included; and at Bruges, in Flanders, the verges are called ſeſters of 16 ſtops each, and the ſpirit is ſold at ſo much per ſtop.

Olive-oil is alſo ſhipped in caſks of various ſizes, according to the cuſtom of the places where it is embarked, and the conveniency of ſtowage. In England it is ſold by the ton of 236 gallons; and at Amſterdam by the ton of 717 mingles, or 1434 pints. In Provence it is ſold by milleroles of 66 Paris-pints: from Spain and Portugal it is brought in pipes, or butts, of different gauges; at the firſt place it is ſold by roves, whereof 40 go to the butt; and at the latter place by almoudas, whereof 26 make a pipe. Train-oil is ſold in England by the ton, at Amſterdam by the barrel.

MEASURES *of Capacity for Things dry.* Engliſh dry or corn-meaſures are raiſed from the Wincheſter-gallon, which contains 272¼ ſolid inches, and ought to hold of pure running water 9 pounds 13 ounces. This ſeems to ſtand on the foot of the old wine-gallon of 224 cubic inches, 12 being to 14 $\frac{12}{16}$ as 224 to 272 ¼; but by an act of parliament made in 1697 it is decreed, that a round buſhel, 18 ½ inches wide, and 8 deep, is a legal Wincheſter-buſhel. Now ſuch a buſhel will only hold 2150.42 cubic inches, conſequently the gallon will hold 268.8 cubic inches, the diviſions and multiples whereof are in the following table:

English Dry or Corn MEASURE.

Solid inches					
33.6	Pint				
268.8	8	Gallon			
537.6	16	2	Peck		
2150.4	64	8	4	Buſhels	
17203.2	512	64	32	8	Quarter.

Scripture MEASURES of Capacity for Things dry, reduced to Engliſh Corn-meaſure.

							ſolid inch.
Gachal	—	—			0	0 0 $\frac{42}{100}$	0.031
20	Cab	—	—		0	0 2 ¼	0.073
36	1¼	Gomer	—	—	0	0 5 $\frac{4}{10}$	1.211
120	6	3½	Seah	—	1	0 1	4.036
360	18	10	3	Epha	—	3 0 3	12.107
1800	90	50	15	5	Leteeh	—	16 0 0	26.500
3600	180	100	30	10	2	Chomer, or Coron	32 0 1	18.969

In the ſeveral parts of Europe, ſalt, which is a more ſtaple and current commodity than any other, is bought and ſold by different meaſures, according to the ſeveral places of its diſpatch: at Amſterdam it is ſold by the cent of 404 meaſures, or ſcheppels, which cent is reckoned to be ſeven laſts, or 14 tons, and the laſt is to weigh 4000 lb. the ſeven laſts making 28000 lb. called the cent of ſalt, which alſo contains 208 ſacks; though ſome of this commodity is much heavier than others. In the cities of France, ſalt is ſold by the muid, whoſe ſize varies according to the different places of its manufacture and diſpatch. At Paris this meaſure is reckoned to contain 12 ſetiers, or 48 minots, which minot is alſo divided into other meaſures. The cent of ſalt from Marans, Brouage, Sude, and the Iſle of Rhé, contain 28 ſtricken muids, and each muid 24 boiſeaux, which yields at Amſterdam 11 ½ laſts, or 23 tons, more or leſs. In Copenhagen, the ſaid cent renders only 9 ½ laſts, the laſt being reckoned here equal to 18 tons, and 50 laſts to correſpond with 52 of Coningſberg, at which place the cent produces about 10 laſts, or 40,000 lb. At Riga the ſaid cent yields the ſame meaſure as at Coningſberg, and about 6 ¼ laſts of Riga, make the great cent of Amſterdam. The ſaid French cent produces at Dantzick from 11 ½ to 12 laſts, of which laſts from 7 ¼ to 7 ½, make likewiſe the great cent of Amſterdam. At Stetin in Pomerania, the French cent yielded 10 laſts, making 40,000 meaſure and weight of the ſaid place. In Portugal it is bought by the muid, of which four make a laſt, and ſeven the cent of Amſterdam. At Alamat and Ivica it is ſold by the modin, which weighs from 27 ½ to 28 hundred weight Engliſh.

MEASURE *of Wood*, for firing. See the article CORD *of Wood.*

MEASURE *for Horſes*, is the hand, which by ſtatute contains four inches.

MEASURE is alſo uſed to ſignify the cadence and time obſerved in poetry, dancing, and muſic, to render them regular and agreeable. See METRE.

MEASURE, in muſic, the interval or ſpace of time which the perſon who beats time takes between the riſing and falling of his hand, in order to conduct the movement ſometimes quicker and ſometimes ſlower, according to the muſic or ſubject that is to be ſung or played. See TIME.

MEATUS AUDITORIUS, in anatomy, the auditory paſſage. See the article EAR.

MECHANICS, that branch of mathematics which conſiders motion and moving powers, their nature and laws, with their effects in machines. See the article MACHINE.

The knowledge of mechanics is one of thoſe things, ſays Mr. Mac Laurin, that ſerves to diſtinguiſh civilized nations from barbarians. It is by this ſcience, that the utmoſt improvement is made of every power and force in nature; and the motions of the elements, water, air, and fire, are made ſubſervient to the various purpoſes of life: for however weak the force of man appears to be, when unaſſiſted by this art; yet, with its aid, there is hardly any thing above his reach. It is diſtinguiſhed, by Sir Iſaac Newton, into practical and rational mechanics; the former of which treats of the mechanical powers, viz. the lever, ballance, axis and wheel, pulley, wedge, ſcrew, and inclined plane. See the articles LEVER, BALLANCE, &c.

Rational mechanics comprehends the whole theory of motion; ſhews, when the powers or forces are given, how

how to determine the motions that are produced by them; and, converſely, when the phænomena of the motions are given, how to trace the powers or forces from which they ariſe. See MOTION.

MECHANICAL, an epithet applied to whatever relates to mechanics: thus we ſay, mechanical powers, cauſes, &c. See the articles POWER, CAUSE, &c.

The mechanical philoſophy is the ſame with what is otherwiſe called corpuſcular philoſophy. See the article CORPUSCULAR.

MECHANICAL, in mathematics, denotes a conſtruction of ſome problem, by the aſſiſtance of inſtruments, as the duplicature of the cube and quadrature of the circle, in contradiſtinction to that which is done in an accurate and geometrical manner.

MECHANICAL *Curve*, is a curve, according to Deſcartes, which cannot be defined by any algebraic equation: and ſo ſtands contradiſtinguiſhed from algebraic or geometrical curve.

Leibnitz and others call theſe mechanical curves tranſcendental, and diſſent from Deſcartes in excluding them out of geometry. Leibnitz found a new kind of tranſcendental equations, whereby theſe curves are defined: but they do not continue conſtantly the ſame in all points of the curve, as algebraic ones do.

MECHOACAN, in the materia medica, the root of an American convolvulus, brought chiefly from a province in Mexico of the ſame name, in thin tranſverſe ſlices, like jalap, but larger and whiter.

This root was firſt introduced about the year 1524, and continued in eſteem for a conſiderable time, as a mild cathartic, of very little taſte or ſmell, not liable to offend the ſtomach, of ſlow operation, but effectual and ſafe: by degrees it gave place to jalap, which has now, among us, almoſt wholly ſuperſeded its uſe. It ſeems to differ from jalap only in being weaker: the reſins obtained from the two roots have the ſame qualities, but mechoacan ſcarcely yields one ſixth part ſo much as jalap does, and hence requires to be given in much larger doſes to produce the ſame effects. The doſe of the mechoacan in ſubſtance is from one dram to two or more.

MECONIUM, in medicine, a black thick fœces gathered in the inteſtines of infants, and brought with them into the world at the time of their birth. The retention of theſe fœces is one of the diſeaſes to which infants are liable; for the cure of which, ſee the article INFANTS.

MECONIUM, in pharmacy, the extract of Engliſh poppies.

MEDAL, a piece of metal in the form of coin, intending to convey to poſterity the portrait of ſome great perſon, or the memory of ſome illuſtrious action.

The parts of a medal are the two ſides, one of which is called the face, or head, and the other the reverſe. On each ſide is the area, or field, which makes the middle of the metal; the rim, or border; and the exergue; and on the two ſides are diſtinguiſhed the type, or the figure repreſented, and the legend, or inſcription.

There was formerly no difference between money and medals. An old Roman had his purſe full of the ſame pieces that we now preſerve in cabinets. As ſoon as an emperor had done any thing remarkable, as gaining a victory, giving up a tax, or the like, it was immediately ſtamped on a coin, and became current through his whole dominions. This was a pretty device to ſpread abroad the virtues of an emperor, and make his actions circulate; and thus a freſh coin was a kind of gazette, that publiſhed the lateſt news of the emperor.

The uſe of medals is very conſiderable: they give a very great light into hiſtory, in confirming ſuch paſſages as are true in old authors, in reconciling ſuch as are told in different manners, and in recording ſuch as have been omitted. In this caſe, a cabinet of medals is a body of hiſtory. It was, indeed, the beſt way in the world to perpetuate the memory of great actions, thus to coin out the life of an emperor, and to put every exploit into the mint. It was a kind of printing before the art was invented; and they have this advantage over books, that they tell their ſtory quicker, and ſum up a whole volume in twenty or thirty reverſes: thus Mr. Vaillant, out of a ſmall collection of medals, has given us a chronicle of the kings of Syria. They are, indeed, the beſt epitomes in the world, and let us ſee, with one caſt of the eye, the ſubſtance of above an hundred pages. Another uſe of medals is, that they not only ſhew the actions of an emperor, but at the ſame time mark out the year in which they were performed; for as every exploit has its date ſet to it, a ſeries of an emperor's coins is his whole life digeſted into annals. A medalliſt, upon the firſt naming of an emperor, will immediately tell his age, family, and life. To remember where he enters in the ſucceſſion, he only conſiders in what part of the cabinet he lies; and by running over in his thoughts ſuch a particular drawer, will give an account of all the remarkable parts of his reign. Nor are medals of leſs uſe in architecture, painting, poetry, &c. A cabinet of medals is a collection of pictures in miniature, and by them the plans of many of the moſt conſiderable buildings of antiquity are preſerved.

MEDALLION, or MEDALION, a medal of an extraordinary ſize, ſuppoſed to be anciently ſtruck by the emperors for their friends, and for foreign princes and embaſſadors; but that the ſmallneſs of their number might not endanger the loſs of the devices they bore, the Romans generally took care to ſtamp the ſubject of them upon their ordinary coins.

Medallions, in reſpect of the other coins, were the ſame as modern medals in reſpect of modern money: they were exempted from all commerce, and had no other value but what was ſet upon them by the fancy of the owner. Medallions are ſo ſcarce that there cannot be any ſet made of them, even though the metals and ſizes ſhould be joined promiſcuouſly.

MEDEOLA, in botany, a genus of the hexandria-trigynia claſs of plants, the flower of which conſiſts of ſix oblong, patent, and revolute petals: the fruit is a berry of a roundiſh form, with three cells, in each of which is contained a ſingle cordated ſeed.

MEDIAL, or ALLIGATION MEDIAL, in arithmetic. See ALLIGATION.

MEDIANA, a vein formed by the concourſe of the cephalic and baſilic veins in the bend of the elbow.

MEDIASTINUM, in anatomy, is a double membrane continuous to the ſternum, ſituated under it, and adhering firmly to it. It divides the cavity of the thorax longitudinally into two parts: but as it is not exactly under the middle of the ſternum, but ſomewhat to the left-ſide, the right-part of the thorax is larger than the left.

The mediaſtinum is connected with the ſternum, pleura, pericardium, and other adjoining parts. It receives veins and arteries from the mammary and diaphragmatic veſſels, and ſometimes has proper and particular ones of its own from the aorta and cava: theſe are then called the mediaſtinal veſſels. Its nerves, which are ſmall, are from the diaphragmatics and the par vagum. It has alſo a number of lymphatics, which run to the ductus thoracicus.

The uſes of the mediaſtinum are two. The firſt is to divide the breaſt longitudinally into two parts, by which ſeveral great purpoſes are anſwered; as, 1. That on one of the lobes of the lungs being ulcerated, the other might not be immediately affected. 2. That water, matter, or any thing elſe contained in one part of the thorax, might not at the ſame time affect both parts of the lungs. 3. That in caſe of a wound in one ſide of the thorax, reſpiration might be continued in the other, and the perſon not be immediately ſuffocated. The ſecond general uſe of the mediaſtinum, is to ſupport the heart in its pendulous ſtate, for the benefit of its free motion, eſpecially when we lie on our backs.

MEDIASTINUM CEREBRI, the ſame with the tranſverſe ſeptum of the brain. See BRAIN.

MEDIATE, or INTERMEDIATE, ſomething that ſtands between and connects two or more terms, conſidered as extremes; in which ſenſe it is oppoſed to immediate.

MEDICAGO, in botany, a genus of the diadelphia-decandria claſs of plants, with a papilionaceous flower, and a long compreſſed and crooked pod for its fruit.

This genus comprehends the medicago, medica falcata, and cochleata of authors.

MEDICINE,

MEDICINE, *Medicina*, or *Phyſic*, the art of healing, which, according to Boerhaave, conſiſts in the knowledge of thoſe things, by whoſe application life is either preſerved ſound and healthy, or, when diſordered, again reſtored to its priſtine healthineſs.

Medicine is undoubtedly of the ſame date with diſeaſes, and diſeaſes are almoſt as ancient as the world itſelf. Men were long each his own phyſician: and it is hard to fix the time when it firſt was made an art and profeſſion. In certain countries thoſe who had been cured of ſome diſeaſe, wrote down how and by what remedies it had been affected, and depoſited thoſe accounts in the temples for the inſtruction of others in the like caſe. In other places, as Egypt and Babylon, the ſick were expoſed in public, that ſuch as paſſed by who might have been cured of the ſame diſeaſe, might give them advice.

The Egyptians cultivated medicine both more anciently and more learnedly than any other people. The Greeks diſputed that glory with them, or at leaſt followed them very cloſe in it.

Before the Trojan war, Chiron the Theſſalian, ſurnamed the Centaur, who was Achilles's governor, made himſelf famous by the cure of wounds, and knowledge of ſimples. Æſculapius, Chiron's diſciple, did not give place to his maſter. Celſus places Pythagoras, Empedocles, and Democritus, in the number of celebrated phyſicians.

Phyſicians were diſtinguiſhed into different claſſes, namely, empirics, becauſe they followed experience almoſt entirely; others, of whom Hippocrates was the chief, joined reaſon with experience, hence called dogmatic or rational. Hippocrates firſt applied himſelf to the ſtudy of natural things in general, and afterwards to that of the human body in particular. He made a great proficiency in all the parts of phyſic. He was born 460 years before Chriſt, and was cotemporary with Democritus. He compiled a body of Greek medicine, which continued a long time ſacred and unaltered, and was the ſtanding practice of many ages. At length Aretæus the Cappadocian digeſted it into an orderly body; after which it was ſeveral times altered and improved, till at length it was taken in hand by Galen of Pergamus, who lived in the year 131. He aſcribed all he knew to Hippocrates, and explained every thing by the rigid doctrines of the Peripatetics; and did both a great deal of ſervice, and a great deal of miſchief to the art; he being the firſt who introduced the doctrine of the elements, the cardinal qualities, the degrees, the four humours, &c. into medicine, and on which he made the whole art depend.

Other famous phyſicians after Hippocrates, were Diocles Caryſtius, Praxagoras, Chryſippus, Eraſiſtrates, Herophilus, Serapion, Apollonius, Glaucias, Heraclides, Tarentinus, Dionyſius, Crito, Menodotus, Theodas, Aſclepiades, Themiſon, Theſſalus, Soranus, Cælius Aurelianus, Celſus, Oribaſius, Aetius, Alexander Trallianus, Paulus Ægineta, Actuarius, Myrepſus, &c.

Phyſic had for ſome time got almoſt entirely into the hands of the Arabians, till the end of the fifteenth century, when the original authors, moſt of which they had tranſlated, came to be read in their own language; at length the immortal Harvey, overturning the whole theory of the ancients, by the diſcovery of the circulation of the blood, laid a new and certain baſis for medicine. Since his time it is improved by ſure diſcoveries in anatomy, chemiſtry, mechanics, &c.

It does not appear that phyſicians were very common among the Hebrews, eſpecially for internal maladies; but for wounds, fractures, bruiſes, and all external injuries, they had phyſicians who underſtood the dreſſing them, and the application of certain medicaments, as roſin, balm, fat, &c. The Jewiſh authors ſpeak very unfavourably of phyſicians.

We are told by Pliny, that Archagathus of Peloponneſus was the firſt phyſician who came to Rome in the conſulſhip of L. Æmilius and L. Julius, A. U. C. 535. That is, the Romans till his arrival, uſed only the ſimple empiric kind of phyſic, ſuch as was practiſed by the firſt men. It ſeems, however, that ſeveral phyſicians came from Greece to Rome, though Cato had oppoſed it with his whole power.

Till Pliny's time, of all profeſſions, that of medicine, as gainful as it was, was the only one no Roman had followed, becauſe they thought it below them.

Without entirely deciding, as to the merit of the ancient and modern phyſic, they have each their peculiar advantages, which render both highly eſtimable; and no doubt but the experience of many ages muſt have added conſiderable lights to the knowledge of the ancients. The new diſcoveries which have enriched the phyſic of the moderns may give it the preference to that of the ancients.

The phyſic of the ancients is perhaps to be preferred to that of the moderns, in being leſs profuſe of medicines in ſickneſs, and leſs deſirous to precipitate cures; in obſerving the motions of nature with more attention, and aſſiſting them with greater confidence; and in being contented to divide the honour of the cure with nature, without arrogating the whole glory of it to itſelf.

Phyſic, however uſeful and ſalutary, has had the misfortune of being made the butt of great men, eſpecially among the Romans. Cato declared himſelf moſt ſtrenuouſly againſt phyſicians, as we ſee in a letter to his ſon preſerved by Pliny; but it is to be obſerved that he means only the phyſicians from Greece. Pliny the naturaliſt was of much the ſame way of thinking, but his complaints extend only to perſons of no repute, authority, or learning.

Extremes are not to be admitted upon this head, in which blind confidence and ill-grounded contempt may be equally dangerous.

In ſhort, whether we conſider our bodies or our medicines, phyſic muſt be very precarious. Our bodies are more compounded and unequal than other bodies are; moſt other creatures live on a ſimple diet, and are regular in their appetites; whereas man feeds almoſt upon every thing, and, where appetite fails, invention is called in to ſwell the account by high ſauces and rich ſpices. Hence proceed ſuch variety of diſeaſes as diſtract the phyſician's ſkill. A healthy conſtitution is eaſily reſtored when out of order, nature in a great meaſure does its own work; whereas, in a diſordered body, a phyſician muſt give a new conſtitution before he can perfect the cure.

Though our materia medica be large enough, and to look into our diſpenſatories, one would think no diſeaſe incurable; yet the miſchief is, all thoſe fine medicines do not always anſwer in the application, nor have they been found ſo ſovereign in our bodies, as they are in our books: all which things have ſo diſtracted our phyſicians that they vary even in the moſt common method. In one age alkalies are in faſhion, and in the next acids begin to recover credit: bleeding is practiſed by one nation, and condemned by their neighbours, &c.

Medicine is divided into five principal branches: the firſt conſiders the human body, life, and health, and the effects flowing therefrom; this is called phyſiology, the doctrine of the œconomy or uſe of the parts; and its objects are called res naturales, or things according to nature.

The ſecond branch conſiders the diſeaſes of the human body, their differences, cauſes, and effects: as it conſiders diſeaſes, it is called pathology; as it enquires into the cauſes, ætiology; when it examines their differences, it is called noſology; and when it explains their effects, ſymptomatology. The objects of this branch are called res præternaturales, or beyond nature.

The third branch conſiders the ſigns or ſymptoms, and how to apply them to uſe; ſo as to judge both in a ſound and diſeaſed body what is or will be the degree, order, and effect of the health or diſeaſe. This is called ſemeiotica. Its objects are things both natural, non-natural, and preternatural.

The fourth branch conſiders the remedies and their uſe, whereby life may be preſerved; whence it is called hygieine. Its objects are what we ſtrictly call non-natural.

The fifth furniſhes the materia medica, its preparation and manner of exhibiting, ſo as to reſtore health; and is called therapeutica, comprizing the diætetica, pharmaceutica, chirurgica, and iatrica.

MEDICINES, *Medicamenta*, whatever ſubſtances ſerve to reſtore health.

MEDIETAS LINGUÆ, in law, ſignifies a jury, or

inqueſt impannelled, of which the one half are natives of this land, and the others foreigners.

MEDITULLIUM is uſed by anatomiſts for that ſpungy ſubſtance between the two plates of the cranium, and in the interſtices of all laminated bones. See the article DIPLOE.

MEDIUM, in logic, the mean or middle term of a ſyllogiſm, being an argument, reaſon, or conſideration for which we affirm or deny any thing; or, it is the cauſe why the greater extreme is affirmed or denied of the leſs in the concluſion.

MEDIUM, in philoſophy, that ſpace or region through which a body in motion paſſes to any point; thus æther is ſuppoſed to be the medium through which the heavenly bodies move; air, the medium wherein bodies move near our earth; water, the medium wherein fiſhes live and move; and glaſs is alſo a medium of light, as it affords it a free paſſage. That denſity or conſiſtence in the parts of the medium, whereby the motion of bodies in it is retarded, is called the reſiſtance of the medium, which together with the force of gravity, is the cauſe of the ceſſation of the motion of projectiles.

Subtile, or *Ætherial* MEDIUM. See ÆTHER.

MEDLAR, *Meſpilus*, in botany, &c. See the article MESPILUS.

MEDULLA, MARROW, in anatomy. See MARROW.

MEDULLA OBLONGATA, is the lower and medullary part of the cerebrum and cerebellum, formed into a kind of tail, and extended to the great foramen or hole in the occipital bone of the cranium, where it gives origin to the ſpinal marrow, and to the nerves of the brain. See the articles BRAIN and NERVE.

MEDULLA SPINALIS, or ſpinal marrow, is a continuation of the medulla oblongata of the brain, and forms, as it were, a tail to that part. It is included in a kind of bony canal, formed by the vertebræ, and in this is continued from the head to the extremity of the os ſacrum. Its length is therefore the ſame with that of the ſpina dorſi, which is different in perſons of different ſtature. Its thickneſs, in general, is nearly equal to that of a finger; but it is not uniformly of the ſame diameter throughout. Its ſubſtance, in the upper-part, as far as to the laſt vertebra of the thorax, is the ſame with that of the medulla oblongata of the brain, but ſomewhat tougher and more firm: they are externally of a medullary ſubſtance, that the nerves may eaſily make their way out; internally cineritious, and of the ſame nature with the cineritious or cortical part of the brain; but the lower part of them, from the laſt vertebra of the thorax to the extremity of the os ſacrum, is fibrous and very tenacious, and is called cauda equina. The diviſion of the ſpinal marrow is formed by means of a fiſſure; it is by this ſeparated into a right and left part, or into two columns; but this ſeparation is not continued to the center. Its proper integuments are no leſs than ſix: theſe are, 1. the bony canal, formed by the cavities of the twenty-four vertebræ, and the os ſacrum: 2. the tunica, which is very ſtrong, and connects the vertebræ within: 3. the cellular, or adipoſe coat, which, in fat perſons, always contains more or leſs fat, and ſeems deſtined by nature to ſoften the former: 4. the dura mater, which is ſtronger in the upper-part, and finer and weaker in the lower; this looſely incloſes the medulla in the ſpine, and in its anterior part, is firmly connected with the vertebræ: 5. the tunica arachnoides, which in its anterior part, adheres very firmly to the pia mater, but in its poſterior part is looſe and fluctuating: 6. the pia mater, which ſurrounds every part of the ſpinal marrow, and all the nerves that ariſe from it, and enters alſo its longitudinal diviſion. The arteries and veins of the ſpinal marrow enter at the apertures of the vertebræ, which give paſſage out to the nerves; they make a multitude of anaſtomoſes, and are derived from the vertebrals of the neck, the intercoſtals, and the lumbar. The nerves of the ſpine are thirty-one, or as others count them, thirty-two pair. Theſe are compoſed each of a multitude of fibres, ariſing from the anterior and poſterior parts of the medulla: theſe fibres afterwards unite, and are connected by and covered with membranes, and in that ſtate they conſtitute what we call nerves.

The uſes of the ſpinal marrow are, to give origin to the before-mentioned pairs of nerves, which are principally diſtributed to the limbs and external parts; and to ſecrete and prepare a nervous fluid.

MEDUSA's HEAD, in aſtronomy. See the article ALGOL.

MEI, or MISERERE MEI, in medicine. See the article MISERERE.

MEL, HONEY. See the article HONEY.

MELANCHOLY, in medicine, a ſpecies of madneſs, being a kind of delirium without a fever, uſually attended with fear, heavineſs, and ſorrow, without any apparent cauſe. It is infinitely varied according to the temperament and ideas of the perſon affected therewith. See MADNESS.

The word is Greek, μελαγχολια, and formed of μελας, black, and χολη, bile or gall.

The cauſes evidently productive of melancholy are obſerved to be,

1. All things which fix, exhauſt, or diſturb the nervous fluid of the brain; ſuch as violent and ſudden frights, intenſe thinking upon any ſubject, exceſſive love, watchings, ſolitude, fear, and hyſteric diſorders.

2. Such things as hinder and diſturb the generation, reparation, circulation, and various ſecretions and excretions of the blood, eſpecially in the ſpleen, ſtomach, omentum, pancreas, meſentery, inteſtines, liver, uterus, and hæmorrhoidal veſſels: ſo that, of conſequence, melancholy may be produced by the hypochondriacal diſorder; by acute diſeaſes ill cured, and eſpecially a phrenitis and burning fever; by an exceſs of all the ſecretions and excretions; by ſuch aliments and drinks as are cold, tenacious, terreſtrial, tart, and aſtringent; by violent heat long protracted and parching the blood; as alſo by a ſtagnant, moiſt, and cloudy air.

3. A naturally black, hairy, dry, ſlender, and robuſt conſtitution of body, a middle age, a quick, penetrating, and diſcerning genius.

If this diſorder continues long, it produces ſtupidity, epilepſies, apoplexies, madneſs, convulſions, blindneſs, ſurpriſing fancies, laughter, weeping, ſinging, ſighs, eructations, flatulences, anxieties; an urine ſometimes copious and limpid like water, and at others highly thick; a retention, accumulation of the excrementitious blood in the veſſels of the abdominal viſcera, and often a ſudden excretion of it; obſtinate coſtiveneſs, frequent ſpitting of a thin matter, and an incredible ability of enduring watchings, hunger, and cold.

This diſorder has often been cured by a ſupervening unſeemly itch, ſometimes reſembling an elephantiaſis; by numerous and large varices; by a copious diſcharge from the turgid hæmorrhoidal veins; and an evacuation of the black bile by vomit and ſtool.

Patients labouring under this diſorder are generally injured by all medicines which impair the ſtrength, and evacuate too forcibly; as alſo by thoſe which throw the humours into too violent commotions, whether cordials, or medicines of whatever other denomination.

Hence the beſt method of curing this diſorder is, after a due obſervation of the firſt cauſes and the variety of patients conſtitutions, to accommodate various medicines to theſe cauſes, and various conſtitutions.

The ſeveral intentions of cure to be purſued, therefore, are, 1. To rouſe, augment, and regulate the fluids of the brain and nerves; which is done, firſt, by diverting the mind from its uſual object to others of an oppoſite nature: ſecondly, by inducing cautiouſly another diſpoſition, or affection of mind, oppoſite to melancholy: thirdly, by humouring the perverſe and falſe turn of the imagination: or, fourthly, by frequently oppoſing it with great vigour.

2. To remove thoſe obſtructions which are either the cauſe, or the effect, of a perverted imagination, by ſoftening, inciding, and ſtimulating the obſtructing matter, by means of mineral waters, whey, viſceral, hepatic, and antihypochondriac decoctions, waters invigorated with fixed vial or compound ſalts, laxative preparations of mercury, emetics, motion, exerciſe, riding, ſailing, uterine medicines, and ſuch as promote the lochia, remedies which procure hæmorrhoidal diſcharges, baths, liniments, and plaſters.

3. To alleviate the ſymptoms by veneſection, im-

merſion

merſion in cold water, and the uſe of carminatives and opiates.

4. After due evacuations, to exhibit ſuch things as are from experience known to exhilarate the mind, and corroborate all the parts of the body.

From what has been ſaid, it is obvious that the perfect cure of this diſorder, as well as of great many others falſly accounted incurable, conſiſts in the correction of the bilis atra, or melancholic humour.

When melancholy increaſes ſo far as to bring on an agitation of the fluids of the brain, capable of driving the patient into a raging fury, the diſorder is called madneſs.

This only differs in degree from a dejected melancholy, is its offspring, ariſes from the ſame cauſes, and is generally to be cured by the ſame medicines.

In madneſs the muſcles are generally ſurpriſingly ſtrong, the patient is afflicted with watchings, incredibly capable of enduring hunger and cold, diſtracted by terrible imaginations, and ſubject to thoſe diſorders called lycanthropia and cynanthropia; which ſee.

It is obſervable, that, upon diſſecting thoſe who have died of madneſs, the brain has been found dry, hard, and friable, with its cortical ſubſtance of a yellow colour, and its veſſels turgid, varicoſe, and diſtended with black and viſcid blood.

It is alſo obſervable, that, during this diſorder, all the excretions have, in like manner, almoſt ceaſed.

Unexpected precipitation into the ſea, and a ſubmerſion in it, continued as long as poſſible, conſtitute the principal remedy for it.

Madneſſes, obſtinate againſt all remedies, have often been removed upon the approach of varices, hæmorrhoidal diſcharges, dyſenteries, dropſies, copious ſpontaneous hæmorrhages, tertian and quartan fevers.

Such a ſort of madneſs ſometimes ariſes after the body is, by an autumnal, violent, and long-continued intermittent fever, weakened and exhauſted, both by the force of the diſeaſe, and repeated veneſections and purgings. The madneſs is alſo generally brought on again by theſe very means.

This ſpecies of the diſorder is only to be cured by the uſe of reſtoratives, cardiacs, and corroboratives, long perſiſted in; but, if it is treated with evacuation, it brings on an atrophy, a weakneſs, and an unſurmountable fooliſhneſs.

But a madneſs ariſing in robuſt vigorous perſons in the flower of their age, or of hot and plethoric habits, is to be cured by repeated veneſections, interpoſing a briſk purge between each; and when the diſorder is alleviated, it is to be treated with opiates and cardiacs. *Boerhaave's Aphoriſms.*

MELANE, among phyſicians. See the article ALPHOS.

MELANTERIA, in natural hiſtory, a very beautiful foſſil, of a denſe, compact, and regular texture, and of an extremely bright pale yellow, reſembling nothing ſo much as the pureſt gold: it is remarkably heavy, and is uſually found in little irregular maſſes of the bigneſs of a pigeon's egg, which are broken with a ſlight blow; but it is uſually met with in the form of a fine gold-coloured efflorescence on vitriolic and pyritical bodies; or in looſe, ſhattery, and friable maſſes, of a more duſky yellow, in which latter ſtate, it ſo much reſembles a native ſulphur, that it is frequently miſtaken for one: however, it is not inflammable; but calcines in the fire to a greyiſh powder, which by burning longer changes to a deep and fine purple.

MELASSES, or MOLASSES. See the article MOLASSES.

MELCHITES, in church hiſtory, the name given to the Syriac, Egyptian, and other Chriſtians of the Levant. The Melchites, excepting ſome few points of little or no importance, which relate only to ceremonies and eccleſiaſtical diſcipline, are in every reſpect profeſſed Greeks; but they are governed by a particular patriarch, who reſides at Damas, and aſſumes the title of patriarch of Antioch.

MELCHIZEDECHIANS, in church hiſtory, a ſect which aroſe about the beginning of the third century, and affirmed, that Melchiſedech was not a man, but a heavenly power, ſuperior to Jeſus Chriſt; for Melchiſedech, they ſaid, was the interceſſor and mediator of the angels, but Jeſus Chriſt was ſo only for men, and his prieſthood only a copy of that of Melchiſedech. This hereſy was revived in Egypt by one Hierax, who pretended that Melchiſedech was the Holy Ghoſt.

MELEAGRIS, the turkey, in ornithology. See TURKEY.

MELES, the badger, in zoology. See the article BADGER.

MELIANTHUS, honey flower, in botany, a genus of plants, the flower of which conſiſts of four petals; and its fruit is a capſule with four cells, each containing a roundiſh ſeed.

MELICERES, in ſurgery, a kind of encyſted tumours, ſo called when their contents are of the conſiſtence of honey; but when this is of the conſiſtence of paſte, they are called a theromata.

MELILOT, *Melilotus*, in botany, a plant with ſmooth oval ſerrated leaves, ſtanding three together, on ſlender pedicles, and round, ſtriated, branched ſtalks, terminated by long ſpikes of papilionaceous flowers drooping downwards, which are followed by ſhort thick wrinkled pods, containing each one or two roundiſh ſeeds. It is annual or biennial, and found in flower, in hedges and corn-fields, greateſt part of the ſummer.

Melilot has been ſaid to be reſolvent, emollient, anodyne, and to participate of the virtues of chamomile. In its ſenſible qualities it differs very materially from that plant; its taſte is unpleaſant, ſabacrid, ſubſaline, but not bitter: when freſh, it has ſcarcely any ſmell; in drying, it acquires a pretty ſtrong one, of the aromatic kind, but not agreeable. The principal uſe of the plant has been in clyſters, fomentations, and other external applications: it formerly gave name to one of the officinal plaſters; which received from the melilot a green colour and an unpleaſant ſmell, without any addition to its efficacy.

MELISSA, baum, in botany. See the article BAUM.

MELODY, in muſic, the agreeable effect of different ſounds, ranged and diſpoſed in ſucceſſion; ſo that melody is the effect of a ſingle voice or inſtrument, by which it is diſtinguiſhed from harmony. See HARMONY.

MELON, in botany, makes a diſtinct genus of plants, the flowers of which conſiſt only of one leaf each, and are wide at the mouth, and divided into ſeveral ſegments, wholly reſembling the flowers of cucumbers. Of theſe alſo ſome are male or ſterile flowers, having no embryo fruit; others are fruitful or female flowers, having an embryo which ripens into a large fruit of an oval figure, ſometimes ſmooth, ſometimes rough, divided into three cells, and containing oblong ſeeds; each of theſe cells ſeems alſo divided into two.

The proper management and culture of melons is this: the ſeeds ſhould be procured from good melons, produced in ſome diſtant garden; for, if ſowed on the place where it was raiſed and ripened, it is very apt to degenerate. This ſeed ſhould be kept three years before it is ſowed, and it ſhould be ſowed at two ſeaſons. The firſt for the early crop, to be raiſed under frames, ſhould be ſown in January or the beginning of February; the ſecond, to be raiſed under bell or hand glaſſes, is to be ſowed in March, and this is the ſowing which produces the general crop of melons, which ripen in July and Auguſt. About a week before the time of ſowing the ſeed, ſome dung ſhould be prepared in a heap with the litter, or ſome coal aſhes, and the ſame methods uſed in the early cucumbers, for the firſt crop; but for the ſecond, which is of more general uſe, the ſowing may be on the upper ſides of the hot-beds that were for the early melons or cucumbers, or on a freſh moderate hot-bed. When the young plants are come up, they muſt be removed to another hot-bed, and covered with hand glaſſes, and watered and ſhaded till they have taken root; and after this, they muſt have as much air and ſun as the ſeaſon will permit, and their ſtalks ſhould be earthed up as they grow, which will vaſtly ſtrengthen them.

In the beginning of April the plants will begin to ſhew their rough leaves; a parcel of dung is then to be prepared with litter and coal aſhes. The common quantity is a load to five holes; a trench muſt then be dug, which

ſhould be ten inches deep, if the ſoil be dry, but only three, if it be wet. The dung muſt be evenly laid in this, and heaped up to three feet high; then the place intended for the holes muſt be marked out, at each of which muſt be laid a baſket full of light rich earth, thruſting a ſtick of two feet long into the middle. Then cover the dung all over with the earth, which was dug up out of the trench, laying it ſmooth, and about three inches thick; then the glaſſes are to be placed cloſe down over the place where each of the ſticks is, and in two days the earth will be warm enough to receive the ſeedling plants. The ſticks are now to be taken out, and the earth formed in the places into a hollow like a baſon, that it may retain the water which is given to the plants. The plants are then to be taken up, and two ſtrong and thriving ones put into each of theſe holes, which muſt be watered and ſhaded till they have taken root. The plants having taken root, and thruſt out a fourth leaf, the top of each of them ſhould be pulled off, in order to force out ſhoots from the bottom; and as the weather becomes warmer, the glaſſes muſt be raiſed with ſtones on the ſouth-ſide, to give them air, and about twice a week they ſhould have a little water.

About the middle of May the ſtalks of the plants will begin to preſs upon the glaſſes on every ſide, and the glaſſes are then to be raiſed up on bricks, to give them room to run out; and they ſhould be pegged down with forked ſticks, and turned into a proper direction for their running, ſo that they may be out of the way of tangling one with another: they ſhould now, if the weather be ſevere, be ſheltered with mats in the night, and watered gently at times. When the ſtalks of the plants are grown to the edges of the bed, the earth muſt be raiſed with old dung buried under it, till it be upon a level with the beds, for two feet wide on each ſide. The branches are here to be trained in a proper courſe, and the glaſſes are to be left over the roots of the plants; and after this, what water is given them is to be ſprinkled all over the plants. When the fruit begins to appear, the waterings muſt be very gentle on the plants; but it will be proper to ſoak the earth well with large quantities of water about the beds, which will ſpread a moiſture even to the roots of the plants; from this time the plants ſhould be gently watered twice a week, and that always in the evening. When the melons are grown of the ſize of a tennis ball, a piece of tile ſhould be laid under each to keep them from the ground. As they afterwards approach to ripeneſs, they ſhould be turned ſeveral times, that they may ripen equally every ſide; and if the weather be not very favourable, they ſhould be covered with glaſſes. If the melon is deſigned to be eaten as ſoon as cut, it ſhould be ſuffered to remain on the plant till it changes pretty yellow, and the ſtalk begins to ſeparate from the fruit; but if it is to be kept two or three days after cutting, it muſt be always cut proportionably earlier.

It is a practice with many to take off the leaves about the fruit, that it may have more ſun; but it is wrong, and the fruit is always the worſe taſted for it, and the ſkin is hard and tough. *Miller's Gard. Dict.*

When a melon is perfectly fine, it is full, without any vacuity: this is known by knocking upon it, and when cut the fleſh muſt be dry, no water running out, only a little dew, which is to be of a fine red colour. Large melons are not to be coveted, but firm and well-flavoured ones. Our gardeners, who raiſe melons for ſale, ſow the ſeeds of the large rather than the good kinds, and they increaſe the ſize of theſe by much watering the roots, but this ſpoils the taſte. Some of the French raiſe at this time particularly fine melons, by a method kept as a ſecret, but which we find, on a ſtrict enquiry, is no other than the ingenious Mr. Quintiny's, of that nation, publiſhed near eighty years ago in our Philoſophical Tranſactions.

The melons particularly proper to be treated in this manner, are thoſe which have a thin and ſomewhat embroidered ſkin, not divided by ribs, and have a red pulp, dry and melting on the tongue, not mealy, and of a high flavour.

MEMBRANE, in anatomy, a pliable texture of fibres, interwoven together in the ſame plane.

The membranes differ in thickneſs, according to the ſmallneſs of their fibres, or the number of their planes. Theſe particular planes are termed laminæ, and are diſtinguiſhed into internal, external, and middle. The difference of membranes, in general, depends on that of the fibres of which they are compoſed. Small portions of membranes, eſpecially when they are very thin, are called pellicles, and called the cellular or ſpongy ſubſtance.

MEMBRANOSUS, in anatomy, a muſcle otherwiſe called faſcia lata.

MEMOIRS, in matters of literature, a ſpecies of hiſtory, written by perſons who had ſome ſhare in the tranſactions they relate, anſwering to what the Romans called *commentarii*, commentaries.

MEMORY, *Memoria*, a faculty of the human mind, whereby it retains or keeps the ideas it has once perceived. See IDEA.

Memory, ſays Mr. Locke, is, as it were, the ſtore-houſe of our ideas; for the narrow mind of man not being capable of having many ideas under view at once, it was neceſſary to have a repoſitory in which to lay up thoſe ideas which it may afterwards have uſe of. But our ideas being nothing but actual perceptions in the mind, which ceaſe to be any thing where there is no perception of them; this laying up of our ideas in the repoſitory of the memory, ſignifies no more but this; that the mind has a power, in many caſes, to revive perceptions it has once had, with this additional perception annexed to them, that it has had them before. And it is by the aſſiſtance of this faculty, that we are ſaid to have all thoſe ideas in our underſtandings which we can bring in ſight, and make the ſubjects of our thoughts, without the help of thoſe ſenſible qualities which firſt imprinted them there.

Attention and repetition help much to the fixing ideas in our memories: but thoſe which make the deepeſt and moſt laſting impreſſions, are thoſe which are accompanied with pleaſure and pain. Ideas but once taken in and never again repeated, are ſoon loſt; as thoſe of colours in ſuch as loſt their ſight when very young.

The memory of ſome men is tenacious even to a miracle: but yet there ſeems to be a conſtant decay of all our ideas, even of thoſe which are ſtruck deepeſt; and in minds the moſt retentive: ſo that if they be not ſometimes renewed, the print wears out, and at laſt there remains nothing to be ſeen.

Thoſe ideas that are often refreſhed by a frequent return of the objects or actions that produce them, fix themſelves beſt in the memory, and remain longeſt there: ſuch are the original qualities of bodies, viz. ſolidity, extenſion, figure, motion, &c. and thoſe that almoſt conſtantly affect us, as heat and cold.

In memory, the mind is oftentimes more than barely paſſive; for it often ſets itſelf on work to ſearch ſome hidden ideas; ſometimes they ſtart of their own accord; and ſometimes tempeſtuous paſſions tumble them out of their cells. This faculty other animals ſeem to have to a great degree, as well as men, as appears by birds learning of tunes, and their endeavour to hit the notes right. For it ſeems impoſſible that they ſhould endeavour to conform their voices, as it is plain they do, to notes whereof they have no idea.

Local MEMORY, among orators, is nothing but the aſſociating the different heads to be handled, with the objects before the ſpeaker's eyes; ſo that by only looking around him, he is put in mind of what he is to ſay.

Artificial MEMORY, *Memoria Technica*, a method of aſſiſting the memory, by forming certain words, the letters of which ſhall ſignify the date or æra to be remembered.

MENDICANTS, or begging friars, ſeveral orders of religious in Popiſh countries, who having no ſettled revenues are ſupported by the charitable contributions they receive from others.

MENIALS, in law books, domeſtic or houſhold-ſervants, who live under their lord or maſter's roof.

MENINGES, or MENYNGES, in anatomy, a name given to the dura and pia mater of the brain.

MENIPPEAN, in poetry, a kind of ſatire, conſiſting of proſe and verſe intermixed.

MENISCUS, in optics, a lens convex on one ſide, and concave on the other. See LENS.

For finding the focus of a meniſcus, the rule is, as the difference of the ſemi-diameters of the concavity and convexity, to the ſemi diameter of the concavity; ſo is the diameter of the convexity to the focal diſtance.

MENNONITES, a ſect of baptiſts in Holland, ſo called from Mennon Simonis of Friezeland, who lived in the ſixteenth century. This ſect believe, that the New Teſtament is the only rule of faith; that the terms perſon and Trinity are not to be uſed in ſpeaking of the Father, Son, and Holy Ghoſt; that the firſt man was not created perfect; that it is unlawful to ſwear, or to wage war upon any occaſion; that infants are not the proper ſubjects of baptiſm; and, that miniſters of the Goſpel ought to receive no ſalary.

MENOLOGY, the Greek calendar, in which the lives of the ſaints in ſhort, or barely their names, are cited; anſwering nearly to the martyrology of the Latin church.

MENSALS, *Menſalia*, in church hiſtory, ſuch livings as were formerly united to the tables of religious houſes, and hence called menſal benefices.

MENSES, *Catamenia*, fluors, courſes, in medicine, are the monthly evacuations from the uterus of women not with child, and not giving ſuck.

The word is derived from the Latin *menſis*, a month, the period wherein they generally return.

The common cauſe of the ſtoppage of the menſtrual diſcharges is the blood's lentor; whereby this fluid becomes incapable of forcing the ſphincters of the ducts deſtined by nature for this evacuation. For it is not from the burſted arteries of the uterus, which is the common opinion, that the blood iſſues every month, but from veſſels peculiarly appropriated to this office. And this lentor or thickneſs of the blood changes the lively colour of the face into a greeniſh pale, and wan complexion.

The proper medicines, in this diſtemper, are thoſe which are capable of increaſing the blood's circulation, and attenuating the viſcid humours: and ſuch are all bitters, joined with aromatics, as alſo many preparations of ſteel. But to theſe ought to be premiſed blood-letting, and cathartics blended with calomel. The tinctura ſacra is alſo an excellent medicine.

But of all the moſt powerful emmenagogues, I have found ſo ſingular virtue in black hellebore, that I hardly remember it ever failed anſwering my expectations. My way of ordering it is, a tea-ſpoonful of tincture of black hellebore in a glaſs of warm water, to be taken twice a day. And I have obſerved this remarkable circumſtance, that whenever, either from a bad conformation of the parts, or any other cauſe, this medicine had not the deſired effect, the blood was forced through ſome other paſſages; which is a manifeſt proof of the great power of this medicine in ſpurring the blood forward.

But likewiſe the menſtrual diſcharges frequently run to exceſs. In that caſe the flux is to be reſtrained; which, after letting blood, is effected both by thoſe medicines which condenſe and inſpiſſate the blood, and by thoſe which allay its heat. Of the firſt ſort, the principal are ſuch as participate of vitriol or alum; eſpecially the tincture of roſes; or a powder compoſed of alum three parts, and dragon's-blood one part, melted together. But the heat of the blood, and its conſequence, the flux, is more powerfully checked by the Peruvian bark, than by any other medicine whatſoever. *Mead.*

MENSTRUUM, or DISSOLVENT, in chemiſtry, a body which, when artificially applied to another, divides its ſubtility, ſo that the particles of the ſolvent remain thoroughly intermixed with thoſe of the ſolvend.

It was called a menſtruum, becauſe the chemiſts, in its application to the ſolvend, firſt uſed a moderate fire, for a philoſophical month, or forty days; and hence aroſe the name of menſtrual ſolvent, at length barely a menſtruum.

It is the property of a menſtruum to be itſelf equally diſſolved, when it diſſolves the ſolvend; but when the ſolution is perfected, it may ſometimes happen that the ſolvent and ſolvend ſhall ſeparate. The divided parts, therefore, of the ſolvent, muſt inſinuate itſelf among the parts of the ſolvend, ſo as to divide and diſſolve the body. Hence it appears, that the actions of menſtruums differ from all mechanical ſeparations, where the inſtrument, ſuch as a knife, ſword, or ſaw, while it divides, is not itſelf divided, but remains almoſt entire. But there is ſome reaſon to ſuſpect, that the ſingle particles of a menſtruum act like mechanical inſtruments, by the properties of their own proper ſize, figure, hardneſs, and gravity. Every menſtruum, while it diſſolves, is neceſſarily divided into inviſible particles, and muſt therefore be fluid in the action; and when the diſſolution is completed, the ſolvent and ſolvend muſt become one fluid.

Cuſtom has given the name of menſtruums to many bodies of a hard and conſiſtent nature, though in that ſtate they cannot act as ſolvents; and hence the chemiſts have divided menſtruums into ſolid and fluid.

Dry or ſolid menſtruums may be again divided into five claſſes, which, according to Boerhaave, are as follow: 1. The ſix metals, gold, lead, ſilver, copper, iron, and tin, which act upon one another after being fuſed in the fire, and may be intimately mixed, ſo as to make an apparently homogeneous maſs, every particle of which holds the ſame proportion of a different metal as the whole: for if ten ounces of ſilver be thus mixed with an ounce of gold, and a grain of this maſs be given to an aſſay-maſter, he will diſcover that it contains one eleventh part gold, and ten parts ſilver. 2. The ſemi-metals, as antimony, biſmuth, cinnabar, marcaſites, and zinc, which, when melted, mix with one another or with metals; but when thus mixed they are no longer malleable, but may eaſily be reduced to powder. 3. The dry ſalts, as alum, borax, nitre, ſal-ammoniac, ſea-ſalt, vitriol, fixed alkali, and mercury ſublimate, which may be ſubtilly divided by fire, and intimately mix with one another, with metals, ſemi-metals, and other things. 4. Hard foſſile ſulphureous bodies, as ſulphur vivum, common brimſtone, arſenic, orpiment and cobalt. 5. The foſſile bodies, called by refiners cements, which conſiſt of ſalts, ſulphur, and brick, reduced to dry powders, and ſtrewed betwixt plates of metals, in order to raiſe their colour, or ſeparate one metal from another.

Some menſtruums being left to themſelves, after ſolution concrete into a hard maſs, which, though compounded, appears of an uniform ſimple nature. In this manner, if melted lead be mixed with tin, they unite, as water with water, or mercury with mercury. The caſe is the ſame in all the metals, and in ſome of the ſemi-metals. Thus if a ſcruple of regulus of antimony be added to a pound of melted tin, the maſs when cold will appear uniform, but become entirely brittle; ſo fixed alkali unites with ſand in the fire; and ſulphur and mercury, by being ground together, turn to a black and dry powder, which being ſublimed produces an apparent ſimple body, called cinnabar. Many become an hard, and ſometimes a dry body. Thus almoſt all the menſtruums of metals unite with their reſpective metals into ſolid vitriols: and thus ſtrong diſtilled vinegar, when it has diſſolved ſhells, chalk, and ſtony ſubſtances, ſeparates from its water, and together with the body it diſſolves, forms a dry hard maſs.

Numerous menſtruums have a liquid form before they act as ſolvents; as vinegar, water, ſaline, acid, alcaline and compounded ſpirits, alcaline oils per deliquium, &c. Some menſtruums become liquid after the ſolution, and continue ſo with the ſolvent. Thus in the diſſolution of five of the metals with ſimple mercury a ſoft paſte is produced, which may indefinitely be diluted by the addition of more mercury; but there is ſcarcely any known method of reſtoring this amalgama to its ſolidity. All the liquid menſtruums, after having diſſolved metals in a large proportion, cannot eaſily be dried; whence many have imagined theſe ſolutions to be fixed metallic oils, and in vain ſought ſecrets in them.

It is now eaſy to obſerve that many menſtruums unite bodies as well as ſeparate them; for frequently after the diſſolution the particles of the menſtruum preſently join with thoſe of the ſolvent, and produce a new compound, often very different from the nature of the ſimple reſolved body. The parts however of the ſolvent, after its concretion, no longer touch one another, but are ſeparated by the interpoſition of the particles of the matter diſſolved; and the particles which before conſtituted the ſolvend are ſeparated by the interpoſition of the particles of the ſolvent.

Hence it is plain that the parts of the menſtruums apply themſelves to the parts of the ſolvend; and a certain cauſe is here required to make the particles of the ſolvent fly from one another and approach the particles of the ſolvend, rather than remain in their former ſituation. The like cauſe ſeems to be required to make the particles of the ſolvend, now ſeparated, remain united with the parts of the menſtruum, rather than ſuffer the diſſolving and diſſolved particles to unite by their natural affinity into homogeneous bodies. This cauſe muſt be ſought in the ſolvend as well as in the ſolvent, for the action is reciprocal. Thus while aqua regia diſſolves thrice its weight of gold into a yellow liquor, the particles of gold are united with the aqua regia, and remain ſuſpended in it, though gold be eighteen times heavier than aqua regia. Whence there muſt be a mutual correſponding power between the particles of the gold and aqua regia, whereby they act upon, embrace and detain each other, otherwiſe the particles of gold would fall to the bottom, the ſaline particles reſt upon them, and the water float over both. If we were to deduce the cauſe from ſimilitude of ſubſtance, the action of diſſolution ſeems to be performed by a certain power of the parts of the menſtruum to attract the diſſolved parts rather than to repel them; and is not a mechanical action, or unfriendly commotion, but rather an appetite of union. Thus, in a violent ſolution, the agitation, heat, hiſſing and tumult ceaſe when all the parts of the ſolvend have united with thoſe of the ſolvent, as appears in throwing a piece of iron into weak aqua-fortis.

The whole ſolvent never acts at once on the whole ſolvend, only thoſe particles of the ſolvent which touch ſome others of the ſolvend act firſt; and theſe being ſeparated, freſh particles of the menſtruum apply themſelves to others of the ſolvend: therefore part of the menſtruum acts upon that part of the body which it ſtrikes off and ſeparates; but the conflict made in this ſeparation excites a greater motion in the menſtruum, by which means other parts of the menſtruums are agitated and applied to other parts of the ſolvend.

Fire excites, promotes, and increaſes the action of menſtruums; for in extreme cold ſolutions are either not made or made but ſlowly, but they are ſoon performed by the aſſiſtance of heat: ſome menſtruums require a ſtrong heat, as mercury, before it will diſſolve metals: ſome a ſmaller; thus ſal armoniac, ſea ſalt, and ſalt of tartar eaſily diſſolve in water: ſome menſtruums act with a moderate heat, but loſe their diſſolving power, or even acquire a power of coagulating, by a ſtronger; thus warm water diſſolves the white of eggs, which boiling coagulates. This effect of fire ſeems to be produced, 1. by impelling, moving and agitating the menſtruum in the manner of a mere mechanical motion. 2. By its general power of expanding the ſubſtance of all bodies. 3. By ſeparating the parts ſo as to ſet them farther aſunder. In moſt caſes the heat is increaſed during the ſolution, and even the action of thoſe menſtruums is augmented by heat, which generate a great degree of cold in the ſolution; thus ſal ammoniac diſſolves ſooneſt in warm water.

Sir Iſaac Newton accounts for the action of menſtruums, from the acids wherewith they are impregnated, which are found to be endued with a ſtrong attractive force, wherein their activity conſiſts. See ACID.

MENSTRUUM, in pharmacy, chiefly denotes a body that will extract the virtues of ingredients by fuſion, decoction, &c.

MENSTRUUM *Peracutum*, a menſtruum which Mr. Boyle extracted from bread only, that would prey even on glaſs, and perform many things which aqua-fortis would not.

With this he drew tinctures from coral, lapis hæmatites, granates, diamonds, and rubies.

Univerſal MENSTRUUM. See ALKAHEST.

MENSURATION, *Menſuratio*, in general, denotes the act or art of meaſuring lines, ſuperficies, or ſolids.

MENTHA, mint, in botany, a perennial herb, with ſquare ſtalks, ſerrated undivided leaves ſet in pairs; and ſpikes of monopetalous flowers, each of which is cut into four ſections, and followed by four ſeeds incloſed in the cup.

MENTHA *Vulgaris*, mint, hartmint, ſpearmint, with oblong, narrow, pointed leaves, joined cloſe to the ſtalk; and ſmall purpliſh flowers ſtanding in long ſpikes on the tops. It is a native of the warmer climates, common in our gardens, and flowers in June and July.

This herb has a ſtrong agreeable aromatic ſmell, and a bitteriſh, roughiſh, moderately warm taſte. It is in general uſe as a reſtringent, ſtomachic, and carminative: in vomitings and weakneſs of the ſtomach, there are perhaps few ſimples of equal efficacy.

MENTHA *Piperitis*, pepper-mint, with acuminated leaves on very ſhort pedicles; and the flowers ſet in ſhort thick ſpikes or heads. It is a native of this kingdom; and ſo far as is known, of this kingdom only: it has of late been received into general practice as a medicine, and is now raiſed plentifully in gardens, and does not appear to loſe any thing of its virtue with the change of ſoil.

This ſpecies of mint has a very penetrating ſmell, a ſtrong and warm taſte, pungent and glowing like pepper, and ſinking as it were into the tongue. It is a medicine of great importance in flatulent colics, hyſteric depreſſions, and other like complaints; exerting its activity as ſoon as taken into the ſtomach, and diffuſing a glowing warmth through the whole ſyſtem; yet not liable to heat the conſtitution near ſo much as might be expected from the great warmth and pungency of its taſte.

By maceration or infuſion, it readily and ſtrongly impregnates both water and ſpirit with its virtue; tinging the former of a browniſh colour, and the latter of a deep green. In diſtillation with water it yields a conſiderable quantity of eſſential oil, of a pale greeniſh yellow colour, growing darker-coloured by age, very light, ſubtile, poſſeſſing in a high degree the ſpecific ſmell and penetrating pungency of the pepper-mint; the decoction remaining after the ſeparation of this active principle, is only bitteriſh and ſubaſtringent, like thoſe of the other mints. Rectified ſpirit, drawn off with a gentle heat from the tincture made in that menſtruum, brings over little of the virtue of the herb, nearly all its pungency and warmth remaining concentrated in the extract, the quantity of which amounts to about one fourth of the dried leaves.

MERCATOR's CHART, a projection of the earth's ſuperficies in plano, where the meridians are ſtraight lines, parallel to, and equidiſtant from each other. The parallels of latitude are alſo ſtraight lines, and parallel to one another, but the diſtance between them increaſes from the equinoctial towards either pole, in the ratio of the ſecant of the latitude to the radius.

If the ſuperficies of the terreſtrial globe be ſuppoſed to be taken off, and extended on a plane, ſo as to make the meridians parallel to each other, and the degrees of longitude every where equal, it is eaſy to conceive that it muſt be productive of moſt notorious errors; for an iſland in latitude 60°, where the radius of the parallel is only equal to one half of the radius of the equator, will have its length from eaſt to weſt diſtorted in a double ratio to what it was on the globe; that is, its length from eaſt to weſt, in compariſon of its breadth from north to ſouth, will be repreſented in a double proportion to what it really is; whence it follows, that in whatever proportion the degrees of any parallel are increaſed or diminiſhed, by a projection in plano, the degrees of longitude ought to be increaſed or diminiſhed in the ſame ratio; for otherwiſe the true bearings and diſtances of places will be loſt, as in the caſe of the plain-chart, where the degrees of latitude and longitude are all equal.

Though this projection is generally called Mercator's projection, yet our countryman, Mr. Wright, had long before invented it, demonſtrated its uſe, and ſhewn a ready way of conſtructing it, by enlarging the meridian line by a continued addition of ſecants; but neither of theſe gentlemen is thought the original author of it, as being hinted by Ptolemy about two thouſand years ago.

The Manner of conſtructing MERCATOR's *Chart.*—Let AB (plate LXXXVII. *fig.* 1.) be an arch of the equator, intercepted between any two meridians as AP, BP, meeting in P, the pole of the ſphere, whoſe center is C. Upon the points A and B, erect the perpendiculars AH and BI, and let DE repreſent an arch of any parallel contained between the ſame meridians. Draw CA and CB, KD and KE, perpendicular to PC; through D and

and E draw C F, C G, and join F G; laſtly, let fall the perpendicular D L.

Now the arch of the equator A B is to the ſimilar arch of the parallel D E, as A C is to D K, or as the radius to the co-ſine of the latitude A D. Suppoſe now the meridians A P, B P, to be in the part projected into the perpendiculars A H and B I, then will the arch D E be projected into the arch F G = A B; but in this caſe D E, the natural length of the arch, is to F G, its protracted length, as the radius C D to the ſecant of the latitude C F, or as the co-ſine L C to the radius C D; for as C F : A C = C D :: D C : L C. Hence it follows, that the degrees of latitude in Mercator's chart, increaſe in proportion of the ſecant of the latitude to the radius. Let us now project a chart on theſe principles; in order to which, draw the line A B, (plate LXXXVI. *fig.* 1.) and divide it into as many degrees as your map is to contain in longitude, ſuppoſe 90°. At the extremities A and B raiſe perpendiculars, to which draw parallel lines at every ſingle, fifth, or tenth degree of the equator for the meridians; as in the figure, where they are drawn at every tenth degree. This done, put one foot of the compaſſes in the point A, and extending the other to the point in the firſt meridian in the equator G; or, for greater exactneſs, to ſome more diſtant point, as B 90; deſcribe the quadrant F B, which divide into nine equal parts, and draw lines from A to each point of the diviſion; or, to avoid ſcoring the paper, only mark where a ruler cuts the firſt meridian G H, at every tenth degree's diſtance. Laſtly, becauſe the diſtances of the parallels from one another are marked, by this means, in the line G H, you muſt tranſfer them from that line to the ſide lines A C, B D, after the following manner. 1. Set one foot of the compaſſes in A, and extending the other to the firſt point above G, marked 1, tranſfer this diſtance, viz. A 1, to the lines A C, B D, and draw a line parallel to the equator A B, for the tenth parallel. 2. Next tranſfer the diſtance A 2 into the lines A C, B D, from the tenth parallel to the twentieth, which is to be drawn. 3. In the ſame manner the diſtances A 3, A 4, A 5, &c. laid off upon the lines A C, B D, from the immediately preceding parallels, viz. 20, 30, 40, &c. will ſucceſſively point out where the parallels 30, 40, 50, &c. are to be drawn.

MERCATOR's *Sailing*. See *Mercator*'s SAILING.

MERCHANT, a perſon who buys and ſells commodities in groſs, or deals in exchanges; or that traffics in the way of commerce, either by importation or exportation. Formerly every one who was a buyer or ſeller in the retail way, was called a merchant, as they are ſtill both in France and Holland; but here ſhop-keepers, or thoſe who attend fairs or markets, have loſt that appellation.

MERCURIAL, ſomething conſiſting of, or relating to mercury.

MERCURIFICATION, in chemiſtry, the method of ſeparating the mercuries of metals, which is moſt eaſily effected by means of a burning-glaſs; for the metal being placed in its focus, its mercurial parts are ſaid to fly off in ſmoke, which when condenſed and collected, appears to be true quickſilver.

MERCURY, in natural hiſtory, a fluid metallic ſubſtance, not moiſtening the hands; perfectly opake; of a bright ſilver colour, reſembling lead or tin when melted; entirely void of taſte and ſmell; extremely diviſible; not congealable in the greateſt degree of natural cold.

It is the moſt ponderous of all fluids, and of all known bodies except gold and platina: its gravity is to that of water nearly as 14 to 1; a cubic foot of quickſilver weighing 947 pounds, whilſt a cubic foot of water weighs but 70: it is found to be heavier in winter than in ſummer, in the proportion of eleven ounces thirty-two grains, to eleven ounces ſeven grains. In conſequence of its great denſity, it is of all fluids the coldeſt to the touch: the hand cannot be kept one quarter of an hour in a quantity of quickſilver with ſafety. Of all fluids likewiſe it grows hotteſt, not really, but apparently, from the application of an equal external heat.

In a heat below ignition, it totally exhales in extremely thin, ſubtile, penetrating fumes, which condenſe into running mercury again: the admiſſion of air, which changes the fumes of the other ſemi-metals into a powdery calx, has not that effect upon thoſe of quickſilver.

It diſſolves in all the mineral acids, but with different degrees of facility; and proves itſelf a menſtruum for ſundry metallic bodies. It has the greateſt affinity with gold; adhering to and diſſolving that metal the moſt readily of all. It unites eaſily alſo with ſilver; leſs eaſily with lead; ſtill leſs ſo with tin; very difficultly with copper; moſt difficultly of all with iron, to which it ſeems to have an inſuperable repugnance. It does not eaſily take up biſmuth or regulus of antimony, unleſs they are previouſly mingled with other metals, or diſpoſed to unite with it by particular managements; after it has been combined with either of theſe, it throws them out again upon digeſtion; biſmuth nevertheleſs diſpoſes ſome other metals, particularly lead, to ſuch an intimate union with the mercury, as to paſs along with it through the pores of leather. Quickſilver mingles alſo with various ſaline ſubſtances, and with ſulphur; with which laſt it forms a black maſs called æthiops, which changes, on ſublimation, into a red one called cinnabar.

There are different methods of purifying quickſilver; as ſtraining through leather; trituration or ablution with vinegar; with vinegar and ſalt, with ſope-leys, with rectified ſpirit of wine, and with aqua-fortis; and diſtillation, either without addition, or with alkaline ſalts, quick-lime, or iron filings. When quickſilver is only ſuperficially mixed with duſt or earthy powders, ſtraining thro' leather is ſufficient for its purification: if any foulneſs ſtill remains, ſpirit of wine will waſh it off: unctuous or oily impurities require ablution with ſope-leys. Lead and biſmuth are moſt effectually ſeparated by making the mercury into an æthiops, with a ſufficient quantity of ſulphur, and reviving it again from the æthiops by diſtillation, with twice its quantity of quicklime, alkaline ſalt, or iron filings; the mercury alone will diſtil, and leave all its impurities behind; ſulphureous, antimonial, and other like admixtures, are to be ſeparated by the ſame means. The purification by aqua-fortis is performed by taking only a ſmall quantity of the acid to a large one of mercury; grinding them diligently together, and then waſhing the quickſilver with water. When mercury is combined with ſulphur into cinnabar, the revivification of it does not well ſucceed with alkaline ſalts; by fixed alkalies, the ſulphur is very difficultly, and not perfectly abſorbed; to volatile alkalies it does not yield at all: on the other hand it is obſervable, that metallic bodies, as iron, lead, tin, regulus of antimony, readily detain the ſulphur in diſtillation, and ſuffer the mercury to ariſe pure.

The largeſt quantities of mercury are employed for metallurgical operations: gold and ſilver are extracted, in the Spaniſh Weſt Indies, from their ores or matrices, by amalgamation with mercury; and both metals are recovered by the ſame means, when blended in minute particles with earthy matters, as in filing or working them. Amalgamated with tin, it makes the foil for looking-glaſſes, and reflecting balls. It is uſed alſo for gilding on ſilver, for anatomical injections, for weather glaſſes, and ſundry other purpoſes. In vacuo, it appears luminous, and is then called the mercurical phoſphorus.

Quickſilver, conſidered as a medicine, is a ſpecific againſt the venereal diſeaſe, worms, lice, and all kinds of inſects: the venereal diſtemper is not perhaps to be radically cured without it, but againſt inſects there are other remedies equally if not more effectual. It is commonly ſuppoſed to have, of itſelf, no poiſonous quality; but it appears, from experience, manifeſtly prejudicial to the nerves and the bones. Its ill effects are moſt obſervable in thoſe, who are expoſed to its fumes; which fumes are no other than perfect quickſilver, as any one may be convinced by receiving them on a piece of moiſt leather or cloth, upon which they will reunite into little globules of mercury. Moſt people admit a pernicious quality in the fumes, though they deny it to the quickſilver; not conſidering that the fumes are only the quickſilver itſelf, divided but not altered by the heat. Even mercurial ointments applied externally have occaſioned contractions of the limbs, corroſions of the bones, and other dangerous conſequences. How ſoon do the miners feel its ill effects, though they neither anoint with it, nor ſwallow it, nor are expoſed to the fumes into

which

which it is reſolved by fire! They firſt become paralytic, and fall afterwards into a ſalivation: their teeth drop out: violent pains in the whole body, particularly in the bones, and at length death, ſucceed. It may be proper to obſerve, that the Spaniſh phyſicians treat theſe patients in a different method from that purſued among us and in other countries: they expoſe them frequently for a conſiderable length of time to the open air, and give internally nothing but abſorbents.

Quickſilver, included in a flat-bottomed glaſs, having a ſmall hole open to the air, and kept for ſeveral months in a conſtant heat juſt not ſtrong enough to make it evaporate, calcines by degrees into a red powder, called mercurius calcinatus. A greater heat, ſufficient to make the mercury diſtil, does not only promote the calcination, but revives ſuch part as has been already calcined, into running mercury again. A weaker heat, as that of the human body, or even of boiling water, though continued for years, changes only a ſmall part of the mercury into a blackiſh powder; conſtant triture or agitation produces ſimilar effects to this low degree of heat, and in a much ſhorter time. If the free acceſs of air ſhould be found to influence the calcination of this, as it does that of the metallic bodies called imperfect, the tedious proceſs might be expedited, by uſing, for the veſſel, a glaſs tube, with both its ends bent upwards, and one of them conſiderably higher than the other; through which, a conſtant ſtream of freſh air would paſs over the ſurface of the ſmall thread of mercury at the bottom.

This red powder has by ſome been greatly eſteemed in venereal caſes, and ſuppoſed to be the moſt effectual and certain of the mercurials. It is accompanied with one conſiderable inconvenience, being greatly diſpoſed to irritate the firſt paſſages, and occaſion gripes; to prevent which, a ſmall quantity of opium, and ſome warm aromatic material, are commonly joined to it: the antivenereal pills of a late celebrated empyric are ſuppoſed to have been a compoſition of this kind. Even when thus corrected, however, it does not appear to have any advantage above the mercurials in common uſe and of eaſier preparation. The doſe is from half a grain to two grains: five or ſix grains are ſaid to vomit and purge violently.

The blackiſh powder, obtained by long agitation, is the baſis of an antivenereal medicine, which has lately come into great repute abroad; but which appears, from the accounts publiſhed of it in France, to be neither ſo ſafe, nor ſo effectual, as ſome of the common officinal mercurials.

If oil of vitriol be poured on half, or equal, its weight of quickſilver, and gradually heated till the liquor boils and diſtils; the more phlegmatic parts ariſe, while the ſtronger acid corrodes the mercury into a white cauſtic maſs. On the affuſion of warm water, the maſs falls into powder, and becomes immediately yellow; a part of it, ſatiated with acid, diſſolving in the water: the larger the quantity of acid made uſe of, and the leſs thoroughly the matter has been exſiccated or calcined, the more of it will diſſolve. The yellow powder, ground with freſh quantities of water till all the ſoluble part is extracted, becomes inſipid, and in this ſtate, commonly called turpeth or turbith mineral, it proves, tho' not corroſive, ſtrongly emetic; operating, in this intention, the moſt effectually of all the mercurials that can be given with ſafety. It is uſed chiefly in violent gonorrhœas, and other venereal caſes accompanied with a great flux of humours to the parts: it is ſaid likewiſe to have been employed with ſucceſs, in robuſt conſtitutions, againſt leprous diſorders, and obſtinate glandular obſtructions. The doſe, as an emetic, is from two grains to ſix or eight; though ſome conſtitutions, habituated to mercurials, can bear larger quantities. It may be given in ſmaller doſes, as half a grain or a grain, as an alterative, after the ſame manner as the red calx of mercury already mentioned: and even when intended as an evacuant, it may perhaps, as Malouin obſerves, be moſt adviſable, to give only a ſmall quantity at a time, as one grain, and repeat this doſe every hour till the vomiting ſucceeds.

On adding a ſolution of ſea-ſalt to a ſolution of mercury made in aqua-fortis, the nitrous acid quits the mercury, and unites with the alkaline baſis of the ſea-ſalt; and at the ſame time, the acid of the ſea-ſalt unites with the mercury, and forms with it a compound, difficultly, and only partially diſſoluble, of which therefore great part ſubſides, on ſtanding for ſome time, in form of a white powder. This powder, waſhed with freſh quantities of hot water, till the more ſoluble parts are extracted, becomes nearly inſipid. In this ſtate it is recommended by Boerhaave as one of the beſt of the mercurials, and ſaid, in doſes of three grains, to purge and vomit gently. It appears however too corroſive for internal uſe; being ſo much ſo, as to be employed by the farriers for the purpoſes of an eſcharotic. The preparation is likewiſe a very unfrugal one, a conſiderable part of the mercury remaining unprecipitated, and a conſiderable part of the precipitate being diſſolved and carried off in the ablution.

Spirit of ſal ammoniac, or other volatile alkalies, dropped into a filtered ſolution of ſublimate, abſorb a part of the acid; and the mercury, retaining ſo little as to be indiſſoluble, renders the liquor milky, and ſubſides on ſtanding, in form of a fine white powder, which, waſhed by repeated affuſions of hot water, becomes inſipid. Solutions of fixed alkaline ſalts, ſubſtituted to the volatile ſpirit, produce a yellow precipitation; but if an equal weight of crude ſal ammoniac be diſſolved along with the ſublimate, fixed alkalies, added to this ſolution, extricate the volatile alkali of the ſal ammoniac, and the precipitate proves the ſame as if the volatile alkali alone had been added in its pure ſtate. Theſe precipitates are uſed chiefly on account of the elegance of their colour, in unguents for cutaneous eruptions; one part of the mercurial precipitate, three of precipitate ſulphur, and eighteen of the ſimple ointment or pomatum, moiſtened with a little ſtrong alkaline ley, make the common mercurial application for theſe complaints. The precipitates have been given internally; but mercurius dulcis, which differs from them only in being more mild, and more equal and certain in its effects, is in this intention greatly to be preferred. It does not appear that a combination of mercury, with ſo ſmall a proportion of acid, that is, ſo mild and ſafe a mercurial, can be obtained by any kind of precipitation, as by the proceſs by which mercurius dulcis is prepared.

Mercurius dulcis is ſublimate made mild, by combining with it ſo much freſh mercury, as is ſufficient to ſatiate the redundant acid. Four parts of powdered ſublimate are ground with three of quickſilver, an operation in which great caution is neceſſary, to avoid the lighter corroſive particles that fly off, till they are thoroughly incorporated; or, which is much more commodious, digeſted together in a gentle heat, by which the union will be performed as effectually. The mixture is then ſublimed in a glaſs matraſs or phial; the ſublimed maſs freed from the whitiſh acrid matter about the mouth of the veſſel, and from ſuch mercurial globules as may happen to appear diſtinct, then pulveriſed, and ſublimed again: in this manner the ſublimation is repeated ſix times, by which means the medicine becomes leſs liable to irritate the firſt paſſages, and run off by ſtool.

Mercurius dulcis ſeems to be the beſt and ſafeſt of the mercurial preparations that can be taken in a ſolid form. It may be given from fifteen to twenty grains; or, as an alterative, from one to two or three grains.

MERCURY ☿, in aſtronomy, the ſmalleſt of the inferior planets, and the neareſt to the ſun. See the article PLANET.

According to Mr. Caſſini, the greateſt diſtance of Mercury from the earth is 32704, the mean diſtance 22000, and the leaſt diſtance 11296 ſemi-diameters of the earth: therefore his mean diſtance will be about 88000000 Engliſh miles; and the diameter of Mercury is $\frac{3}{4}$ of the diameter of the earth, and therefore the globe of Mercury muſt be $\frac{2}{3}$ of that of the earth.

Mr. Azout pretends to prove, that though Mercury be ſo near the ſun, the light there is not capable of burning any objects. But Sir Iſaac Newton makes the heat of Mercury ſo great, as to be ſeven times as much as the heat of our ſummer ſun; which he found, by experiments deſignedly made by the thermometer, is enough to make water boil. And, therefore, if bodies will not be there enkindled by ſuch a degree of heat, it muſt be becauſe their degree of denſity is proportionably greater than that of

5 JA 59

Fig. 1. Mercator's Chart.

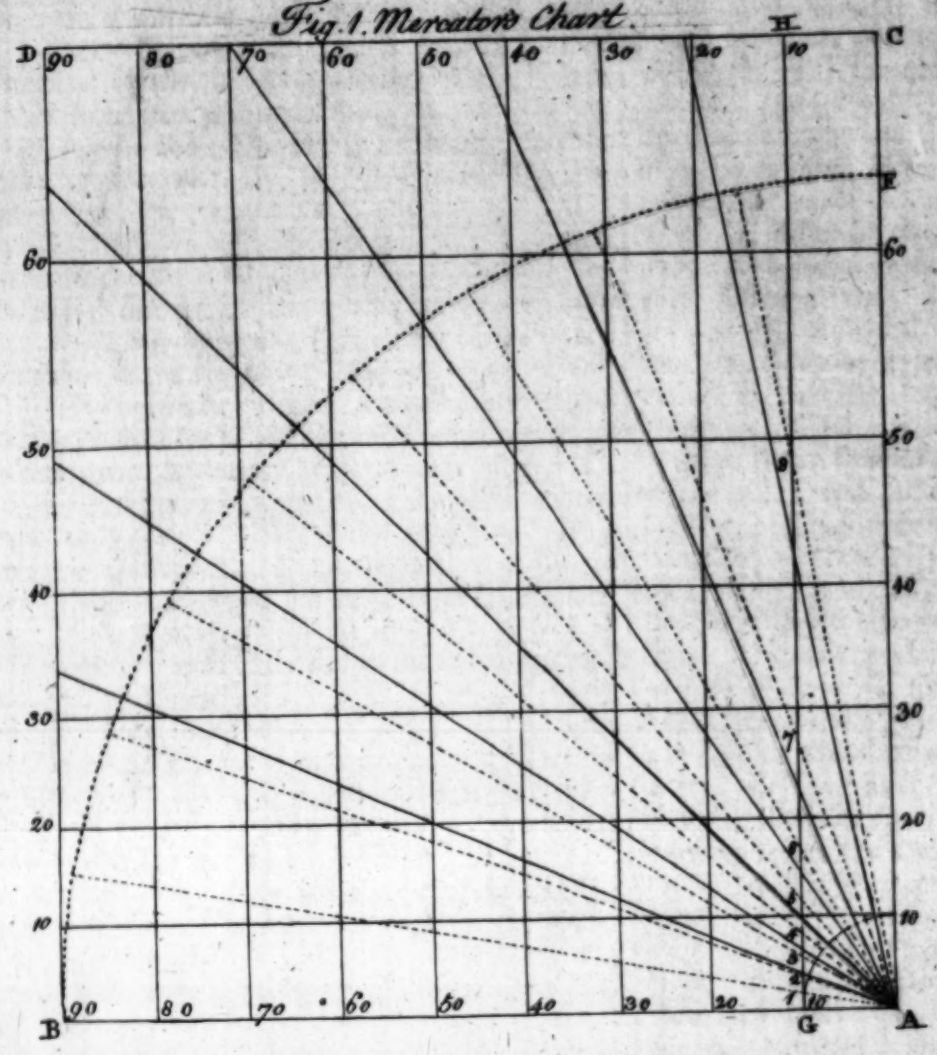
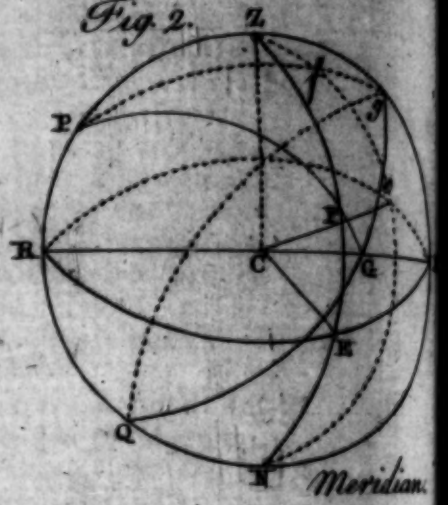


Fig. 2.



Meridian.

Fig 3. Meridian.

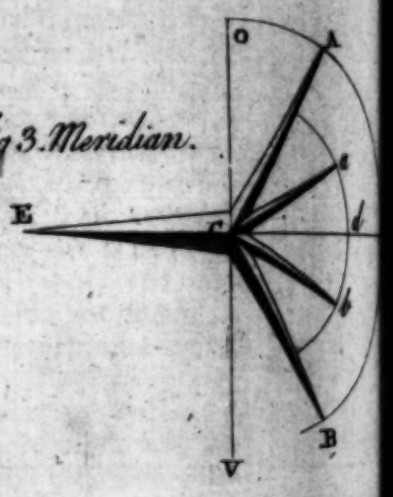


Fig 4. Micrometer.

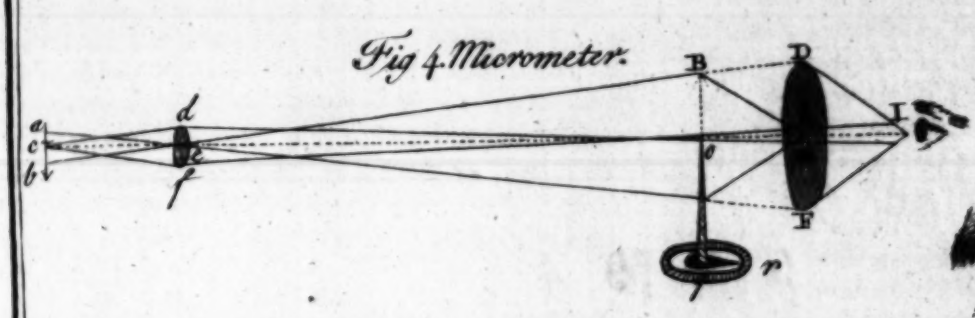


Fig 5. Microscope.

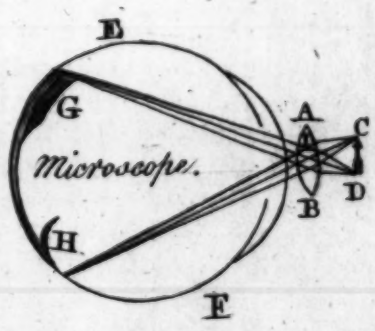
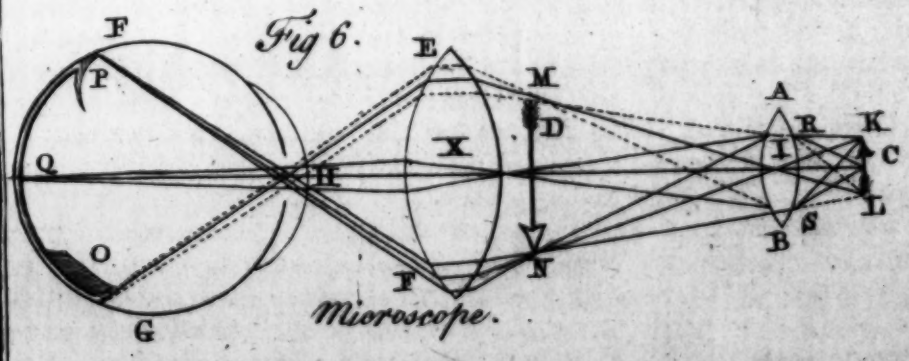


Fig 6.



Microscope.

Fig 7. Microscope.

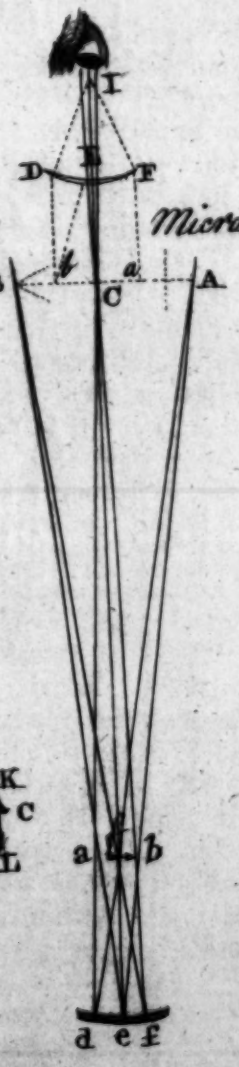


Fig 9. Micros

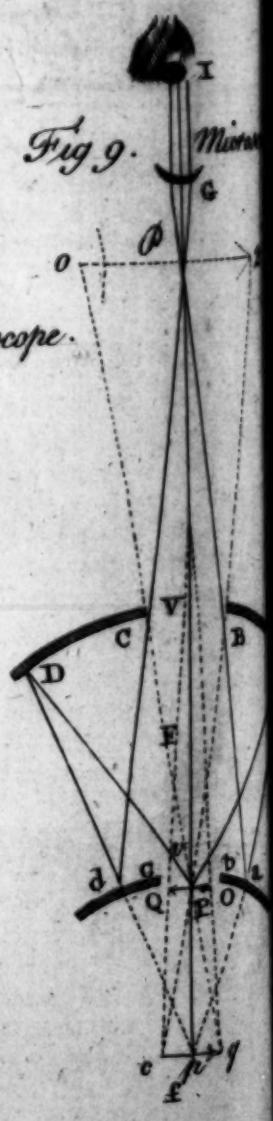
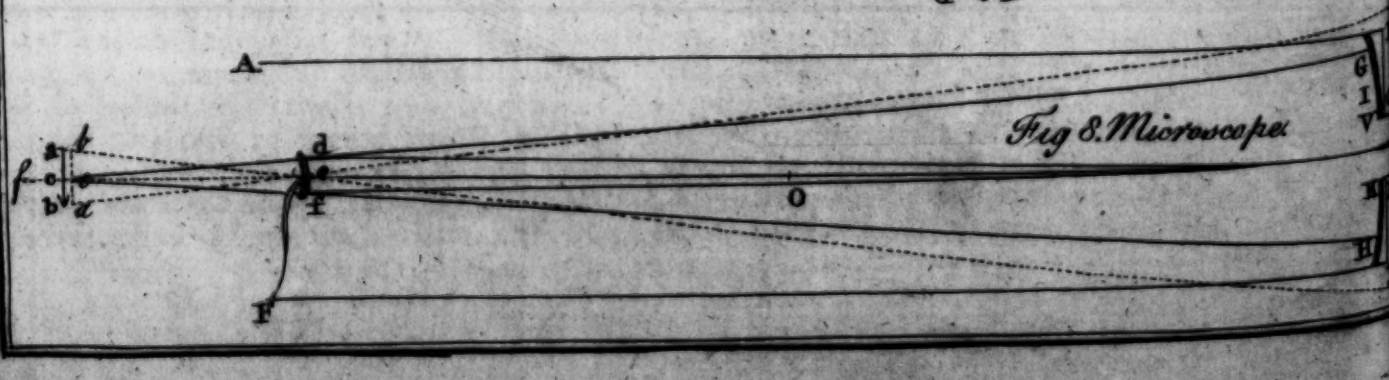


Fig 8. Microscope.



of ſuch kinds of bodies on our earth: wherefore, undoubtedly, this fiery planet is uninhabitable by ſuch creatures as live on our earth.

Dr. Halley, in his obſervation of Mercury ſeen in the ſun, in the year 1677, at St. Helena, ſays, that this plant may be ſeen nine times in the ſun, near the aſcending node, in the years 1710, 1723, 1736, 1743, 1756, 1769, 1776, 1782, 1789, in October: and four times near the other node, in the month of April, in the years 1707, 1753, 1786, 1799; all within this century.

Dr. Gregory, in his Elements of Aſtronomy, deſcribes the phænomena that will appear to the eye in Mercury: he ſays, that beſides the phænomena of the order of the fixed ſtars, which agree alike with an eye placed any where within the orbit of Saturn, it is plain that the eye, poſited in Mercury, will ſee the ſun almoſt three times broader than we ſee it from the earth, becauſe that planet is almoſt three times nearer to the ſun than the earth. Whence alſo the ſolar diſk, ſeen from Mercury, is ſeven times greater than the diſk as it appears to us, and Mercury has ſeven times more light and heat, *cæteris paribus*, than the earth. But theſe qualities are much more or leſs intenſe, according to the different diſtance of Mercury from the ſun: for its orbit is much more excentric, than the orbit of any other planet.

The accelerating gravity, towards the ſun, is alſo ſeven times greater there than here.

It has not yet been found by obſervation, whether Mercury turns upon its own axis, and therefore it cannot be certainly defined, whether to an eye, placed on its ſurface, all the things without will appear to revolve with a contrary motion; that is, whether it has the viciſſitude of day and night, much leſs what is the ſpace of its nychthemeron, or natural day: but we may ſafely enough conjecture, that it does revolve about its axis, ſince other planets do. But the year of Mercury is ſcarce equal to a quarter of our year, though it is uncertain whether it has different ſeaſons, becauſe they depend upon the inclination of the axis of its rotation, which is unknown, to the plane of the orbit which it deſcribes about the ſun. The eye placed in Mercury, looking at the ſun, will ſee the ſun's ſpots (when it has any) ſometimes in a right line croſſing his diſk from eaſt to weſt; at another time their way will appear elliptical and curve, towards one ſide or the other; and all the variety of this phænomenon will happen in one year, in which the track or way of the ſpots will appear twice rectilineal. But the way of the ſolar ſpots, ſeen from Mercury, will be always almoſt ſtraight; becauſe Mercury never declines much from the plane of the ſun's equator; and therefore not ſenſibly from the planes of the circles, which the ſpots deſcribe by their rotation. And as the plane of the orbit of the earth is moſt of all inclined to the ſaid plane of the ſun's equator, the way of the ſpots, ſeen from the earth, appears more curve than if the ſun was ſeen from any other planet. This curvature will be ſomething leſs, ſeen from Jupiter or Mars; and yet leſs from Saturn, leſs ſtill from Venus, and leaſt of all from Mercury, as we have juſt obſerved.

The other five planets are ſuperior to Mercury, therefore their phænomena are to an eye placed in Mercury, as the phænomena of Mars, Jupiter and Saturn, ſeen from the earth. Therefore Venus and the earth, when they are in oppoſition with the ſun, will ſhine with a full orb, and reflecting the ſun's rays very directly, will ſhine upon Mercury all night, and powerfully expel the darkneſs. For ſince Venus, when it is horned, and ſhews the leaſt part of its enlightened hemiſphere to the inhabitants of the earth, is ſo bright as to caſt a ſhadow, it will appear very bright to Mercury, to which it turns its whole enlightened hemiſphere.

Mercury ſees no inferior planet known to us, conſequently ſees no celeſtial body falcated or horned; and therefore a ſpectator there, will want the argument taken from ſuch phaſes of the planets, to eſtabliſh the true ſyſtem of the world: for the phaſes of the inferior planets have clearly ſhewn that they move about the ſun; whence it was natural to think the ſame of the other motions. But nevertheleſs, though we do not ſee any planets inferior to Mercury, it does by no means follow that there are no ſuch: for Mercury himſelf is ſeldom ſeen in our oblique ſphere, and one that ſhould be much inferior to it, would never be ſeen upon account of its nearneſs to the ſun.

MERCURY, in heraldry, a term uſed in blazoning by planets, for the purple colour in the arms of ſovereign princes. See BLAZONING.

MERCURY, in matters of literature, denotes a book, or other paper, chiefly filled with news; ſo called from the Pagan deity Mercury, who is ſaid to have been the meſſenger of the gods. Hence alſo the perſon employed to collect news, or diſtribute the news-papers, are called Mercuries.

MERIDIAN, in aſtronomy, a great circle of the ſphere, paſſing through the zenith, nadir, and poles of the world; dividing the ſphere into two hemiſpheres, the eaſtern and weſtern. It is a vertical circle paſſing through the poles of the world.

The word is derived from *meridies*, noon, by reaſon when the ſun is in this circle, it is noon in thoſe places ſituate under it.

To draw a MERIDIAN *Line.*—Knowing the ſouth-quarter pretty nearly, obſerve the altitude F E (plate LXXXVI. *fig.* 2.) of ſome ſtar on the eaſtern ſide thereof, not far from the meridian H Z R N; then, keeping the quadrant firm on its axis, ſo as the plummet may ſtill cut the ſame degree, only directing it to the weſtern ſide of the meridian, wait till the ſtar has the ſame altitude as before, *f e*. Laſtly, biſſect the angle E C *e*, formed by the interſection of the two planes wherein the quadrant is placed at the time of the two obſervations, by the right line H R. This line H R is a meridian line.

Or thus; which is a very eaſy and good method for practice. On an horizontal plane, from the center C, (*fig.* 3.) deſcribe ſeveral concentric arches B A, *b a*, &c. and on the ſame center C, erect a ſtyle or gnomon, perpendicular to the plane A C B, a foot or half a foot long. About the time of the tropics before noon, between the hours of nine and eleven in the morning, and between one and three in the afternoon, obſerve the points B, *b*, &c. A, *a*, wherein the ſhadow of the ſtyle terminates. Biſſect the arches A B, *a b*, &c. in D, *d*, &c. If then the right-line D E biſſect all the arches A B, *a b*, &c. it will be the meridian line ſought. As the extremity of the ſhadow is ſomewhat hard to determine, it will be convenient to have the ſtyle flat at the top, and to drill a little hole, noting the lucid ſpot projected by it, on the arches A B and *a b*, inſtead of the extremity of the ſhadow.

Hence, if the meridian line be biſſected by a right line O V, drawn perpendicularly through the point C, O V will be the interſection of the meridian, and firſt vertical, and conſequently O will ſhew the eaſt point, and V the weſt.

MERIDIAN LINE, on a dial, is a right line ariſing from the interſection of the meridian of the place, with the plane of the dial; this is the line of twelve o'clock, and from hence the diviſion of the hour-lines begins. See DIAL.

Magnetical MERIDIAN, is a great circle paſſing thro' the magnetical poles, to which the magnetic needle, or needle of the mariner's compaſs, conforms itſelf.

MERIDIAN *Altitude of the Sun or Stars*, is their altitude when in the meridian of the place where they are obſerved. Or it may be defined, an arch of a great circle perpendicular to the horizon, and comprehended between the horizon and the ſun or ſtar then in the meridian of the place.

To take the MERIDIAN *Altitude with a Quadrant.*—If the poſition of the meridian be known, and the plane of an aſtronomical quadrant be placed in the meridian line, by means of the plumb-line ſuſpended at the center, the meridian altitudes of the ſtars, which are the principal obſervations whereon the whole art of aſtronomy is founded, may eaſily be determined. The meridian altitude of a ſtar may likewiſe be had by means of a pendulum-clock, if the exact time of the ſtar's paſſage by the meridian be known. Now it muſt be obſerved, that ſtars have the ſame altitude for a minute before and after their paſſage by the meridian, if they be not in or near the zenith; but if they be, their altitudes muſt be taken every minute when they are near the meridian, and their greateſt altitudes

will be the meridian altitudes ſought. See the article QUADRANT.

MERIDIONAL DISTANCE, in navigation, is the ſame with the departure, eaſting or weſting, or the difference of longitude between the meridian under which the ſhip now is, and any other meridian ſhe was before under.

MERIDIONAL PARTS, MILES, or MINUTES, in navigation, are the parts by which the meridians in Mr. Wright's chart, commonly, though falſely, called Mercator's, do increaſe, as the parallels of latitude decreaſe. See *Mercator's* SAILING.

MERIT, in theology, ſignifies deſert. This term is more particularly uſed to ſignify the moral goodneſs of the actions of men, and the rewards to which thoſe actions entitle them.

MERLIN, *Æſalon*, in ornithology, the leaſt of the hawk kind, but much reſembling the haggard-falcon.

MERLON, in fortification, is that part of a parapet which is terminated by two embraſures of a battery. Its height and thickneſs is the ſame with that of the parapet; but its breadth is generally nine feet on the inſide, and ſix on the outſide. It ſerves to cover thoſe on the battery from the enemy; and is better when made of earth well beat and cloſe, than when built with ſtone; becauſe they fly about and wound thoſe they ſhould defend.

MEROPS, the bee-eater, in ornithology, the blue-breaſted iſpida, with a variegated head; a very beautiful bird, ſomewhat larger than the common king-fiſher. See ISPIDA.

MERULA, the blackbird, in ornithology, a ſpecies of the turdus or thruſh-kind. See the article TURDUS.

MESENTERY, in anatomy, a thick fat membrane, placed in the midſt of the inteſtines, particularly of the ſmaller ones, whence it has the name. Its ſubſtance is compoſed of membranes, fat, veſſels of all kinds, and in the human body of a number of glands. In the upper part, it is connected with the three ſuperior vertebræ of the loins; and in the lower, with the inteſtines, and particularly with the jejunum and ileum; to which it alſo gives their outer coat. When it is ſeparated from the inteſtines, it has ſeveral folds reſembling gloves. Its length, in the whole, is about three ells; but the inteſtines which are joined to it, are at leaſt four times that length. Its coats or membranes are two, and between theſe there is a cellular ſubſtance, which contains the fat: meſeraic veſſels and glands are alſo placed there, which many reckon a third coat of the meſentery, and that not improperly; this they call the tunica celluloſa.

MESN, in law, ſignifies him who is lord of a manor, and ſo hath tenants holding of him, yet himſelf holding of a ſuperior lord. This word alſo ſignifies a writ, which lies where there is a lord meſn and tenant, and the tenant is diſtrained for ſervices due from the meſn to the ſuperior lord.

MESOCOLON, in anatomy, that part of the meſentery connected with the great guts, eſpecially the colon.

MESOLABLE, an inſtrument uſed by the ancients for finding two mean proportionals mechanically, which they could not effect geometrically.

It conſiſted of three parallel organs, moving in a groove to certain interſections.

MESOLOGARITHMS, according to Kepler, are the logarithms of the coſines and co-tangents, the former of which were called by lord Napier antilogarithms, and the latter differentials.

They are otherwiſe called artificial ſines and and tangents. See the articles LOGARITHM, SINE, TANGENT, &c.

MESPILUS the medlar, in botany, a genus of plants, the flower of which is made up of roundiſh hollow petals; and its fruit is an umbilicated globoſe berry, containing five oſſeous and gibbous ſeeds.

MESSENGERS are certain officers chiefly employed under the direction of the ſecretaries of ſtate, and always are in readineſs to be ſent with all kinds of diſpatches foreign and domeſtic. They alſo, by virtue of the ſecretaries warrants, take up perſons for high treaſon, or other offences againſt the ſtate.

MESSENGER, a rope faſtened to the cable to draw in, in ſmall ſhips of war.

MESSIAH, the anointed; a title which the Jews gave to their expected great deliverer, whoſe coming they ſtill wait for: and a name the Chriſtians apply to Jeſus Chriſt, in whom the prophecies relating to the Meſſiah were accompliſhed.

Among the Jews, anointing was the ceremony of conſecrating perſons to the higheſt offices and dignities; kings, prieſts, and ſometimes prophets were anointed: thus Aaron and his ſons received the ſacerdotal, Eliſha the prophetic, and David, Solomon, and others, the royal unction.

METAL. See METALLIC *Bodies*.

Prince's METAL, called *Bath* METAL, a kind of factitious metal, of a beautiful yellow, and diſpoſed to receive a fine poliſh, luſtre, &c. It is prepared, according to Dr. Shaw, as follows: take ſix ounces of copper, melting it in a wind furnace; add to it one ounce of zink: then ſtirring the whole well together, pour out the metal immediately. The copper and zink may be put into the crucible together, if firſt covered over with the black flux, which prevents the evolution of the zink, or preſerves its metalline form.

METAL, in heraldry. There are two metals uſed in heraldry, by way of colours, viz. gold and ſilver, in blazonry called *or* and *argent*.

In the common paintings of arms theſe metals are repreſented by white and yellow, which are the natural colours of thoſe metals. In engraving, gold is expreſſed by dotting the coat, &c. all over; and ſilver, by leaving it quite blank.

It is a general rule in heraldry, never to place metal upon metal, nor colour upon colour; ſo that if the field be of one of the metals, the bearing muſt be of ſome colour; and if the field be of any colour, the bearing muſt be of one of the metals.

METALLIC *Bodies*, in natural hiſtory, are ſuch metals as are capable of being worked and conſiderably extended under the hammer; and ſemi-metals, or thoſe which want that valuable quality.

There are other characters alſo, no leſs diſcriminative of the two claſſes: metals appear when broke of an uniform, or a fibrous, or a granulated texture; whilſt the broken ſurfaces of ſemi-metals, the fluid one, quickſilver excluded, are compoſed of large angular plates or flakes: metals, expoſed to the moſt intenſe degree of culinary fire, if the air is perfectly ſhut out, remain fixed and unaltered at the botton of the veſſel; whilſt ſemi-metals, impatient of vehement heat, ariſe in fumes into that part of the veſſel which is furtheſt removed from the fire, and there condenſe again into their original form.

Though neither metals or ſemi-metals ſuffer any eſſential change from heat, ſo long as the air is excluded; there are ſeveral bodies of both claſſes, which by the action of fire and air conjointly, are gradually deprived of their metallic appearance and qualities, and converted into a powdery or vitreous ſubſtance, called calx or ſcoria. Hence ariſes a further diſtribution into imperfect, or thoſe which are ſuſceptible of theſe changes; and perfect, or thoſe which ſuffer none.

METALLURGY, *Metallurgia*, according to Boerhaave, comprehends the whole art of preparing and working metals from the glebe, or ore, to the utenſil; in which ſenſe, mineralogy, aſſaying, ſmelting, refining, ſmithery, gilding, &c. are only branches of metallurgy. See MINERALOGY, &c.

Dr. Shaw however reſtrains metallurgy to thoſe operations required to ſeparate metals from their ores, for the uſes of life. Theſe operations are of two kinds, or ſmaller and large; with regard to which the whole art of metallurgy may be divided into two parts, aſſaying and ſmelting. See ASSAYING, &c.

Dr. Cramer obſerves, that the art of aſſaying conſiſts in a well-made ſeparation of minerals, eſpecially metals, and in a diviſion of the ſeveral conſtituent parts of them from each other, in order that the quantity and quality of each in particular may be known: it is plain that thoſe operations

tions which belong to the general clafs of ſolution, appertain ſtrictly and primarily to this; and that the others, which are performed by the aſſayer, are only ſecondary or auxiliary operations. But there is hardly any chemical operation which is not ſometimes neceſſary to be performed in the art of aſſaying: there are many, on the contrary, which are peculiar to aſſaying alone; therefore we have given a general view of thoſe which properly belong to it, or of thoſe which, though taken from chemiſtry at large, are nevertheleſs uſed by aſſayers; only obſerving here that every primary docimaſtical operation may, on account of its effects, be called ſolution, ſince, in every operation, the menſtrua, among which the air and fire have a right to be claſſed, effect a ſolution, by interpoſing themſelves between the parts of the objects to be changed. See the articles MENSTRUUM and FLUX.

Semi-METALS, metallic foſſils, fuſible by fire, and not malleable in their pureſt ſtate. See METALLIC *Bodies*.

METAMORPHOSIS, in general, denotes the changing of ſomething into a different form; in which ſenſe it includes the transformation of inſects, as well as the mythological changes related by the ancient poets.

Mythological metamorphoſes were held to be of two kinds, apparent and real: thus, that of Jupiter into a bull, was only apparent; whereas that of Lycaon into a wolf, was ſuppoſed to be real.

METAPHOR, *Metaphora*, in rhetoric, a figure of ſpeech, whereby the proper denomination of one thing is applied to another, for the greater elegance of expreſſion.

The word is Greek, μεταφορα, and formed of μετα, and φερω, to carry or bring.

A metaphor is a ſimile or compariſon intended to illuſtrate the thing ſpoken of, without the form of compariſon.

If any author is obliged to give a large account of things, plain and of common obſervation, he muſt raiſe and ennoble them by ſtrong and graceful metaphors. This rule Tully has obſerved in his deſcription of the ſeveral parts of this habitable globe, in his book on the Nature of the Gods. So has Virgil, in his Georgics, where he has made his meaneſt and coarſeſt ſubjects fine and admirable, by his judicious uſe of metaphors; in his perfect lines, the little affairs of ſhepherds and farmers appear with dignity; his deſcriptions make the country a paradiſe, and his touches, as a noble writer expreſſes it, turns every thing into gold. Thoſe are admirable and beautiful metaphors, in which the properties of rational creatures are applied to animals, and thoſe of animals to plants and trees; this way of treating a ſubject gives life and beauty to the whole creation. But we receive the ſtrongeſt pleaſure from thoſe bold and comprehenſive metaphors, in which, beſides the illuſtration of the ſubject they are intended to raiſe and improve, convey to us a freſh and lively image.

Metaphors never fail of being beautiful, when applied with nature, judgment, and a lively wit; that is, when they are drawn from nature, and connect ideas that have a due relation to each other, and are not too much wreſted to a foreign ſenſe. But nothing is more abſurd, than when theſe rules are tranſgreſſed, which is very often the caſe with our modern writers.

Cardinal Perron lays down this general rule for metaphors, that they muſt always deſcend from the genus to the ſpecies, and never go backward from the ſpecies to the genus.

Mr. Addiſon propoſes it, as a rule for writers, to imagine their metaphors actually painted before them, and to view and examine the juſtneſs of their application and aſſemblage under theſe circumſtances, throwing every thing out of their writings, but what might be retained in the picture.

METAPHRASE uſually ſignifies ſomething more than either a tranſlation or a paraphraſe: according to Baillet, a metaphraſt implies a tranſlator, gloſſator, and interpolator altogether.

METAPHYSICS, *Metaphyſic*, *Tranſnaturals*, or *Ontology*, a ſcience that treats of being as ſuch in the abſtract, or in general, not reſtrained to this or that ſpecies of it.

The word is Greek, μεταφυσικη, and formed of μετα, beyond or above, and φυσις, nature.

This ſcience is wholly converſant in the acts of the underſtanding, and it raiſes itſelf only to bring about things above the verge of ſenſe and matter, applying itſelf only to beings ſeparated from their individual ſingularity, particularly beings purely ſpiritual. The end of this ſcience is the ſearch of pure and abſtracted truth.

Ariſtotle ſeems to have been the firſt founder of this abſtracted method of reaſoning, and the conſideration of immaterial beings. Indeed, Pythagoras, by his travels into Egypt, learned the unity of the Godhead from the Hebrews, and taught it the Greeks; but he alſo borrowed moſt of the viſions of the Egyptians relative to ſpirits, which they inveſted with ſubtile bodies, and filled the world with their airy train. Plato took the ſame doctrine from Pythagoras, and Zeno afterwards tranſcribed it from Plato.

Antiquity affords nothing on this ſubject compoſed with ſo much ſtrength of reaſon as Cicero's books of the Nature of the Gods. His ſentiments are as juſt, and his doctrine as good, as merely heathen theology could produce.

The chief modern works of this kind are thoſe of Deſcartes, Malebranche, Dr. Willis, Locke, Dr. Moore, &c.

If we are ſhort-ſighted in phyſical matters, which are nearer our ſenſe, and, in a manner, expoſed to our view, how much more muſt we be bewildered in our ſearch after ſpiritual abſtracted truths, in the conſideration of univerſals? This ſcience proceeds in almoſt unknown paths, containing very few doctrines of allowed certainty, few principles in which men are univerſally agreed, ſcarce any juſt definition, any exact diviſion, and, conſequently, affords large matter for doubts and diſputes. Add to this the barbarous terms and perplexed reaſonings with which the ſchools have embarraſſed this ſcience.

We ought by no means to approve of the deſign and notion of ſome contemplative men, who would introduce too great a mixture of metaphyſics into the ſubjects of religion, which ought to be treated with the moſt familiar plainneſs of method.

METAPLASMUS, in grammar, a tranſmutation or change made in a word, by adding, retrenching, or altering a letter, or ſyllables thereof.

METASTASIS, in medicine, a tranſpoſition or ſettlement of ſome humour or diſeaſe, on ſome other part; and ſometimes it ſignifies ſuch an alteration of a diſeaſe, as is ſucceeded by a ſolution.

METATARSUS, in anatomy, a fleſhy maſs lying under the ſole of the foot. See the article FOOT.

METATHESIS, in grammar, a ſpecies of the metaplaſmus; being a figure whereby the letters or ſyllables of a word are tranſpoſed, or ſhifted out of their uſual ſituation, as piſtris for priſtis; Lybia for Libya, &c.

METEMPSYCHOSIS, the doctrine of tranſmigration, which ſuppoſes that human ſouls, upon their leaving the body, become the ſouls of ſuch kind of brutes as they moſt reſemble in their manners.

This was the doctrine of Pythagoras and his followers, who held that the ſouls of vicious men were impriſoned in the bodies of miſerable beaſts, there to do penance for ſeveral ages, at the expiration of which they returned again to animate men; but if they had lived virtuous, ſome happier brute, or even a human creature, was to be their lot.

Pythagoras is ſaid to have borrowed the notion of a metempſychoſis from the Egyptians; others ſay from the ancient Banians, and other idolaters of India and China, and makes the principal foundation of their religion. Many of the modern Jews are ſaid to eſpouſe this doctrine.

METEMPTOSIS, in chronology, denotes the ſolar equation neceſſary to prevent the new moon from happening a day too late.

The word is Greek, and derived from μετα, after, and πιπτω, to fall.

It ſtands contra-diſtinguiſhed from *proemptoſis*, which ſignifies the lunar equation neceſſary to prevent the new moon from appearing a day too ſoon.

The

The new moon's running a little backward, that is, coming a day too ſoon, at the end of three hundred twelve years and a half; by the proemptoſis a day is added every three hundred years, and another every two thouſand four hundred years. On the other hand, by the metemptoſis, a biſſextile is ſuppreſſed every one hundred and thirty-four years; that is, three times in four hundred years. Theſe alterations are never made but at the end of each century; that period being very remarkable, and rendering the practice of the calendar eaſy.

There are three rules for making this addition or ſuppreſſion of the biſſextile day, and by conſequence for changing the index of the epacts. 1. When there is a metemptoſis without a proemptoſis, the next following, or lower index, muſt be taken. 2. When there is a proemptoſis without a metemptoſis, the next preceding, or ſuperior index is to be taken. 3. When they are both a metemptoſis and proemptoſis, or when there is neither the one nor the other, the ſame index is preſerved.

METEOR, in phyſiology, an imperfect, changeable, and mixt body, or the reſemblance of a body appearing in the atmoſphere, and formed by the action of the heavenly bodies, out of the common elements.

Meteors are of three kinds, fiery, airy, and watery. Fiery meteors conſiſt of a fat ſulphureous ſmoke ſet on fire; ſuch as lightning, thunder, falling ſtars, draco volans, the ignis fatuus, and other phænomena appearing in the air. Airy meteors conſiſt of flatulent and ſpirituous exhalations, ſuch as winds, &c. Watery meteors are compoſed of vapours or watery particles, variouſly modified by heat and cold, ſuch as clouds, rain, hail, ſnow and dew.

METHEGLIN, a ſort of drink prepared from water and honey.

The word is Welſh, *medyglin*, which ſignifies the ſame thing.

The beſt way of making it is as follows; Put as much new honey, naturally running from the comb, into ſpring-water, as that, when the honey is thoroughly diſſolved, an egg will not ſink to the bottom, but be juſt ſuſpended in it. Then boil the liquor for an hour or more, till ſuch time as the egg ſwim above the liquor; then take it off the fire, and let it cool. When very cool, next morning, it may be barrelled up; and adding to it half an ounce of ginger, as much of cloves, as much of mace, and a quarter of an ounce of cinnamon, all groſly pounded, a ſpoonful of yeaſt may be added alſo at the bung to increaſe its fermentation. When it has done working, it may be cloſely ſtopped up, and after it has ſtood a month it may be drawn off into bottles.

METHOD, *methodus*, the art of diſpoſing things in ſuch a manner, as they may be eaſily comprehended, either to diſcover the truth which we ourſelves are ignorant of, or to demonſtrate it to others, when known.

The word is Greek, μεθοδος, and derived from μετα, and οδος, a way.

Gaſſendus divides method, with regard to its object, into the method of invention, or diſcovering a truth unknown, the method of judging of a propoſition propoſed, and the method of demonſtration, or exhibiting it to another.

Method, with regard to the order of procedure, is uſually divided into the method of reſolution, or analytic method, whereby we proceed from ſome general known truth to others which belong to ſome particular thing; and into the method of compoſition, or ſynthetic method, in which we propoſe ſome certain general truths, from which we produce particular truths.

If, in the method of reſolution, we lay down any axioms, it is not immediately in the beginning, but as they are found neceſſary in the diſquiſition; but the caſe is otherwiſe in the method of compoſition.

In both theſe methods, no propoſition ſhould be admitted as true, which is not evident. 2. That the connection of the following propoſition with the foregoing be likewiſe evident in every ſtep.

The laws of the ſynthetic method will be beſt drawn from mathematicians, as, 1. To offer nothing but what is couched in terms perfectly underſtood. 2. To build only on clear principles. 3. To prove demonſtratively all their conſequences, namely, by definitions that have been laid down, axioms that have been granted, and propoſitions that have been already proved; which become principles to things that follow them.

METHOD, in mathematics, more peculiarly denotes certain particular proceſſes for ſolving problems.

METOCHE, in ancient architecture, a term uſed by Vitruvius to ſignify the ſpace or interval between the dentils.

METONIC CYCLE, in chronology, the ſame with the cycle of the moon. See the article CYCLE.

METONYMY, in rhetoric, is a trope in which one name is put for another, on account of the near relation there is between them. By this trope any of the moſt ſignificant circumſtances of a thing are put for the thing itſelf.

METOPE, *Metopa*, in architecture, is the interval, or ſquare ſpace between the triglyphs of the Doric frieze, which among the ancients uſed to be painted or adorned with carved work, repreſenting the heads of oxen, or utenſils uſed in ſacrifices.

Semi-METOPE, in architecture, is a ſpace in the corner of the Doric frieze, ſomewhat leſs than half a metope.

METOPOSCOPY, the pretended art of knowing a perſon's diſpoſitions and manners, by viewing the traces and lines in the face.

METRE, *Meter*, *Metrum*, in poetry, denotes a ſyſtem of feet of a proper length.

The word is derived from the Greek, μετρον, meaſure.

METRETES, an ancient meaſure of capacity, containing a little more than nine gallons.

METRICAL VERSES, thoſe verſes that conſiſt of a determinate number of long and ſhort ſyllables.

METROPOLIS, the capital of a country or province.

The word is Greek, and formed of μητηρ, mother, and πολις, a city, as being the mother or head, as it were, of all the reſt.

It alſo denotes an archiepiſcopal church.

MEUM, ſpignel, in botany, an umbelliferous plant, with buſhy leaves divided into ſlender ſegments, like thoſe of fennel but finer; producing large, oblong, ſtriated ſeeds, flat on one ſide, and convex on the other. The root is long, variouſly branched, with generally a number of hairs or filaments at top, which are the remains of the ſtalks of former years, of a browniſh colour on the outſide, pale or whitiſh within, when dried of a fungous texture. It is perennial, grows wild in meadows in ſome parts of England, and flowers in June.

The root of this plant is recommended as a carminative, ſtomachic, and for attenuating viſcid humours, appearing to be nearly of the ſame nature with that of lovage; differing in its ſmell, being rather more agreeable, ſomewhat like that of parſnips, but ſtronger, and in its taſte being leſs ſweet, and more warm or acrid.

MEW, a place where a hawk is ſet during the time ſhe raiſes her feathers.

MEWING, the falling off, or change of hair, feathers, ſkin, horns, or other parts of animals, which happens in ſome annually, in others only at certain ſtages of their lives; but the generality of beaſts mew in the ſpring.

MEXICO, a large and extenſive kingdom in North-America, divided at preſent into that of Old and New Mexico.

Old MEXICO, ſituated between 83 and 116 degrees of weſt long. and between 8 and 28 deg. north lat. is bounded by New Mexico, or Granada, on the north; by the gulf of Mexico on the north-eaſt; by Terra-Firma on the ſouth-eaſt; and by the Pacific ocean on the ſouth-weſt.

New MEXICO, including California, ſituated between 100 and 140 deg. of weſt long. and between the Tropic of Cancer, and 48 deg. of north lat. is bounded by unknown lands on the north; by Florida on the eaſt; by Old Mexico on the ſouth; and by the Pacific ocean on the weſt.

MEZANINE, or MEZZANINE, a term uſed by ſome architects, to ſignify an entreſole. See the article ENTRESOLE.

The

The word is borrowed from the Italians, who call thoſe little windows which are leſs in height than breadth, that ſerve to illuminate an Attic, mezzanine.

MEZEREON, or MESEREUM, ſpurge-olive, a ſpecies of thymelæa, which agrees in virtue with the ſpurge-laurel. See THYMELÆA.

MEZZOTINTO, a particular manner of repreſenting figures on copper, ſo as to form prints in imitation of painting in Indian ink.

The ſcraping mezzotintos is a kind of engraving, which is executed by covering the ſurface of a copper-plate with lines, ſunk in it cloſe to each other, in different directions; ſo that it would, if uſed for printing in this ſtate, give a black impreſſion, or ground, from the whole: and then taking away or diminiſhing the effect of the ground, by ſcraping or burniſhing, according to the neceſſary expreſſion of any given deſign, ſuch parts of theſe lines as brings the plate to the ſame condition, as if lines had been originally cut, correſpondently to the manner of other engravings, in thoſe places where they were wanted to expreſs the ſhades or darker parts of the deſign.

This appears, therefore, in one view, to be an oppoſite kind of engraving to the others; as in them the ſhades and darker parts are formed by the deſtroying part of the lights, of which the whole ground muſt be conſidered as at firſt conſiſting; whereas in this, the ground being originally all ſhade, the lights are produced by deſtroying the neceſſary parts of thoſe ſhades. As it is much eaſier to ſcrape or burniſh away parts of a dark ground correſpondently with the out-line of any deſign ſketched upon it, than it is to form the ſhades, upon a light ground, by an infinite number of hatches, ſtrokes, and points, which muſt all terminate with exactneſs on the out-line, as well as differ in their force and manner, the method of ſcraping in mezzotinto conſequently becomes much more eaſy and expeditious than any other method of engraving: for which reaſon it is of courſe much better accommodated to painters, or others, who are maſters of deſign, and deſirous to engrave prints, without the long application to attain the talent, and the labour and trouble afterwards required to exerciſe it, that attend the other methods. The forming the ground of the plate, which is part of the neceſſary work, is indeed laborious and tedious: but it may be thrown upon thoſe who are uſed to ſuch mechanical employments; as it requires little ſkill or judgment, unleſs what may be acquired by a ſmall ſhare of practice; being a matter only of care and application; and therefore no proper part of the buſineſs of the artiſt, who is to ſcrape the deſign on the plate. Not only the facility of the work, but the effect of it when finely executed, are great recommendations to this kind of engraving; as the extreme ſoftneſs of the teints, along with a great force of relief, renders the prints, done this way, that are perfect, more generally pleaſing than thoſe engraved in any other manner; which the great number of portraits lately done evinces.

It is, however, only with regard to ſome kind of ſubjects, that this ſpecies of engraving has this merit: portraiture is the great object of its excellence; and ſome landſcapes have been done that are not contemptible: horſes alſo have been attempted with ſucceſs; and ſome deſigns of hiſtory properly adapted may be brought within its reach. But where any thing beſides the portraits of men, and other animals, come in queſtion, there muſt be a peculiar accommodation of the ſubject; as its powers, with reſpect to variety of expreſſion, are much leſs extenſive than thoſe of etching: and conſequently fall far ſhort of thoſe of the graver. The principles, on which the fitneſs or unfitneſs of ſubjects for this kind of engraving are founded, are of two kinds; the one reſpecting the proportion of light and ſhade; the other, the nature of the deſign with regard to the outline. Such pieces as contain large and clear maſſes of light, do not ſucceed at all: but where, on the contrary, there is a large proportion of very dark parts, as in the repreſentations of night ſcenes, or a large proportion of brown ſhades, as in the pictures of Rembrandt, Benedette, and Teniers, in ſome inſtances, the beſt effect is produced, and with the leaſt labour. Such pieces likewiſe, as are of a ſimple compoſition, and do not require great force, and variety of expreſſion, as paſſion and character, are ſuitable; but where great ſpirit and freedom are required to give merit, this manner of engraving fails; as it does not admit of thoſe ſharp and delicate ſtrokes and touches, which are the means of that expreſſion.

Painting MEZZOTINTO *on Glaſs.*—The painting on glaſs by means of mezzotinto prints is performed by cementing the printed ſide of the prints to the ſurface of the glaſs by the aſſiſtance of ſome glutinous body which will not diſſolve in water; and then deſtroying the texture of the paper by water, ſo that it may be rubbed intirely off from the cement upon the glaſs, in the ſame manner as if the original impreſſion had been made there; by which method a complete drawing of the picture deſigned is obtained on the glaſs; and may be coloured by either oil, varniſh, or water colours. The method of performing it is as follows:

Procure a piece of the beſt crown glaſs as near as poſſible in ſize to the print to be taken off; and varniſh it thinly over with turpentine, rendered a little more fluid by the addition of oil of turpentine. Then lay the print on the glaſs, beginning at one end, and preſſing it gently down in every part to the other. In order to prevent any veſicles of air being formed, during the operation of laying it on, by the paper touching the cement unequally in different parts; and to ſettle the whole more cloſely to the glaſs, it will not be improper to paſs a wooden roller of about two inches diameter, well turned, and very ſmooth, over it. This being done, let the glaſs, with the print cemented on it, be gently dried, till the turpentine be perfectly hard: then let the print be thoroughly moiſtened with water; and while it continues wet rub off the paper, by rolling it under the finger, till only a thin film remains. When it is dry, varniſh it over with oil of turpentine, and you may proceed to paint it either with oil, varniſh, or water colours; and the piece, if well executed, will appear on the fore ſide to be elegantly painted on the glaſs.

MIASMA, among phyſicians, denotes ſuch particles as are ſuppoſed to ariſe from diſtempered, putrifying, or poiſonous bodies.

The word is Greek, and derived from μιαινω, to contaminate or defile.

MICHAELMAS, or *Feaſt of St. Michael and all Angels*, a feſtival of the Chriſtian church, obſerved on the 29th of September.

MICROCOSM is chiefly applied to man, who is called the little world, by way of eminence, as being an epitome of all that is wonderful in the great world, or macrocoſm.

The word is Greek, μικροκοσμος, and formed of μικρος, little, and κοσμος, the world.

MICROGRAPHY, *micrographia*, a deſcription of the parts and proportions of objects that are too ſmall to be viewed without the aſſiſtance of a microſcope.

The word is Greek, μικρογραφια, and formed of μικρος, little, and γραφω, to write.

MICROMETER, an aſtronomical machine, which, by means of a ſcrew, meaſures extremely ſmall diſtances in the heavens, &c. to a great degree of accuracy. In ſome micrometers, an inch is divided into 2800 parts, and in others more.

The word is Greek, and derived from μικρος, little, and μετρον, meaſure. Notwithſtanding the invention of the micrometer is aſcribed to M. Huygens, Auzout, and Picard, the two latter having publiſhed one in 1666, yet Mr. Townley, in the Philoſophical Tranſactions, reclaims it for one of our countrymen, Mr. Gaſcoyne. He relates that, from ſome papers of this gentleman's, he learned, that, before our civil wars, he had invented a micrometer, and had made uſe of it for ſome years, in taking the diameter of the planets, diſtances upon land, the moon's diſtance, &c.

The micrometer conſiſts of a graduated circle, (plate LXXXVI. *fig.* 4.) of a ſcrew *q o*, and its index *q r*. The threads of the ſcrew are ſuch, that 50 make the length of one inch exactly. When it is to be uſed, the point *o* is ſet to the ſide of the part to be meaſured, and then the index is turned about with the finger, till the eye perceives the point has juſt paſſed over the diameter of the part; then the number of turns, and parts of a turn, ſhewn by the graduated circle, will give the dimenſions

in part of an inch, as we ſhall ſhew by the following example: Suppoſe it required to meaſure the diameter of an human hair, and I obſerve the index is turned juſt once round, while the point *o* paſſes over it. Then it is plain the diameter of the hair in the image is $\frac{1}{50}$ of an inch. Now if the microſcope, I D E F *def*, magnifies 6 times, or makes the image 6 times larger in diameter than the object, then is the diameter of the hair itſelf but $\frac{1}{6}$ of $\frac{1}{50}$, that is, but $\frac{1}{300}$ part of an inch.

Alſo it is to be obſerved, that as there are 10 large diviſions, and 20 ſmall ones, on the micrometer-plate; ſo each of thoſe ſmall diviſions are the $\frac{1}{20}$ of $\frac{1}{50}$, or the $\frac{1}{1000}$ part of an inch. Therefore, if, in meaſuring any part of an object, you obſerve how many of theſe ſmaller diviſions are paſſed over by the index, you will have ſo many thouſandth parts of an inch for the meaſure required. All which is ſo plain, that nothing can be ſaid to illuſtrate the matter.

MICROSCOPE, an optical inſtrument, whereby very minute objects are repreſented extremely large and diſtinct, according to the laws of refraction.

The word is Greek, and compounded of *μικρος*, ſmall, and *σκοπεω*, to view.

Microſcopes are of two kinds, ſimple and compound. The firſt ſort conſiſts of one glaſs; the other of two or more. The ſimple microſcope is no other than a convex lens, through which objects appear magnified.

An object ſeen through this microſcope appears magnified nearly in that proportion which the diſtance, at which an object would be ſeen diſtinctly with the naked eye, bears to the focal diſtance of the microſcope. Thus, let A B (plate LXXXVI. *fig.* 5) repreſent the microſcope, C D an object placed at the focal diſtance of parallel rays, or ſomething nearer, that the rays of the ſame pencil may be parallel to each other, or rather diverging in a ſmall degree, when they enter the eye, this circumſtance being requiſite to diſtinct viſion; and let the microſcope be ſo ſmall, that all the rays that paſs through it from the object may enter the pupil of the eye E F at the ſame time, when placed cloſe to it, as in the figure; for unleſs it be ſo ſmall, it will ſcarce magnify ſufficiently to obtain the name of microſcope. Things being thus expoſed, the angle under which this object appears will be G I H, or C I D; but this is nearly the ſame it would have appeared under, had there been no microſcope interpoſed: notwithſtanding which, the object is properly enough ſaid to appear magnified by this microſcope, becauſe, without that, it could not have been ſeen diſtinctly at ſo ſmall a diſtance from the eye, but muſt have been ſituated eight or ten inches from it; and therefore, ſince objects appear under a larger angle, the nearer they are to the naked eye, this object appears larger, or is magnified by means of the microſcope, in proportion as it is ſeen diſtinctly at a leſs diſtance with it than without it; that is, nearly as the focal diſtance of the microſcope is to that at which objects are ſeen diſtinctly with the naked eye.

An object will alſo appear diſtinct, though it be ſituated at a very ſmall diſtance from the eye, by being viewed through a ſmall hole in a piece of paper; but then this hole muſt be made ſo very ſmall, that, unleſs the object be ſtrongly illuminated, it will appear very obſcurely through it.

The form of a compound microſcope is expreſſed in *fig.* 6. where A B repreſents a ſmall convex lens, whoſe focal diſtance is ſuch, that rays flowing from the point C may be collected in D; and E F is a large lens, whoſe focus of parallel rays coincides with the point D; and F G repreſents an eye ſo ſituated, that rays proceeding from an object at K L may enter the pupil of it, after having paſſed through both glaſſes. Theſe things being diſpoſed in this manner, the object K L will appear magnified, and alſo diſtinct.

For, firſt, let R C S repreſent a pencil of rays flowing from the point C, theſe will meet their axis again in the point D by ſuppoſition, and, croſſing there, will enter the lens E F diverging from its focus of parallel rays, and will therefore enter the pupil of the eye in directions parallel to each other, and concur upon the retina at Q; the object will therefore appear diſtinct.

Secondly, a pencil of rays flowing from another point of the object, as L, will meet their axis in M, and, diverging from thence, will, after being refracted by the lens E F, become parallel with reſpect to each other; but, with reſpect to the former, they will converge; becauſe, with regard to them, they diverged before they paſſed through the lens E F from I, a point farther diſtant than its focus of parallel rays. They will therefore, conſequently, croſs them at ſome diſtance from it, ſuppoſe at H, where the pupil of an eye being placed to receive them, the point L will be repreſented at O. And for the ſame reaſon, the point K being repreſented at P, the object will be ſeen under the angle P H O, or E H F, which is much larger than that under which it would have appeared to the naked eye. It may be remarked here, that when we view an object through an inſtrument of this kind, we are then in reality looking at the image of that object through a ſingle microſcope. Thus M N is the image of the object we ſee through the lens or ſingle microſcope E F; ſo that the addition of the glaſs A B is only that we may have an image of the object to look at, larger than the object itſelf.

The glaſs ſituated next the object, is called the object-glaſs; and that placed next the eye, the eye-glaſs.

In ſome microſcopes there is a third glaſs placed between the object glaſs and the image, and is called a middle glaſs. This is placed there only to bring the rays to a focus the ſooner, in order that the image may fall nearer the object-glaſs than it otherwiſe would do.

The proportion of magnifying in a microſcope of this kind, is nearly in a ratio compounded of the proportion which the diſtance of the image from the object-glaſs, bears to its diſtance from the eye glaſs, and of that which the diſtance of the object from the eye bears to its diſtance from the object-glaſs.

Catadioptric MICROSCOPE, is that which performs its effects by reflection and refraction conjointly; for it is conſtructed with a ſmall ſpeculum f e d (plate LXXXVI. *fig.* 7.) whoſe focus is at *f*; and it is plain, that if a ſmall object a b be placed a little further from the ſpeculum than the focus *f*, there will be formed a large image of it A B; which image will be inverted, and in proportion to the object, as the diſtance C e to the diſtance *f*e, as when an object lens was uſed.

Part of this image is viewed by the eye-glaſs F D, which muſt be a meniſcus; becauſe the image being formed by reflection, it will be more perfect, and admit of a greater charge in the eye-glaſs; and thoſe of the meniſcus form are beſt for this purpoſe, becauſe the errors of the rays, and conſequently the confuſion cauſed thereby, in the refraction made at the convex ſurface, are, in a great meaſure, rectified by the contrary refraction at the concave ſurface.

Another ſort of catoptric or reflection microſcope is conſtructed with two ſpeculums a b c d and A B C D (*fig.* 9.) with a central hole in each. The larger ſpeculum is concave, the other convex, and both of equal ſphericity. They have their focus at one inch diſtance, and placed one inch and a half from each other, ſo that an object O P Q, being placed a little before the ſmaller ſpeculum, might be nearer the larger one than its center E.

This being the caſe, the rays P A, P D, which flow from the point P, to the ſpeculum A D, will be reflected towards a focus *p*, where an image *o p q* would be formed, if the rays were not intercepted by the convex ſpeculum a b; and the point *p* being nearer its focus f, the rays A a, D d, which tend towards it, will be reflected to a focus *P*, where the laſt image *O P Q* will be formed, to be viewed by the eye-glaſs G, tranſmitting parallel rays to the eye at I.

But the following is a much better method of conſtructing a catoptric microſcope, with two reflecting mirrors. A B C D E F (*fig.* 8) is a caſe or tube, in one end of which is placed a concave ſpeculum G H, with a hole I K, in the middle; the center of this ſpeculum is at c, and its focus at O; ſo that V O = O c. At the open end of the tube is placed a ſmall convex ſpeculum d e f on a foot e F, by which it is moveable nearer to, or farther from, the larger ſpeculum G H, as occaſion requires.

If now the object a b be poſited in the center *c* of the larger ſpeculum, the image thereof *a b* will be formed in th

that place; and this conſideration is all the reaſon of this form of a microſcope; for if we now look upon the image *a b*, as an object nearer to the convex ſpeculum d *f*, than its focus *f*, it is plain a larger image *AB* will be formed thereby at the focus *C*; or that the rays c G, c H, proceeding from any point c in the object a b, will be reflected back upon themſelves, as being perpendicular to the ſpeculum; but the reflected rays meeting with, or impinging on, the convex ſurface of the ſpeculum d f, will, as they tend to a point *e*, nearer than the focus f, be reflected to a focus *C*, and be ſeen more clearly. Q is a concave looking-glaſs, which reflects the light of a candle, or the ſky, directly upwards on the object to be viewed. V is a plano-convex lens, which ſerves to tranſmit the light of a candle or ſun-ſhine upon any opake object which is placed on the ivory or ebony for examination.

The ſolar or camera obſcura MICROSCOPE depends on the ſun-ſhine, and muſt be made uſe of in a darkened chamber, as its name implies. This inſtrument conſiſts of ſeveral parts, viz. A (plate LXXXVII. *fig.* 2.) a ſquare frame of mahogany to be fixed to the ſhutter of a window, by means of the ſcrews 1, 1. To this frame is applied a circular collar of the ſame wood, with a groove on its periphery on the outſide, denoted by 2, 3. This collar is connected by a cat-gut to the pully 4 on the upper-part, which is turned round by the pin 9 within. On one part of the collar, on the outſide, is faſtened, by hinges, a looking glaſs G, in a proper frame, to which is fixed the jointed wire 6, 7; by which means, and the ſcrew H 8, it may be made to ſtand in an angle more or leſs inclined to the frame. In the middle of the collar is fixed a tube of braſs C, near two inches in diameter; the end of which, on the outſide, has a convex lens 5 to collect the ſun beams thrown on it by the glaſs G, and converging them towards a focus in the other part, where D is a tube ſliding in and out to adjuſt the object to a due diſtance from the focus. To the end G of another tube F, is ſcrewed one of Wilſon's ſingle pocket-microſcopes, containing the object to be magnified in a ſlider; and by the tube F, ſliding on the ſmall end E of the tube D, it is brought to a due focal diſtance.

The ſun's rays being directed by the looking-glaſs through the tube upon the object, the image or picture of the object is thrown diſtinctly and beautifully upon a ſcreen of white paper, or a white linnen ſheet, placed at ſome diſtance to receive the ſame; and may be magnified to a ſize beyond the imagination of thoſe who have not ſeen it. For the farther off the ſcreen is removed, the larger will the object appear, inſomuch that a louſe may be magnified to the length of five or ſix feet, or even a great deal more; but it is more diſtinct when not enlarged to above half that ſize.

This inſtrument has been contrived very commodiouſly in ſeveral different forms; but we ſhall here illuſtrate the following by a diagram. A R (*fig.* 3.) is a ſection of the window-ſhutter of a dark room, C D of the frame containing a ſcioptric ball E F; in the forepart whereof is ſcrewed the tube G I K H, at one end of which is a lens G H, which, by converging the ſun-beams into a narrow compaſs, does ſtrongly enlighten the ſmall object *a b*, placed on a ſlip of glaſs, or otherwiſe, in the part of the tube N Q, where a ſlit is made on each ſide for that purpoſe. Within this tube there ſlides another, L *m r* M, which contains a ſmall magnifying lens *m r*. By moving the exterior tube, I G H K, one way and the other, the glaſs G H will be brought to receive the rays of the ſun directly, and will therefore moſt intenſely illuminate the object *a b*. The other tube, L M, being ſlid backwards and forwards, will adjuſt the diſtance of the ſmaller lens *m r*, ſo that the image of the object *a b* ſhall be made very diſtinct, on the oppoſite ſide of the room at O P; and the magnitude of the image will be to that of the object, as its diſtance from the lens *m r* is to the diſtance of the object from it, as is evident from the figure.

Thus, for example, ſuppoſe the focal diſtance of the lens *m r* to be one inch $= r$, and let the diſtance at which it is placed from the object be 1, $1 = d$; then, if the lens be double and equally convex, as uſual, the diſtance of the image will be $\frac{dr}{d-r} = f = 110$; therefore the image will be 110 times larger than the object in its linear dimenſions, and $110 \times 110 = 12100$ times larger in ſurface; and in ſolidity it will be $110 \times 110 \times 110 = 1333100$ times larger than the object.

This is the moſt entertaining of any; and, perhaps, the moſt capable of making diſcoveries in objects that are not too opake, as it ſhews them much larger than can be done any other way. Such too as have no ſkill in drawing, may, by this contrivance, eaſily ſketch out the exact figure of any object they have a mind to preſerve a picture of.

MID-HEAVEN, the point of the ecliptic that culminates, or in which it cuts the meridian.

MIDSHIP-BEAM, in naval architecture, that which is ſituated in the middle of the ſhip, which forms her extreme breadth, and from which the proportion of the maſts and yards are taken. See BEAM.

MIDSHIP-FRAME. A frame of timbers is compoſed of one floor-timber, two or three futtocks, and a top-timber on each ſide; all theſe being united together, and ſecured by croſs-bars, form a circular encloſure: that which incloſes the greateſt ſpace is called the midſhip-frame. The curve of this frame is inverted at the lower-part, ſo that the floor-timber will be ſomewhat hollow in the middle, whereby the ends will form a very obtuſe angle; but this angle decreaſes the farther the frames are removed from the midſhips, in ſuch a manner that the foremoſt and aftermoſt will become very ſharp, and form a very acute angle. Theſe ſort of floor-timbers are called crotches. See the articles CROTCHES, SHIP-BUILDING, and TIMBER.

The timbers of a ſhip are as the ribs to the human body; and ſerve to ſupport the ſides, the planks thereof being all faſtened to them.

The midſhip-frame is always at the broadeſt part of the ſhip. Builders differ about the form of this frame; but there are ſeveral preliminary operations which are neceſſary to be obſerved, in all the different methods uſed in forming it, and great care ought to be taken therein, becauſe the form of all the other timbers chiefly depends upon it, but not altogether; for two ſhips may be ſimilar as to their midſhip-frames, and yet very different afore and abaft; and though the artiſts ſhould make themſelves acquainted with all the different ways of forming this frame, we ſhould recommend that method to them which is the ſimpleſt, and which gives them the moſt liberty to vary the form of it, according to every one's particular taſte or fancy; and it is very poſſible there may be ſeveral other methods as eaſy and plain as thoſe we have deſcribed. This frame being once formed, we may form all the reſt upon the ſame plane. *Murray's Abridgment of Du Hamel's Elements of Naval Architecture.*

MIDSHIP-MAN, in the royal navy, a young officer, who walks on the quarter-deck, and gangways of a ſhip, and forwards the commands of the ſuperior officers. They are generally voluntiers like the cadets in the army, and ſerve in expectation of a commiſſion. They muſt however ſerve ſix years at ſea before they can be qualified to receive it.

MIDSHIPS, the middle of the ſhip. See the article A-MIDSHIPS.

MILE, *Mille Paſſus*, a meaſure of length or diſtance, containing eight furlongs, &c.

We ſhall here give a table of the miles in uſe among the principal nations of Europe, in geometrical paces, 60,000 of which make a degree of the equator.

	Geometrical paces.
Mile of Ruſſia	750
—— of Italy	1000
—— of England	1200
—— of Scotland and Ireland	1500
Old league of France	1500
The ſmall league of France	2000
The mean league of France	2500
The great league of France	3000
Mile of Poland	3000
—— of Spain	3428
—— of Germany	4000
—— of Sweden	5000
—— of Denmark	5000
—— of Hungary	6000

MILIARY, in general, ſomething reſembling millet-ſeeds.

MILIARY-FEVER. See the article FEVER.

MILITANT, or CHURCH-MILITANT, denotes the body of Chriſtians while here on earth.

MILITARY, ſomething belonging to the ſoldiery or militia.

MILITARY ARCHITECTURE, the ſame with fortification. See FORTIFICATION.

MILITARY ART, the ſcience or art of making or ſuſtaining war to advantage.

MILITARY COLUMN, among the Romans. See COLUMN.

MILITARY WAYS, *Viæ Militares*, the large Roman roads which Agrippa procured to be made through the empire in Auguſtus's time, for the marching of troops and conveying of carriages. Theſe were paved from the gates of Rome, to the utmoſt limits of the empire. See ROAD.

MILITIA, in general, denotes the body of ſoldiers, or thoſe who make profeſſion of arms.

In a more reſtrained ſenſe, militia denotes the trained bands of a town or county, who arm themſelves, upon a ſhort warning, for their own defence. So that, in this ſenſe, militia is oppoſed to regular or ſtated troops.

For the direction and command of the militia, the king conſtitutes lords-lieutenants of each county.

MILK, *Lac*, a white juice which nature prepares in the breaſts of women, and the udders of other animals, for the nouriſhment of their young.

It is derived from the pure chyle, conveyed by the arteries to the breaſts, and without any other coction filtered through the glands of which they conſiſt, without undergoing any conſiderable change.

Milk is a compoſition of three different parts, butyrous, caſeous, and ſerous: the butyrous parts are the cream and oil that ſwim a-top; the caſeous are the groſſer parts, and thoſe that coagulate are made into cheeſe: the ſerous are properly a lymph, and make whey.

By their own milk, all the known lactiferous animals are nouriſhed, both male and female; and from this alone every ſuch animal prepares all the other parts, both the ſolid and fluid, by means of the vital actions. It is alſo certain that men may live for years upon milk alone, and perform all the actions of life, and have all the ſolid and fluid parts of their bodies perfectly elaborated.

The human milk is very ſweet and thin; the next is that of aſſes, then that of mares, then that of goats, and laſtly of cows; whence it is preſcribed in this order to conſumptive perſons of weak viſcera.

Dr. Cheyne extols a milk diet in his writings, particularly his method of cure in diſeaſes of body and mind, his eſſays on the gout, health, and long life, &c.

The beſt of all other milks is human milk, ſince it is moſt adapted to our natures; for which reaſon it is always to be preferred to the milk of other animals. It ought to be furniſhed by a ſound woman, who uſes due exercife, obſerves a laudable regimen, and is in the prime of her age. It is alſo beſt when the breaſts are drawn four or five hours after eating; for then the chyle is changed into concocted milk, and begins to aſſume the nature of the human fluids.

MILL, a machine or engine for grinding corn, &c. of which there are ſeveral kinds, according to the various methods of applying the moving power; as water-mills, wind-mills, mills worked by horſes, &c.

In water-mills the momentum of the water is the moving power, and the attrition of the two ſtones in grinding, is the force to be overcome. Of theſe there are two kinds, viz. thoſe where the force of the water is applied above the wheel, and thoſe where it is applied below the wheel, the former being called over-ſhot, and the latter under-ſhot mills; and to theſe we may add a breaſt-mill, where the water ſtrikes againſt the middle of the wheel.

Some may imagine, that it is hardly worth while to write about ſo common a thing as a corn-mill; but the commonneſs of it ſhews its uſefulneſs, and therefore it would be unpardonable in us to paſs it over in ſilence.

Few people are ignorant, that corn is ground by two mill-ſtones, placed one above the other, without touching. The lower or neither mill-ſtone is immoveable, but the upper one turns upon a ſpindle. The oppoſite ſurfaces of the two ſtones, which act to grind the corn, are not plane or flat; but the upper one is hollow, and the under one ſwells up; each of them being of a conic figure, whoſe axis indeed is very ſhort in proportion to the diameter of its baſe; for the upper one, being ſix feet in diameter, is hollowed, but about one inch at its center; and the lower one riſes but about $\frac{1}{4}$ of an inch. Theſe two mill-ſtones come nearer and nearer towards their circumference, whereby the corn that falls from the hopper has room to inſinuate between them as far as $\frac{2}{3}$ of the radius, which is the place where it begins to be ground, and where it makes the greateſt reſiſtance that it is capable of; the ſpace between the ſtones being in that place but about $\frac{1}{3}$ or $\frac{1}{4}$ of the thickneſs of a grain of corn. But as the millers have the liberty of raiſing or ſinking the upper ſtone a little, they can proportion its diſtance from the lower one, according as they would have the flour finer or coarſer.

The circular motion of the upper mill-ſtone brings the corn out of the hopper by jerks, and cauſes it to recede from the center towards the circumference, where being quite reduced to flour, it is thrown out of the mill, by the centrifugal force of the ſtone, through a hole provided on purpoſe.

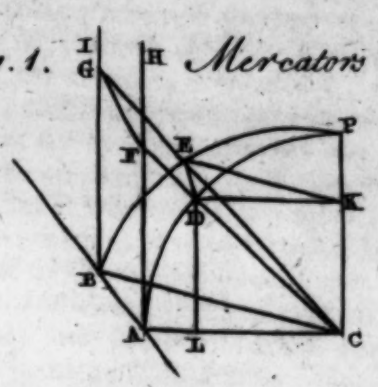
As the water acts upon an over-ſhot mill both by impulſe and weight, ſo does it likewiſe upon a breaſt-mill, or that where the water comes upon the breaſt, or middle part of the wheel. And here, though the weight of the water is not ſo great as in the over-ſhot mill, being contained in the buckets of the lower quarter only; yet the impulſe of the water is much greater, the height of the water being increaſed nearly the ſemi diameter of the great wheel, all other things being equal. If the height of the water remain the ſame, the aperture of the penſtock muſt be enlarged to nearly twice the area, that the force may be the ſame; ſo that to produce the ſame effect, twice as much water is neceſſary for a breaſt mill as for an over-ſhot one, every thing elſe being the ſame.

As to the under-ſhot mill, it is evident there can be only the impulſe from the water; and therefore, the height of the water remaining the ſame, there muſt be a larger aperture of the penſtock for the diſcharge of a greater quantity of water in the ſame time, in order to produce the ſame effect as in the over-ſhot or breaſt-mill: whence a greater expence of water will be made here than in any other mill, and can only be ſupplied for a conſtancy by a river; and where this can be had, the under-ſhot is the eaſieſt, cheapeſt, and moſt ſimple ſtructure a mill is capable of.

The diameter of common mill-ſtones, according to Dr. Deſaguliers, is from five to ſeven feet, and their thickneſs, twelve, fifteen, or eighteen inches: they laſt thirty-five or forty years; and when they have been long uſed, ſo that their thickneſs is conſiderably diminiſhed, they are cut anew.

The following is a deſcription of an underſhot-mill, taken from Belidor's Architecture Hydraulique. AB (plate LXXXVII. *fig.* 4.) is the underſhot-wheel, upon whoſe ſhaft D is fixed a ſpur or cog-wheel E, whoſe cogs take the rounds of the trundle or lantern G, which carries round the mill-ſtone in the hurſt or round frame I, containing the lower mill-ſtone at NN, and the upper one at VV; the axis, or ſpindle, fixed to the upper mill-ſtone being the iron-bar FH. They commonly make theſe ſort of underſhot-wheels from twelve to eighteen feet in diameter, the float-boards about two and a half or three feet long, and ten or twelve inches deep. The ſhaft is fifteen or eighteen inches in diameter; the cog-wheel, eight feet in diameter: it has forty-eight cogs four inches high, and three inches and a half wide. The lantern or trundle is made of two round pieces, or flat heads, twenty-two inches in diameter, and four inches thick, in which are ſet nine rounds of two inches and a half diameter, and eighteen inches high. Through the trundle goes an iron axis, two inches and a half ſquare, and of a height proportionable to the ſituation of the mill-ſtones: it muſt be well faſtened to the upper mill-ſtone, and its lower end being reduced to a pivot, turns in a ſocket let

Fig. 1. Mercator's Chart.



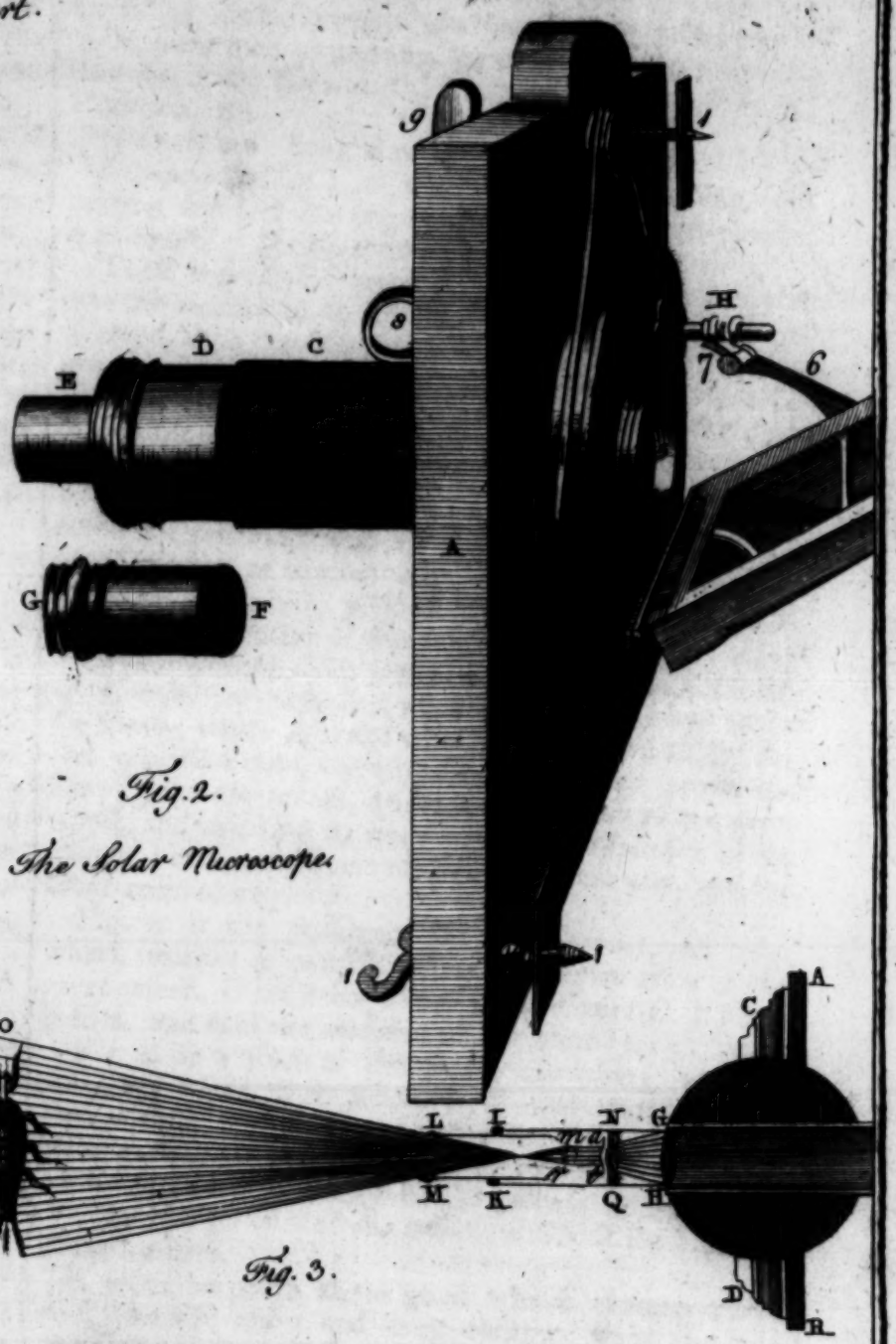


Fig. 2.
The Solar Microscope.

Fig. 4.
An undershot Mill.

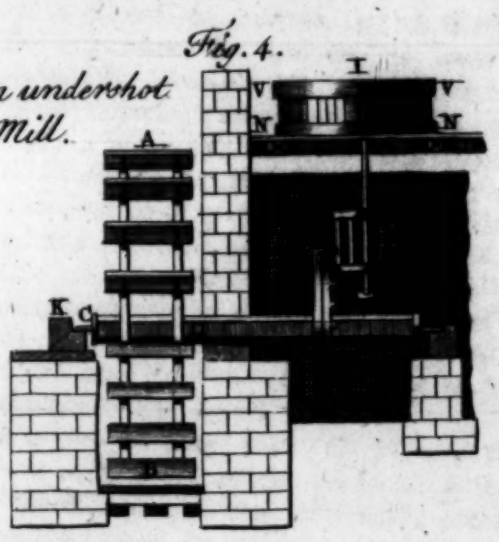


Fig. 3.

Fig. 5. Section of a Mill Hopper Drum.

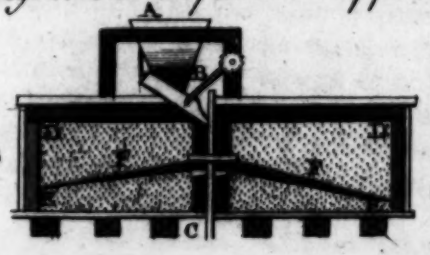


Fig. 6.
An overshot Mill.

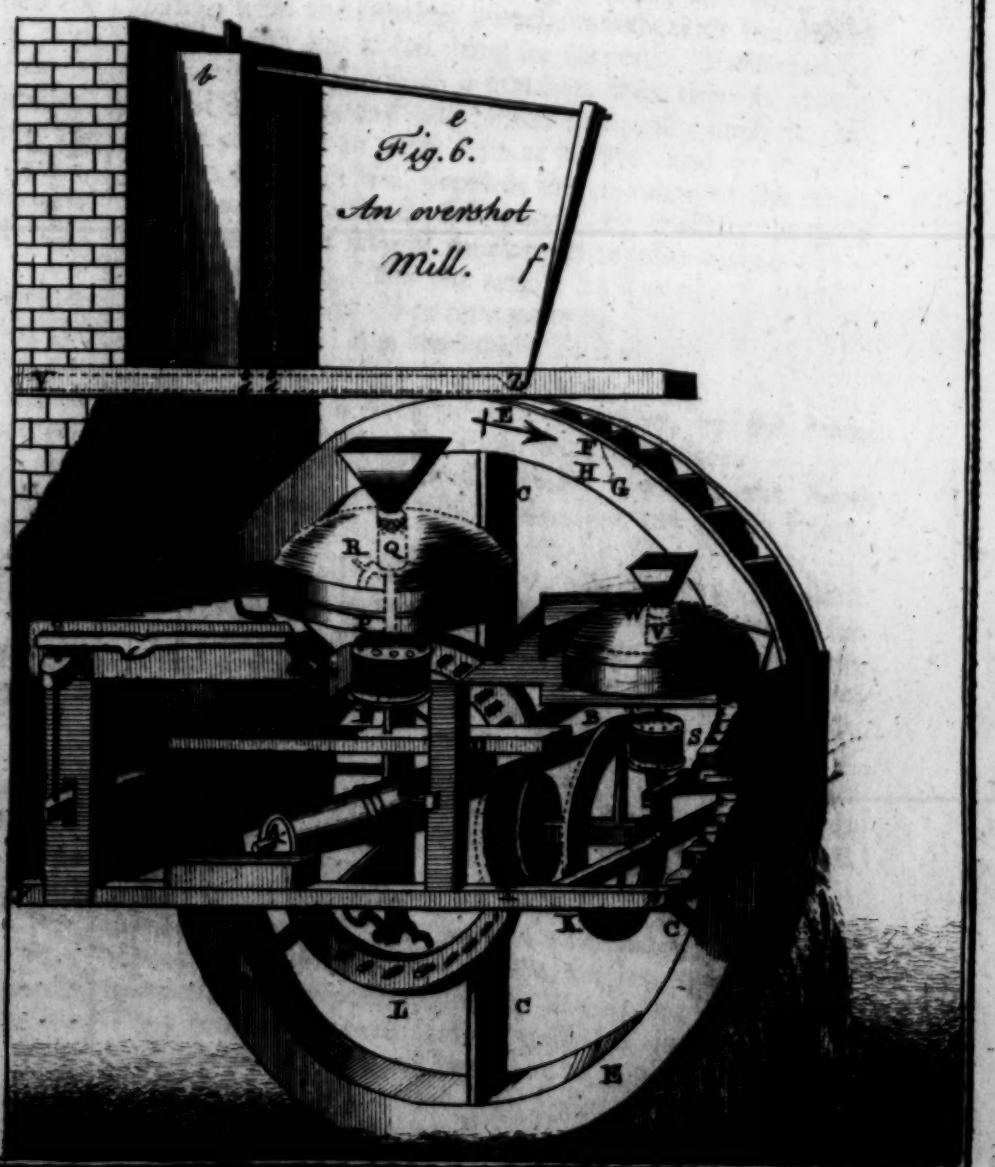
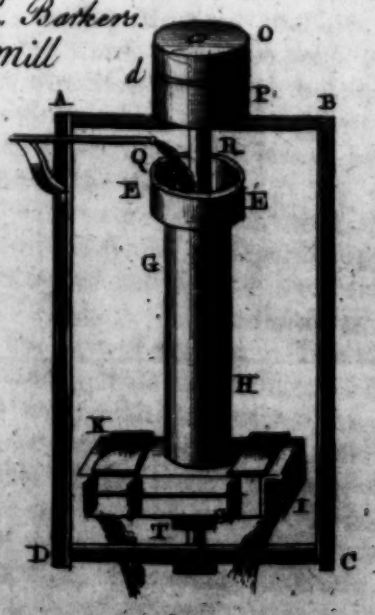


Fig. 7.
Dr. Barkers. mill



5 JA 59

let into the ſupporting piece H. The ſection of a mill-hopper and drum that covers the mill-ſtones, is repreſented in *fig.* 5. The hopper is a ſmall trough A, with a ſpout B, to convey the corn out of the hopper into the aperture of the upper mill-ſtone, DD. The iron-bar which paſſes through the trundle, is marked C, and the under mill-ſtone EE, the interval or ſpace between the ſtones being repreſented by the dark crooked line FF.

To this account of an underſhot-mill, we ſhall add that of an overſhot one; wherein AB (*fig.* 6.) is the axle tree or ſhaft of the water-wheel, which has ſix arms C, C, &c. fixed in it at D. The ſole of the wheel, marked EEE, is fixed, and contains thirty buckets, about eighteen inches broad, and fourteen inches deep; the elbow to the ſole, GH, being four inches. L, a cog-wheel placed on the ſame ſhaft by four arms at M, has forty-eight cogs, which turn the wallower, pinion, or trundle N, with nine rounds or leaves; and in this trundle is fixed an iron-ſpindle NQ, going through the middle of the lower mill-ſtone P, and turning the upper one R, by means of the rind Q.

I is another wallower or trundle, which is applied at pleaſure to the cog-wheel L; and on the ſame axis is another cog-wheel K, having forty cogs, which turn S, a wallower of nine rounds; whoſe axis T has a rind V at its top, whereby it bears and turns the upper mill-ſtone W. YZ is a trough or lander, which conveys the water from the pool or dam to the buckets of the wheel at Z. This has a penſtock *ab*, and an orifice *cd*, with a ſhuttle or ſluice to open or ſhut it; and is generally raiſed about two inches above the wheel, by means of a lever *e*, fixed to the ſhank by the handle *f*. The ſurface of the water in the pool muſt be conſiderably higher than the level of the top of the wheel.

Dr. Barker's new invented mill (*fig.* 7.) is of the moſt ſimple ſtructure of any yet made, performing its effect without any wheel, trundle, cog, or round; the manner of whoſe operation may be eaſily underſtood from the following account of its ſeveral parts. ABCD is an upright frame, ſtanding on a proper baſe; EF is the wider part of GH, an upright hollow pipe or tube, fixed at the bottom to an horizontal ſquare trunk IK; which trunk, together with the tube, is fixed to an upright ſpindle or axis RS, by means of a nut and ſcrew at S. The lower end of the axis moves on a fine point in the pivot-hole, in the part of the frame at T. On the upper part of the frame is a hole through which the ſpindle paſſes, as alſo through the round circular piece P, fixed on the ſaid frame. On the upper part of the ſpindle is fixed another round piece O, which repreſents the upper mill-ſtone. Q is a ſpout of water filling the tube or trunk, and giving motion thereto; and conſequently to the axis and upper ſtone, by the horizontal jets of water from each end to the trunk IK, through holes made at each end on contrary ſides.

While the holes continue ſtopped, the trunk will be at reſt, becauſe then the preſſure is equal over all the parts; but when the holes are open, the preſſure of the water (by its having liberty to iſſue out) will be leſs on that part where the hole is, than on the other part oppoſite to it; which ſtronger preſſure will prevail, and carry round the trunk and tube with the axle and ſtone, in a contrary direction; and each hole contributes to produce this motion, which will be greater or leſſer in proportion to the momenta of the jets of water, or greater or leſſer aperture of the holes.

For it is eaſy to underſtand, that the power of this machine is derived from, or depends upon, three things: 1. The velocity of the ſpouting-water. 2. The quantity thereof. And, 3. The diſtance at which the water ſpouts from the axis of motion. The two firſt make the momentum ariſing from the preſſure of the fluid, which is proportional to the altitude or height of the tube; the laſt is of a mechanical nature, for the trunk is, in this reſpect, exactly of the nature of the lever.

When the quantity of water is not ſufficient to turn an underſhot wheel, and there is not height enough for an over-ſhot one, the water is made to fall into the buckets of a breaſt-wheel, as it is called (ſee plate LXXXVIII. *fig.* 1.) about the height of the center of the ſhaft, and to work by its weight till it gets to the bottom.

MILL is alſo uſed for any machine, which being moved by ſome external force, makes a ſtrong impreſſion on things applied thereto; ſuch are fulling-mills, paper-mills, mills uſed in coining, gunpowder-mills, oil-mills, ſtamping-mills, ſugar-mills, &c. See FULLING, PAPER, COINING, &c.

Cyder-MILL. See the article CYDER.

Gun-powder-MILL is that uſed for pounding and beating together the ingredients of which gun-powder is compoſed. See the article GUN-POWDER.

Theſe ingredients being duly proportioned, and put into the mortars of the mills, which are hollow pieces of wood, each capable of holding twenty pounds of paſte, are incorporated by means of the peſtle and ſpindle. There are twenty-four mortars in each mill, where are made each day 480 pounds of gun-powder; care being taken to ſprinkle the ingredients in the mortars with water, from time to time, leſt they ſhould take fire. The peſtle is a piece of wood ten feet high, and 4½ inches broad, armed at bottom with a round piece of metal. It weighs about ſixty pounds.

But the operation of this mill will be better conceived from an inſpection of its ſeveral parts. Plate LXXXVIII. *fig.* 2. repreſents the plan of the water-wheel and trundle-heads; where A is the wheel; B its arbor; C, D, the two trundle-heads, each turning with their proper arbor; E, the cog-wheel, driven by the arbors of the great wheel, and inſerting its teeth between the ſpindles of the trundle-heads, makes one of them turn one way, and the other another way.

Fig. 3. is the profile of the great wheel and cog-wheel, marked A and E; where BB is the arbor of the great wheel, C the arbor of the trundle-head C, FF the peſtles, and HH the outſides of the mortars.

Fig. 4. is a plan of the whole machine; A being the great wheel, B its arbor, C, D, the trundle-heads, each with its proper arbor, called here canting-wheel; being each environed with twelve ſmall pieces of wood, called lifts, jutting out to raiſe the peſtles. E is the cog-wheel, GG the tails of the peſtles, and HH the bottoms of the mortars.

If water be given to the great wheel, the cog-wheel muſt likewiſe move and drive contrary ways the two trundle-heads and their canting-wheels; and each lift, turning with the canting-wheels, meets with the ſtay of a peſtle, and lets it fall into its mortar. Theſe twelve lifts are diſpoſed in ſuch a manner, that there is always four of them up, and four peſtles unequally ready to fall, ſo that only one of them falls at a time; and on this diſpoſition of the peſtles depends the equality of the trituration, which ſucceeds ſtill better, by making the paſte paſs through the ſeveral mortars at regular times.

Sawing-MILL. See the article SAWING.

Stamping-MILL. See STAMPING.

Sugar-MILL. See the article SUGAR.

MILL-DEW, *rubigo*. See RUBIGO.

MILL-POOL, a ſtock or pond of water, by the force of which the motion of a water-mill is effected.

The dam of a mill-pool is raiſed much in the ſame manner as directed for fiſh-ponds. See the article FISH-POND.

MILLEFOLIUM, yarrow, in botany, a plant with rough ſtiff leaves, divided into ſmall ſegments, ſet in pairs along a middle rib like feathers: the little flowers ſtand thick together, in form of an umbel on the top of the ſtiff ſtalk, and conſiſt each of ſeveral whitiſh or pale purpliſh petala, ſet round a kind of looſe diſk of the ſame colour, followed by ſmall crooked ſeeds. It is perennial, grows plentifully by the ſides of fields and on ſandy commons, and is found in flower greateſt part of the ſummer.

The leaves and flowers of milfoil are greatly recommended by ſome of the German phyſicians, as mild corroborants, traumatics, and antiſpaſmodics, in diarrhœas, hemorrhages, hypochondriacal, and other diſtempers. They promiſe by their ſenſible qualities, to be of no inconſiderable activity. They have an agreeable, though weak, aromatic ſmell, and a bitteriſh, rough, ſomewhat

pungent taſte. The leaves are chiefly directed for medicinal uſe, as having the greateſt bitterneſs and auſterity: the flowers have the ſtrongeſt and moſt ſubtile ſmell, and promiſe to be of moſt efficacy, if the plant has really any ſuch efficacy, as an anodyne or antiſpaſmodic. Dr. Grew obſerves, that the young roots have a glowing warm taſte, approaching to that of contrayerva, and thinks they might in ſome meaſure ſupply its place; but adds, that they loſe much of their virtue in being dried, from whence it may be preſumed that their active matter is of another kind.

MILLENARIANS, or CHILIASTS, a name given to thoſe, who, in the primitive ages, believed that the ſaints will one day reign on earth with Chriſt a thouſand years. The former appellation is of Latin original, the latter of Greek, and both of the ſame import.

The Millenarians held, that after the coming of Antichriſt, and the deſtruction of all nations, which ſhall follow, there ſhall be a firſt reſurrection of the juſt alone: that all who ſhall be found upon earth, both good and bad, ſhall continue alive; the good, to obey the juſt, who are riſen, as their princes; the bad, to be conquered by the juſt, and to be ſubject to them: that Jeſus Chriſt will then deſcend from Heaven in his glory: that the city of Jeruſalem will be rebuilt, enlarged, embelliſhed, and its gates ſtand open night and day. They applied to this new Jeruſalem, what is ſaid in the Apocalypſe, ch. xxi. and to the temple, all that is written in Ezekiel xxxvi. Here, they pretended, Jeſus Chriſt will fix the ſeat of his empire, and reign a thouſand years with the ſaints, patriarchs and prophets, who will enjoy perfect and uninterrupted felicity.

This reign of our Saviour on earth is uſually ſtyled the millennium, or reign of a thouſand years.

MILLEPEDES, the common wood-louſe, an oblong inſect, with fourteen feet, notched along the ſides, rolling itſelf up into a round ball on being touched; found in cellars, and under ſtones and logs of wood in cold moiſt places; rarely met with in the warmer climates. Thoſe which have a white ſilver-like hue, are accounted the beſt; and the black the worſt.

MILLEPEDES have a faint diſagreeable ſmell, and a ſomewhat brackiſh, ſweetiſh, unpleaſant taſte. They are celebrated as reſolvents, aperients, and diuretics; in jaundices, aſthmas, ſcrophulous and other diſorders; but that their virtues are ſo great as they are generally ſuppoſed to be, may be juſtly queſtioned, at leaſt when given in the cuſtomary doſes. Two hundred have been taken every day for ſome time together without producing any remarkable effect: in large doſes, indeed, it is probable that their activity may be conſiderable; as they are ſaid to have ſometimes produced an univerſal heat and thirſt with a pain in the region of the pubes, and ſometimes a ſcalding of urine.

Theſe inſects may be commodiouſly ſwallowed entire, as they ſpontaneouſly contract themſelves, on being touched, into the form of a pill. In the ſhops they are commonly reduced into powder; for which purpoſe they are prepared, either by incloſing them in a thin canvas cloth, and ſuſpending them over hot ſpirit of wine in a cloſe veſſel, till they are killed by the ſteam and rendered friable; or by including them in a proper veſſel, and drying them with a very gentle heat. Of the extraction of their active matter by menſtrua, no direct experiments have been made: it is rather by expreſſion, than on the principle of extraction or diſſolution, that their virtues are commonly endeavoured to be obtained in a liquid form; though ſome liquors are generally added previouſly to the expreſſion, partly to improve their virtue for particular intentions, partly to preſerve the animal juice from corruption, and partly to render it more completely ſeparable. The college of Edinburgh directs directs two ounces of live millepedes to be ſlightly bruiſed, and digeſted for a night in a pint of Rheniſh wine, after which the liquor is to be preſſed through a ſtrainer.

MILLET, MILIUM, the ſeed of a plant which by conſent of authors, both ancient and modern, is refrigerating and drying; it is of bad juice, difficult of digeſtion, binds the belly, and generates flatulences; it is, however, well known to be a very grateful food to many nations at preſent. In former times it ſerved to make bread, under a dearth of better corn, as we are aſſured by Dioſcorides, Pliny, Galen, and others of the ancients. Among the Italians, ſays C. Bauhine, loaves made of millet, which are yellow, are eaten hot by many, not out of neceſſity, but for their ſweetneſs; but, when this bread is grown hard, it is quite black. Of the flour of millet and milk the Italians make fine cakes, which muſt be eaten as ſoon as dreſſed, or elſe they become glutinous, and ungrateful to the taſte. In former times they made a ſort of white puddings of millet, as Pliny tells us. And among the Coſſacks and Tartars, their principal food is millet, the crude meal of which they mix with the milk of mares, or with blood drawn from the crural vein of their horſes. A pudding, prepared of millet, boiled in milk, with an addition of butter, and ſugar ſprinkled over it, is much in requeſt among the Germans at preſent; and theſe puddings have been long ago introduced into England, and are ſtill in faſhion.

The flower of millet was formerly uſed in fomentations for the gripes, and for pains of the head and nerves; it was applied externally in bags, becauſe the uſe of it in cataplaſms was difficult, on account of its friability. If the membrane of the brain happens to be wounded, it is excellently conglutinated, ſays Archigenes, by infuſing thereon the juice of calaminth, and ſprinkling it with the dry flour of millet. A decoction of millet, with figs and raiſins, is called by Heurnius a noble ſudorific and diuretic. Or, take of a decoction of millet, boiled till it burſts, four ounces; white wine, two ounces. Let the patient take it hot. *Cheſneau. Laii Hiſt. Plant.*

Millet is diuretic and aſtringent; the ſeeds are of extraordinary ſervice in diſeaſes of the lungs, and exulcerations of the kidneys; made into a cataplaſm, they are anodyne and reſolvent. *Hiſt. Plant. adſcript. Boerh.*

Indian MILLET.—It delights in a fat and humid ſoil; for which reaſon ſome ſow it in their fields to correct their luxuriance: it was brought from India into Spain, Italy, and other warm countries: they ſow it in ſummer, and reap it in autumn.

The ſeed is like panic both in taſte and temperament. The pooreſt ſort of people in Italy, and the peaſants in the Paduan, grind the ſeed, and make it into loaves, which are friable, and afford but little nutriment, being black, difficult of digeſtion, and binding. It is more uſual to make puddings, or white pots, of the flour and milk. In Tuſcany they ſow it more for the ſake of feeding their poultry, than to ſerve as aliment for men. They, alſo, give it to their cows, horſes and ſwine. Of the pith of the ſtalks is prepared an excellent remedy for the ſtrumæ; the preparation of which ſee in the Bauhines and Matthiolus; which laſt author commends, alſo, the flowers, for uterine fluxes and the dyſentery. *Raii Hiſt. Plant.*

MILLING, in the manufacture of cloth, the ſame with fulling. See FULLING.

MILLING *of Silk* is an operation otherwiſe called throwing. See the article THROWING.

MILLION, in arithmetic, the number of ten hundred thouſand, or a thouſand times a thouſand. See NUMBER and NUMERATION.

MILT, in anatomy, a name ſometimes given to the ſpleen. See SPLEEN.

MILT, or MELT, is alſo a denomination by which ſome call the roes of fiſhes. See the article ROE.

MILVUS, the kite, in ornithology, a ſpecies of falcon, with a forked tail, a yellow cera, a brown body, and a whitiſh head. It is a very common bird with us, about the ſize of a large tame pigeon. See FALCON and KITE.

MIME, μιμος, in the ancient comedy, a perſon who acted any character by mere geſtures, and hence denominated pantomime. See PANTOMIME.

MIND, *Mens*, νους, a thinking intelligent being, otherwiſe called ſpirit, in oppoſition to matter or body. See the articles BODY and SPIRIT.

The culture of the human mind is more immediately taught in the ſciences of logic and ethics. See LOGIC and ETHICS.

When the mind, ſays Mr. Locke, turns its view inwards

wards upon itſelf, thinking is the firſt idea that occurs; wherein it obſerves a great variety of modifications, whence it frames to itſelf diſtinct ideas. See IDEA.

Thus the perception annexed to any impreſſion on the body by an external object, is called ſenſation; when an idea recurs without the preſence of the object, it is called remembrance; when ſought after by the mind, and brought again into view, it is recollected; when the ideas are taken notice of, and as it were regiſtered in the memory, it is attention; when the mind fixes its view on any idea, and conſiders it on all ſides, it is called ſtudy. See the articles SENSATION, REMEMBRANCE, &c.

MINE, in natural hiſtory, a place under ground, where metals, minerals, or precious ſtones, are dug up.

For gold and ſilver mines, the richeſt and moſt celebrated are in the Spaniſh Weſt Indies: iron mines are more abundant in France; copper mines are chiefly in Sweden and Denmark; lead and tin mines abound moſt in England; quickſilver mines in Hungary and Spain; diamond mines in Golconda; ſalt mines in Poland, &c.

Metallic-MINES are generally dug for in mountains, though it is probable plains may abound as much therewith, only theſe are commonly cultivated; beſides this, the waters will ſcarce allow them to dig: and as the metallic veins always run either horizontal or oblique, they are eaſieſt found on the ſides of eminences.

The metallic veins are commonly encompaſſed with a ſort of ſtone peculiar to the mine, and accompanied with ſeveral ſtrata of clay, gravel, rock, &c. By all theſe the miners know when they approach a vein.

They diſcover that there is a mine in a mountain by the mineral ſtones that fall from it, the mineral taſte of the waters, the quality of the exhalations, the difference between the earth over the mines, and that of the neighbouring parts; the firſt freezing on the adjacent places, when it thaws about the mines. Add to this, that the ground producing but little graſs, and that but pale, is an indication of a mine.

In ſome mines the metals are found at their firſt opening crude and imperfect, which yet in time, as ſome ſay, grow ripe and rich.

MINE, in the military art, denotes a ſubterraneous canal or paſſage, dug under the wall or rampart of a fortification, intended to be blown up by gun-powder.

The alley or paſſage of a mine is commonly about four feet ſquare; at the end of this is the chamber of the mine, which is a cavity about five feet in width and in length, and about ſix feet in height; and here the gunpowder is ſtowed. The ſauciſſe of the mine is the train, for which there is always a little aperture left. There are various kinds of mines, which acquire various names, as royal-mines, ſerpentine-mines, forked-mines, according as their paſſages are ſtraight, oblique, winding, &c. There are alſo mines made in the field, which are called fougades. See the article FOUGADE.

Mines are either dug within the body of the earth, as thoſe made by the beſieged to blow up the works of the beſiegers, before they make a lodgment on the covert-way; or in eminences and riſing grounds, as to make a breach in the ramparts, &c. or to blow up walls, or laſtly, to tear up rocks.

Two ounces of powder have been found, by experiment, capable of raiſing two cubic feet of earth; conſequently two hundred ounces, that is twelve pounds eight ounces, will raiſe two hundred cubic feet, which is only fifteen feet ſhort of a cubic toiſe, becauſe two hundred ounces joined together, have proportionably a greater force than two ounces, as being an united force. See GUN-POWDER.

All the turnings a miner uſes to carry on his mines, and through which he conducts the ſauciſſe, ſhould be well filled up with earth and dung; and the maſonry in proportion to the earth to be blown up, as 3 to 2. The entrance of the chamber of the mine ought to be firmly ſet with thick planks, in the form of a St. Andrew's croſs, ſo that the encloſure be ſecure, and the void places ſhut up with dung, or tempered earth. If a gallery be made below, or on the ſide of the chamber, it muſt abſolutely be filled up with the ſtrongeſt maſonry, full as long again as the height of the earth; for this gallery will not only burſt, but likewiſe obſtruct the effect of the mine. The powder ſhould always be kept in ſacks, which are opened when the mine is charged, and ſome of the powder ſtrewed about: the greater the quantity of earth to be raiſed, the greater is the effect of the mine, ſuppoſing it to have the due proportion of powder. Powder has the ſame effect upon maſonry as upon earth, that is, it will proportionably raiſe either with the ſame velocity.

The branches which are carried into the ſolidity of walls, do not exceed three feet in depth, and two feet ſix inches in width nearly; this ſort of mine is moſt excellent to blow up the ſtrongeſt walls.

The weight of a cubic foot of powder ſhould be 80 lb. one foot one inch cube will weigh 100 lb. and one foot two inches and eleven twelfths, 150 lb. and 200 lb. of powder will be one foot five inches cube; however, there is a diverſity in this, according to the quantity of ſalt-petre in the gun-powder.

If when the mines are made, water be found at the bottom of the chamber, planks are laid there, on which the powder is placed either in ſacks or barrels, of 100 lb. each. The ſauciſſe muſt have a clear paſſage to the powder, and be laid in an auget, or wooden trough, through all the branches. When the powder is placed in the chamber, the planks are laid to cover it, and others again acroſs theſe; then one is placed over the top of the chamber, which is ſhaped for that purpoſe: between that and thoſe which cover the powder, props are placed, which ſhore it up; ſome inclining towards the outſide, others to the inſide of the wall; all the void ſpaces being filled with earth, dung, brick, and rough ſtones. Afterwards planks are placed at the entrance of the chamber with one acroſs the top, whereon they buttreſs three ſtrong props, whoſe other ends are likewiſe propped againſt another plank ſituated on the ſide of the earth in the branch; which props being well fixed between the planks with wedges, the branch ſhould then be filled up to its entrance with the forementioned materials. The ſauciſſes which paſs through the ſide branches muſt be exactly the ſame length with that in the middle, to which they join: the part which reaches beyond the entrance of the mine, is that which conveys the fire to the other three; the ſauciſſes being of equal length will ſpring together. From a great number of experiments, it appears, 1. That the force of a mine is always towards the weakeſt ſide; ſo that the diſpoſition of the chamber of a mine does not at all contribute to determine this effect. 2. That the quantity of powder muſt be greater or leſs, in proportion to the greater or leſs weight of the bodies to be raiſed, and to their greater or leſs coheſion; ſo that you are to allow for each cubic fathom of looſe earth, 9 or 10 lb.

Firm earth or ſtrong ſand,	11 or 12
Fat clayey earth,	15 or 16
New maſonry not ſtrongly bound,	15 or 20
Old maſonry, well bound,	25 or 30

3. That the aperture, or entonnoir of a mine, if rightly charged, is a cone, the diameter of whoſe baſe is double the height taken from the center of the mine. 4. That when the mine has been over-charged, its entonnoir is nearly cylindrical, the diameter of the upper extreme not much exceeding that of the chamber. 5. That beſides the ſhock of the powder againſt the bodies it takes up, it likewiſe cruſhes all the earth that borders upon it, both underneath and ſideways.

To charge a mine ſo as to have the moſt advantageous effect, the weight of the matter to be carried muſt be known; that is, the ſolidity of a right cone, whoſe baſe is double the height of the earth over the center of the mine: thus having found the ſolidity of the cone in cubic fathoms, multiply the number of fathoms by the number of pounds of powder neceſſary for raiſing the matter it contains; and if the cone contains matters of different weights, take a mean weight between them all, always having a regard to their degree of coheſion.

As to the diſpoſition of mines, there is but one general rule, which is, that the ſide towards which one would determine the effect be the weakeſt, but this varies according to occaſions and circumſtances.

The calculation of mines is generally built upon this

hypotheſis,

hypotheſis, that the entonnoir of a mine is the fruſtum of an inverted cone, whoſe altitude is equal to the radius of the excavation of the mine, and the diameter of whoſe leſſer baſe is equal to the line of leaſt reſiſtance; and though theſe ſuppoſitions are not quite exact, yet the calculation of mines deduced from them have proved ſucceſsful in practice; for which reaſon this calculation ſhould be followed, till a better and more ſimple be found out.

M. de Valliere found that the entonnoir of a mine was a paraboloid, which is a ſolid generated by the rotation of a ſemi-parabola about its axis; but as the difference between theſe two is very inſignificant in practice, that of the fruſtum of a cone may be uſed. See the article PARABOLOID.

MINERAL, in natural hiſtory, in general, denotes foſſil, and is applied to any body dug out of the earth. In this ſenſe minerals are divided into claſſes; the one fuſible and malleable, which are what we properly call metals; the others want theſe two properties, and are what we ſtrictly call minerals.

MINERAL, in a more accurate ſenſe, denotes a compound foſſil, in which there is ſomething diſcovered, in all reſpects like metals, only that it is not malleable, joined with ſome other foſſil, as ſalt, ſulphur, ſtone, or earth, ſuch as antimony, cinnabar, biſmuth, &c.

Some aſcribe the formation of minerals to the action of the ſun without; ſome to the central fire within; and ſome think the cold does all by condenſing and congealing certain juices of the earth.

The minerals, metals, and ſtones, lie in beds ever ſince the flood, if not from the creation: yet it is highly probable they have a faculty of growing in their reſpective beds, as Mr. Boyle thinks. Among other inſtances he adds, that in the foreſt of Dean in Glouceſterſhire, the beſt iron, and in the greateſt quantities, are found in the old cinders, which they melt over again. This ſome impute to the negligence of former melters; but Mr. Derham imagines it rather owing to the new impregnations of the old ore or cinders from the air.

MINERAL *Waters*, in medicine, all thoſe wherein any medicinal virtues, beſides thoſe of common water, are found.

Theſe mineral waters are of various kinds, but they are conſidered under the general titles of chalybeate, purgative, and alterative. The more uſeful and commodious additions for examining theſe three kinds of mineral waters, are, according to Dr. Shaw, galls, ſyrup of violets, and oil of tartar per deliquium. Galls diſcover in them any ſmall proportion of vitriol or diſſolved iron, as having the property of immediately ſtriking a purple or black colour in all waters where any ſuch ſubſtance is lodged. Spirit of violet, in the ſame manner, diſcovers any ſmall predominancy of an acid, or alkali therein, by changing the water red if acid, and green if alkali preſides. Oil of tartar diſcovers any ſmall proportion of earthy matter leſs capable of diſſolving in water than that ſalt, by precipitating ſuch earthy matter in form of a white cloud to the bottom of the containing glaſs, where it collects and appears like a ſubtile white powder. Theſe particulars may be ſhewn and proved ſatisfactorily by adding to pure water a little of a known acid alkali, diſſolved iron, and ſubtile earth, or fine light ſediment of an earthy water; applying the ſyrup of violets, galls, and oil of tartar reſpectively.

MINERVALIA, in Roman antiquity, feſtivals celebrated in honour of Minerva, in the month of March; at which time the ſcholars had a vacation, and uſually made a preſent to their maſters, called from this feſtival minerval.

MINIATURE, a delicate kind of painting, diſtinguiſhed from all others by the ſmallneſs of the figures; its being performed with dots or points inſtead of lines; by the faintneſs of the colouring; its requiring to be viewed very near; and by its being uſually done on vellum. See PAINTING and REDUCTION.

Your vellum muſt be glued to a copper-plate, or a piece of thin board, exactly of the ſame ſize with the intended piece; in doing which, the fair ſide of the vellum ſhould be moiſtened with a fine wet linen; and a piece of white paper being put upon the back of it, it is to be applied to the plate or board, and ſtretching it upon it equally in all directions, the vellum ought to be every way a finger's breadth larger than what you glue it to, in order to be doubled over and glued behind. When your piece is ſketched out upon the vellum with a pencil, you muſt, with a little thin carmine, run over all the ſtrokes that they may not be defaced in working, and this done clean your vellum with crumb of bread. In laying on the colours, begin with ſketching or drawing with large, bold, but clear ſtrokes, like thoſe who paint in oil: your lights muſt at firſt be ſomething brighter, and your ſhades not quite ſo dark as is required in finiſhing, becauſe in ſtrippling upon them you ſtrengthen the colour, which if too deep at firſt, would in finiſhing become too dark. Endeavour alſo to drown your colours into each other, that no line of ſeparation may be ſeen between them; to this purpoſe ſoften your ſtrokes with the colours on each ſide of them, ſo that they may be blended and confounded with each other. There are ſeveral ways of ſtrippling, and every painter has his manner; ſome do it with round points, others make them longiſh; others again hatch fine ſtrokes, croſſing each other in all directions, till the whole appears as if ſtrippled or wrought with points; this laſt method is the beſt, boldeſt, and ſooneſt perfected: the artiſt ſhould here accuſtom himſelf to be rich, mellow, and ſoft in his work; the points muſt ſeem in a manner loſt in the ground they are wrought upon, and appear but juſt enough to ſhew that the piece is ſtrippled. When the work ſeems finiſhed, heightening it a little has a fine effect; that is, ſtrengthening the lights with touches of a paler colour than at firſt, which muſt be ſoftened away into the reſt.

MINIM, in muſic, a note equal to two crotchets, or half a ſemibreve.

MINIMS, a religious order in the church of Rome, founded by St. Francis De Paula, towards the end of the fifteenth century. Their habit is a coarſe black woollen ſhift, with a woollen girdle, of the ſame colour, tied in five knots. They are not permitted to quit the habit and girdle night nor day. Formerly they went bare-footed, but are now allowed the uſe of ſhoes.

MINIMUM, in mathematics, denotes the leaſt quantity attainable in any given caſe.

The common methods of reſolving problems relating to the minima, are the ſame with thoſe we have ſhewn under the article MAXIMUM. But there are however ſome inquiries of a higher nature concerning problems *de Maximis et Minimis*, which it may be worth while to illuſtrate.

Let therefore KL (pl. LXXXVIII. *fig.* 5.) be a right line given in poſition, AK a perpendicular upon KL from a given point A, E any point in this line; join AE, ſuppoſe KE to be deſcribed uniformly with any given velocity a, and AE to be deſcribed uniformly with any given velocity u, that is leſs than a. Let L be taken upon the right line KL, ſo that AL may be to KL, as a is to u; and the difference of the times in which the right lines AE and KE will be deſcribed by the reſpective velocities u and a (or $\frac{AE}{u} - \frac{KE}{a}$) will be leaſt when E falls upon L; that is, when the angle KAE is ſuch, that its ſine is to the radius as u is to a: for let KH and EV be perpendicular on AL in H and V reſpectively, and AR be taken upon AL equal to AE; then HV will be to KE as KL is to AL, or (by conſtruction) as u to a; conſequently HV will be deſcribed with the velocity u in the ſame time that KE is deſcribed with the velocity a; therefore the exceſs of the time in which AE is deſcribed with the velocity u, above the time in which KE is deſcribed with the velocity a, is equal to the time in which AE−HV, or AR−HV, or AH+VR is deſcribed with the velocity u; and becauſe AH is invariable, this time is leaſt when VR vaniſhes; that is, when E falls upon L, and the ſine of the angle KAE is to the radius as a to u. The ſame will appear from an algebraical inveſtigation; thus, put AK $= b$, AE $= x$; then KE $= \sqrt{xx-bb}$, whence $\frac{AE}{u} - \frac{KE}{a}$, or $\frac{x}{u} - \frac{\sqrt{xx-bb}}{a}$ muſt

a minimum; therefore $a\dot{x} - \frac{u \times \dot{x}}{\sqrt{xx-bb}} = 0$; consequently $a \times KE = u \times AE$, or $AE : KE :: a : u$, the same as before.

Now let GAD (*fig.* 6.) be a curve of any kind, GH the abscissa, and HD its corresponding ordinate rightly applied, and AE a tangent to any point A of the curve. Draw GF parallel to DH, which produce at pleasure; draw FC parallel to GH, and produce DH to C. From A draw AP parallel to DC, produce PA to K, and draw KE parallel to GH. It appears from above, that if AK be given, and a and u denote any given or invariable quantities, then $AE \times a - KE \times u$ (or $\frac{AE}{u} - \frac{KE}{a}$) is a minimum, when $KE : AE :: u : a$, or $a \times KE = u \times AE$. Let the base $FP = x$, the ordinate $PA = y$, the arch $GA = s$, $AK = \dot{y}$, $AE = \dot{s}$, and $KE = \dot{x}$. Now if V and u represent any quantities compounded from the powers of y (so as to be of the same value when y is the same), and if $\dot{y}$ be given, then $V\dot{s} - u\dot{x}$, and $\frac{\dot{s}}{u} - \frac{\dot{x}}{V}$ are minima, when $V\dot{s} = u\dot{x}$. From this it follows, that if GAD be the whole curve, and DH the difference of the ordinates at G and D be given, then the fluent of $V\dot{s} -$ flu. $u\dot{x}$, or the flu. $\frac{\dot{s}}{u} -$ flu. $\frac{\dot{x}}{V}$ shall be a minimum, when the nature of the figure is defined by the equation $V\dot{x} = u\dot{s}$. Therefore, supposing this to be the equation of the curve, and DH to be given, if the fluent of $V\dot{s}$ be also given, then the fluent of $u\dot{x}$ shall be a maximum; or if the latter fluent be given, then the former shall be a minimum: and if the fluent of $\frac{\dot{s}}{u}$ be given, that of $\frac{\dot{x}}{V}$ shall be a maximum; or if the fluent of $\frac{\dot{x}}{V}$ be given, the fluent of $\frac{\dot{s}}{u}$ shall be a minimum. If the base FC or GH, together with DH, be given, and the fluent of $V\dot{s}$ be given or invariable, then the fluent of $u\dot{x}$ will be a maximum or minimum, when the equation of the curve is $V\dot{x} = e \pm u \times \dot{s}$, where e denotes an invariable quantity that may be positive or negative, or vanish.

Suppose therefore $V = A + By + Cyy + Dy^3 +$, &c. and $u = a + by + cy^2 + dy^3$, &c. where A, B, C, &c. and a, b, c, &c. denote any invariable co-efficients that may be positive or negative, any of which may be supposed to vanish; and the fluent of $V\dot{s} - u\dot{x}$; that is, of $\dot{s} \times \overline{A \times By + Cyy + Dy^3}$, &c. $- \dot{x} \times \overline{a + by + cyy + dy^3 +}$ &c. shall be a minimum, when the equation of the figure is $\dot{x} \times \overline{A + By + Cyy + Dy^3 +}$ &c. $= \dot{s} \times \overline{a + by + cyy +}$ &c. the ordinate DH being given; therefore if the fluent of $\dot{s} \times \overline{A + By + Cyy +}$ &c. be also given, the fluent of $\dot{x} \times \overline{a + by + cyy}$ &c. shall be a maximum; or if the latter be given, the former shall be a minimum: and if the base FC or GH be given with DH and the fluent of $\dot{s} \times \overline{A + By + Cyy +}$ &c. then the fluent of $\dot{x} \times \overline{a + by + cyy +}$ &c. shall be a maximum or minimum, when $\dot{x} \times \overline{A + By + Cyy +}$ &c. $= \dot{s} \times \overline{e \mp A + By + Cyy +}$ &c. Of which theorem it is an obvious, but a particular case only, that if the nature of the figure be defined by the last equation, and GH, DH, with the fluents of $A\dot{s}$, $By\dot{s}$, $Cy^2\dot{s}$, &c. $by\dot{x}$, $cyy\dot{x}$, $dy^3\dot{x}$, &c. be all given or invariable, one only excepted, this last fluent shall be either a maximum or minimum.

For example, the points G and D being given, if the periphery GAD (or the fluent of $A\dot{s}$) be also given, the area FGADC (or the fluent of $y\dot{x}$) is a maximum or minimum, when $A\dot{x} = \dot{s} \times \overline{e \pm A \pm By}$; that is, when GAD is an arch of a circle. If the surface generated by the arch GAD about the axis FC (or the fluent of $By\dot{s}$) be given, then the solid generated by the figure FGADC about the same axis (or the fluent of $cyy\dot{x}$) is a maximum or minimum, when $By\dot{x} = \dot{s} \times \overline{e \mp cyy}$; and when $e = 0$, this again is a circle. If the perimeter GAD (or the fluent of $A\dot{s}$) be given, the solid generated by FGADC about the axis FC is a maximum or minimum, when $A\dot{x} = \dot{s} \times \overline{e \pm cy^2}$, and GAD is then the elastic curve.

The late eminent mathematician Mr. Thomas Simpson gives (p. 101 of his Miscellaneous Tracts) the following general rule for the solution of problems of this kind.

Take the fluxions of all the proposed expressions (as well that respecting the maximum or minimum, as of the others whose fluents are to be given quantities) making that quantity, and likewise its fluxion, invariable, whereof the fluxion (as well as the quantity itself) enters into the said expressions; and having divided every where by the fluxion of the other quantity made variable, let the quantities hence arising, joined to general co-efficients 1, e, f, g, &c. be united into one sum, and the whole be made equal to nothing; from which equation (wherein the values of e, f, g, &c. may be either positive, or negative, or nothing, as the case requires) the required relation of the two variable quantities will be truly exhibited.

If the abscissa AP (*fig.* 7.) of a curve AQC be denoted by x, and the ordinate PQ by y, and p be taken to express the measure of the circumference of a circle whose diameter is unity; it is well known that the several fluxions of the abscissa AP, curve-line AQ, area APQ, superficies of the generated solid (by a rotation about the axis AP), and of the solid itself, will be respectively represented by $\dot{x}$, $\sqrt{\dot{x}\dot{x}+\dot{y}\dot{y}}$, $y\dot{x}$, $2py\sqrt{\dot{x}\dot{x}+\dot{y}\dot{y}}$ and $py^2\dot{x}$; if therefore the fluxions of those different expressions be taken as before (making $\dot{x}$ alone variable), we shall get $1 + \frac{e\ddot{x}}{\sqrt{\dot{x}\dot{x}+\dot{y}\dot{y}}} + fy + \frac{gy\dot{x}}{\sqrt{\dot{x}\dot{x}+\dot{y}\dot{y}}} + hy^2 = 0$; being a general equation for determining the relation of x and y, when any one of those five quantities (viz. the abscissa, curve-line, area, superficies, or solid) is a maximum or minimum, and all, or any number of the others, at the same time, equal to given quantities; wherein the co-efficients e, f, g, and h, may be positive, negative, or may vanish, as the case proposed may require. Thus, for instance, if the length of the curve only be given, and the area corresponding is required to be a maximum, our equation will then become $\frac{e\ddot{x}}{\sqrt{\dot{x}\dot{x}+\dot{y}\dot{y}}} + fy = 0$, or $a^2\dot{x}^2 = y^2\overline{\ddot{x}\dot{x}+\dot{y}\dot{y}}$ (by making $a = -\frac{e}{f}$); whence $\dot{x} = \frac{y\dot{y}}{\sqrt{aa+yy}}$ and consequently $x = a - \sqrt{aa-yy}$, or $2ax - xx = yy$; answering to a circle; which is therefore more capacious than any other under equal bounds.

If, together with the ordinate (which is always supposed given), the abscissa at the end of the fluent be given likewise, and the superficies generated by the rotation of the curve about its axis be a minimum; then from the same equation we shall have $1 + \frac{gy\ddot{x}}{\sqrt{\dot{x}\dot{x}+\dot{y}\dot{y}}} = 0$, whence (making $a = -\frac{1}{g}$) $\ddot{x}$ is found $= \frac{a\dot{y}}{\sqrt{yy-aa}}$; and from thence $x = a \times$ hyp. log. $\frac{y+\sqrt{yy-aa}}{a}$; which equation, by being impossible when y is less than a, shews that the curve (which is here the catenaria) cannot possibly meet the axis about which the solid is generated, and consequently that the case will not admit of any minimum, unless the first or least given value of y, exceeds a certain assignable magnitude.

When any, or all of the above specified quantities are given, and the contemporary fluent of some other expression, as $y^m\dot{y}^{1-2n} \times \overline{\ddot{x}\dot{x}+\dot{y}\dot{y}}$, is required to be a maximum or minimum, our equation (by taking the fluxion of this last expression, and joining it to the former) will then be $\overline{\ddot{x}\dot{x}+\dot{y}\dot{y}}^{n-1} \times 2n\dot{x}y^m\dot{y}^{1-2n} + d + \frac{e\ddot{x}}{\sqrt{\dot{x}\dot{x}+\dot{y}\dot{y}}} + fy + \frac{gy\dot{x}}{\sqrt{\dot{x}\dot{x}+\dot{y}\dot{y}}} + hy^2 = 0$; which, when $m = 1$ and $n = -1$, will be that defining the solid of the least resistance; and this, when the length of the axis only is supposed to be given (without farther restrictions) will be expressed by $\overline{\ddot{x}\dot{x}+\dot{y}\dot{y}}^{-2} \times -2\dot{x}y\dot{y}^3 + d = 0$, or $2y\dot{y}^3\dot{x} = d \times \overline{\ddot{x}\dot{x}+\dot{y}\dot{y}}^2$; being the case first considered by Sir Isaac Newton. — If both the length and the solid content be given, the equation will be $d + hy^2 - 2\dot{x}y\dot{y}^3 \times \overline{\ddot{x}\dot{x}+\dot{y}\dot{y}}^{-2} = 0$; but if, besides these, the superficies is given likewise,

wiſe, it will then be $d + by^2 - \frac{gy\dot{x}}{\sqrt{\ddot{x}\ddot{x}+\dot{y}\dot{y}}} - 2\dot{x}y\dot{y}^3 \times \overline{\ddot{x}\ddot{x}+\dot{y}\dot{y}}^{-2} = 0$.

MINION, a piece of cannon, at preſent but little uſed in the field. For its length, bore, and the weight of the ball it carries, ſee CANNON.

MINIUM, red lead, a preparation of lead uſed both in pharmacy and painting.

Minium is commonly prepared from lead calcined into a greyiſh powder by keeping it melted over the fire. This powder, ground in mills, is further calcined, in a reverberatory furnace, under a low arch, and frequently ſtirred with an iron rake, to prevent its melting and running into clots, and to expoſe a freſh ſurface to the action of the air and flame. The calcination laſts two or three days. The increaſe of weight is ſaid to amount to one fourth the weight of the lead; and the lead recovered from the minium to be one twentieth leſs than the original weight of the metal. If the minium be further calcined, the increaſe is no more; but the quantity of lead recoverable proves leſs in proportion to the vehemence and continuance of the calcination.

The largeſt quantities of minium are made at Venice, and in England. The Venetians employ for the beſt ſort, ceruſſe, or white lead: for the middling ſort, the refuſe plates of lead remaining after the making of ceruſſe; the worſt kind is prepared from litharge. See the articles LEAD, LITHARGE, &c.

MINOR, in law, is an heir, either male or female, before they arrive at the age of twenty-one; during the minority of ſuch, they are uſually incapable of acting for themſelves. See INFANT.

MINOR, in logic, the ſecond propoſition of a regular ſyllogiſm. See SYLLOGISM.

MINOR, in muſic, ſignifies leſs, and is applied to certain concords or intervals, which differ from others of the ſame denomination by half a tone. Thus we ſay, a third minor, meaning a leſs third: a ſixth major and minor.

MINOTAUR, *Minotaurus*, in antiquity, a fabulous monſter much talked of by the poets, feigned to be half man and half bull.

The minotaur was brought forth by Paſiphae, wife of Minos, king of Crete. It was ſhut up in the labyrinth of that iſland, and at laſt killed by Theſeus.

MINT, the place where the king's money is coined. See COINAGE.

MINT. See MENTHA.

MINUET, in muſic, a very graceful kind of dance, which conſiſts of a coupee, a high ſtep, and a ballance; it begins with a beat, and its motion is triple.

MINUTE, in geometry, the ſixtieth part of a degree of a circle. See CIRCLE and DEGREE.

MINUTE *of Time*, the ſixtieth part of an hour. See HOUR.

MINUTE, in architecture, uſually denotes the ſixtieth, ſometimes the thirtieth part of a module. See the article MODULE.

MIRACLE is defined by Dr. Clarke, to be a work effected in a manner different from the common and regular method of Providence, by the interpoſition either of God himſelf, or ſome intelligent agent ſuperior to man.

MIRROR, *Speculum*, in catoptrics, any poliſhed body, impervious to the rays of light, and which reflects them equally.

Mirrors were anciently made of metal; but at preſent are generally ſmooth plates of glaſs, tinned or quick-ſilvered on the back part, and called looking-glaſſes. See LOOKING-GLASS.

The doctrine of mirrors depends wholly on that fundamental law, that the angle of reflection is always equal to the angle of incidence. See INCIDENCE.

Let EH (plate LXXXVIII. *fig.* 8.) be a concave mirror, V its vertex, and C the center of its concavity. Let A be a ray of the ſun's light incident on the point E, and draw EC, which will be perpendicular to the mirror in the point E; make the angle CEF equal to the angle AEC, then ſhall EF be the reflected ray. Thus alſo HF will be the reflected ray of the incident one DH, at an equal diſtance on the other ſide of the axis BV.

If now the poiuts E and H be taken very near the vertex V, we ſhall have EF, or HF, very nearly equal to FV; but EF = FC; therefore FV = FC = ½CV. That is, the focal diſtance FV of parallel rays will be at the diſtance of half the radius CV of the concavity of the mirror, from the vertex V, in the axis BV. After the ſame manner, a convex mirror is ſhewn to reflect the rays AE, DH, (*fig.* 9.) into EF, HF, as if they came diverging from a point *f* in the axis CV, which is half the radius CV diſtant from the vertex V. But ſince the rays do not actually come at, or from the focus *f*, it is called the imaginary or virtual focus. See FOCUS.

Parallel rays falling directly on a plane ſpeculum are reflected back upon themſelves; if they fall obliquely, they are reflected in the ſame angle, and parallel as they fell. Hence there is no ſuch thing, properly ſpeaking, as a focus belonging to a plane ſpeculum, neither real nor virtual.

The focus F, or *f*, of parallel rays, is called the ſolar focus; becauſe in that the image of the ſun is formed, and of all objects very remote. But the focus of any object ſituated near the mirror will have its diſtance from the vertex more or leſs than half the radius; the rule in all caſes being as follows:

Multiply the diſtance of the object into the radius of the mirror, and divide the product by the ſum of the radius and twice the diſtance of the object; the quotient will be the focal diſtance of a convex mirrour.

Again, for a concave mirror, the ſame product of the radius into the diſtance of the object, divided by the difference of radius, and twice the diſtance of the object, will give the focal diſtance VF or V*f*. And here we are to obſerve, that, as twice the diſtance of the object is leſſer or greater than the radius, ſo the focus will be poſitive or negative, that is, behind the glaſs or before it.

The image of the object is formed in the focus proper to its diſtance: And, ſince the writers on optics demonſtrate that the angles under which the object OB (*fig.* 10.) and its image IW are ſeen from the center or vertex of the mirror C are always equal, it follows, that the image IW will be always in proportion to the object OB, as the focal diſtance VF to the object's diſtance GV. The poſition of the object will be always erect at a poſitive focus, or behind the ſpeculum; diminiſhed by a convex, and magnified by a concave one. Hence, ſince a convex has but one, viz. an affirmative focus; ſo it can never magnify any object, howſoever poſited before it.

The poſition of the image in a negative focus, or that before the glaſs, will be ever inverted; and, if nearer the vertex than the center C, it will be leſs; if farther from it, it will be greater than the object; but in the center it will be equal to the object, and ſeem to touch it.

The image formed by a plane ſpeculum is erect; large as the life; at the ſame apparent diſtance behind the glaſs as the object is before it; and on the ſame ſide of the glaſs with the object. Thoſe properties render this ſort of mirror of moſt common uſe, viz. as a looking-glaſs.

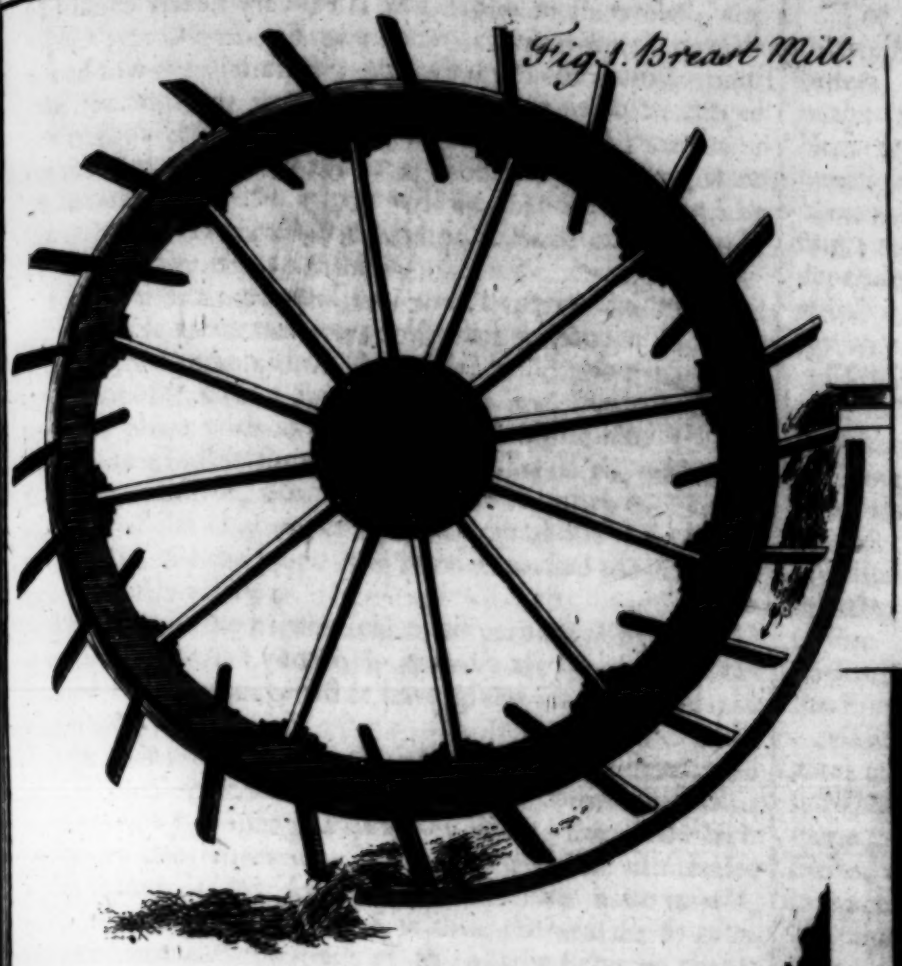
If the rays fall directly, or nearly ſo, on a plane mirror, and the object be opake, there will be but one ſingle image formed, or at leaſt be viſible; and that by the ſecond ſurface of the ſpeculum, and not by the firſt, through which the rays do moſt of them paſs.

But if the object be luminous, and the rays fall very obliquely on the ſpeculum, there will be more than one image formed, to an eye placed in a proper poſition to view them. The firſt image being formed by the firſt ſurface will not be ſo bright as the ſecond, which is formed by the ſecond ſurface. The third, fourth, &c. images are produced by ſeveral reflections of the rays between the two ſurfaces of the ſpeculum; and, ſince ſome light is loſt by each reflection, the images from the ſecond will appear ſtill more faint and obſcure, to the eighth, ninth, or tenth, which can ſcarcely be diſcerned at all.

Mirrors may be divided into plane, concave, convex, cylindrical, conical, parabolical, and elliptical.

The beſt manner of preparing convex mirrors hitherto known is given us by Wolfius, thus:

Fig 1. Breast Mill.



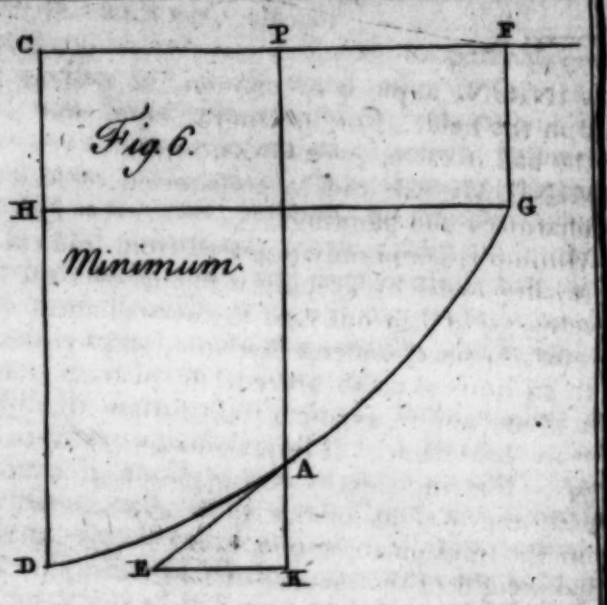


Fig 6.

Fig. 2. Elevation of a Powder Mill.

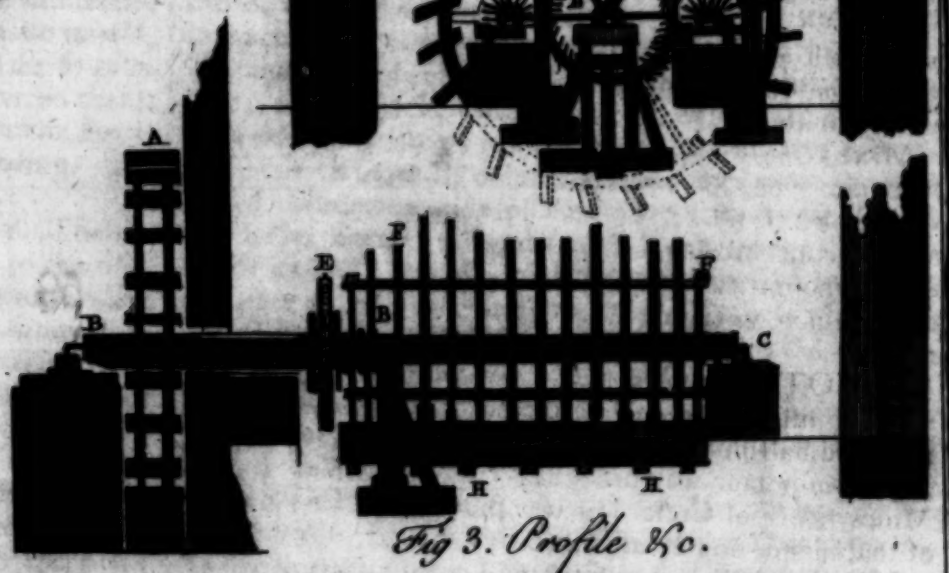


Fig 3. Profile &c.

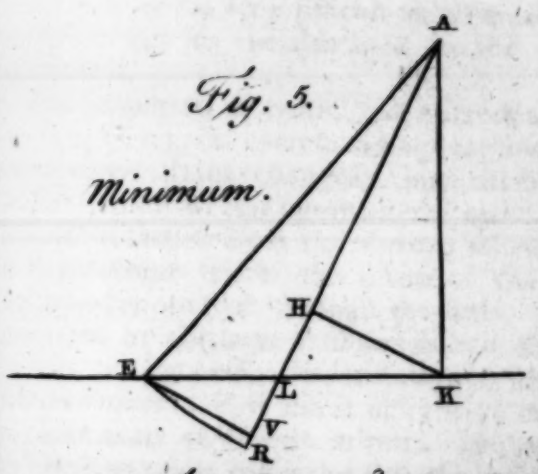


Fig. 5.

Minimum.

Fig. 4. Plan of a Powder Mill.

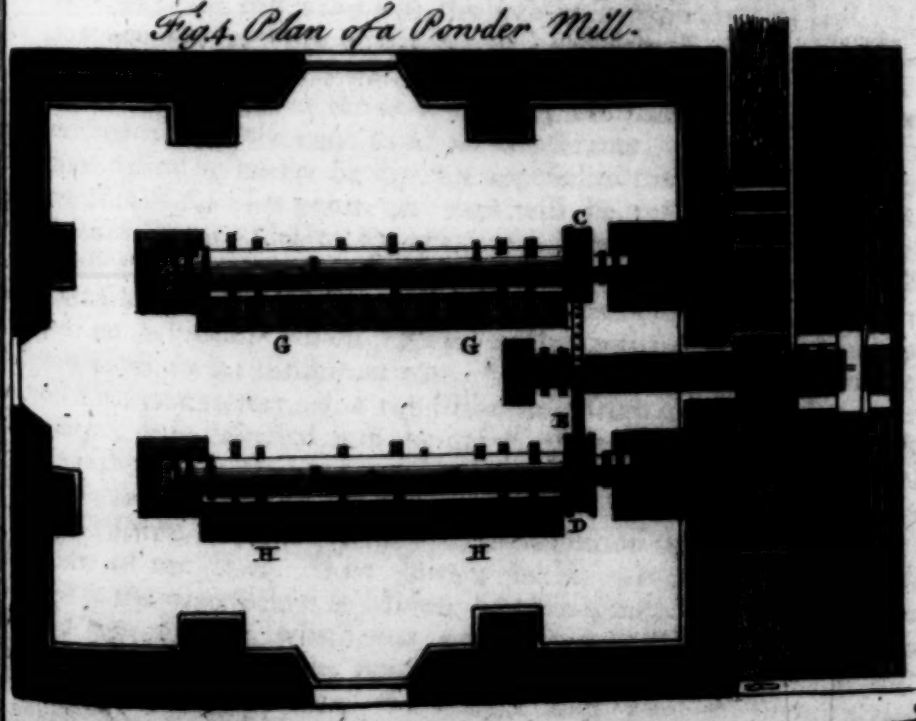
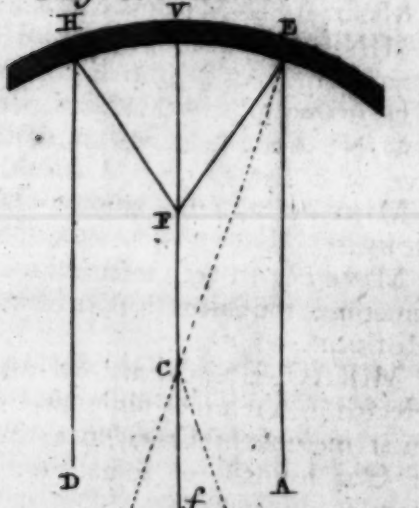


Fig. 8. Mirror.



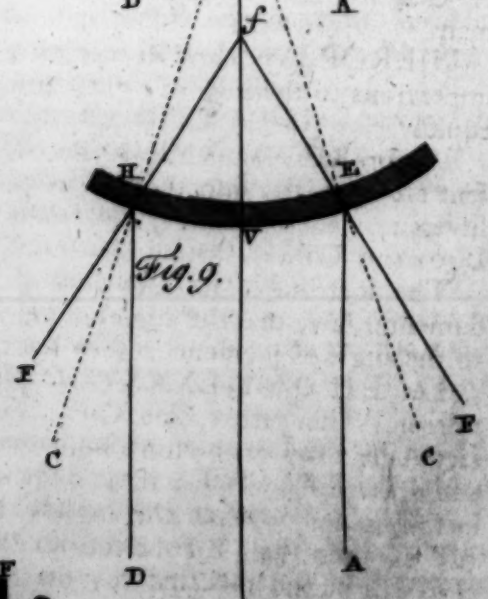


Fig. 9.

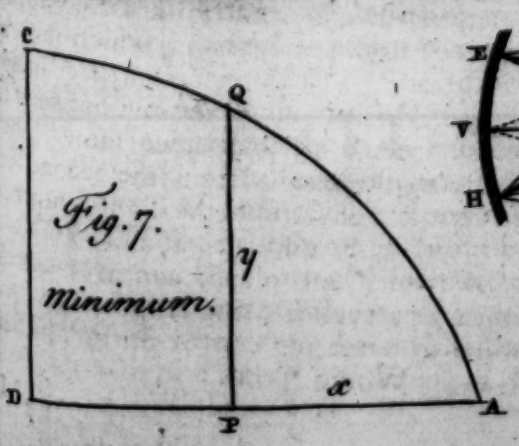


Fig. 7.

Minimum.

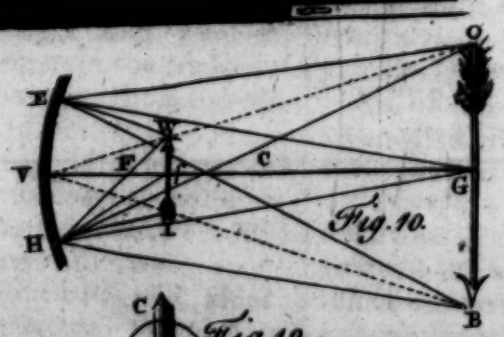


Fig. 10.

Fig. 12.

Fig. 11.

5 JA 59

Melt one part of tin, another of marcaſite, together; and to this maſs add two parts of mercury; as ſoon as the mercury begins to evaporate into ſmoke, the whole is to be thrown into cold water, and when well cooled, the water decanted off. Strain the mixture through two or three folds of linen cloth; and what is thus ſecreted pour into the cavity of a glaſs-ſphere, which is to be turned gently round its axis, till the whole ſurface be covered; the reſt being reſerved for future uſe. If the ſphere were of coloured glaſs, the mirror will be ſo too. And in like manner may conic, elliptic, cylindric, and other mirrors be made. See FOLIATING.

For elliptical, parabolical, and hyperbolical mirrors, the mould is to be thus prepared; on a wooden or braſs plane, deſcribe an ellipſis A B (*fig.* 11.), alſo a parabola or hyperbola, C D (*fig.* 12.); then cut out the figure from the plane with all the accuracy imaginable.

To the elliptic figure fit an axis, as E F, with two fulcra to ſuſtain it, &c. and a handle to move it. Lay a quantity of the clay under it, and turn about the axis by the handle, till the plane A B have impreſſed the elliptical figure exactly thereon.

The axis of the parabolical or hyperbolical figure C D is to be fixed at the vertex, ſo as to be always erect. This is to be turned about, till it have given its figure to the clay round it.

The part of the mould thus formed is to be dried, and then ſmeared over with fat, &c. then a convex mould is to be made by putting a quantity of the ſame clay into the cavity thus formed. The latter is called the male, as the former is the female mould. The male mould, when dry, is to be applied within the female ſo as to leave the intended thickneſs of the mirror between them. Theſe mirrors are very difficult to be made, as the figure thereof is apt to be damaged in the grinding. See GRINDING.

The properties of cylindrical mirrors are, 1. The dimenſions of objects correſponding lengthwiſe to the mirror are not much changed; but thoſe correſponding breadthwiſe have their figure altered and their dimenſions leſſened the farther from the mirror; whence ariſes a very great diſtortion. 2. If the plane of the reflection cut the cylindric mirror through the axis, the reflection is performed in the ſame manner as in a plane mirror; if parallel to the baſe, the reflection is the ſame as in a ſpherical mirror; if it cut it obliquely, the reflection is the ſame as in an elliptic mirror. Hence, as the plane of reflection never paſſes through the axis of the mirror, except when the eye and objective line are in the ſame plane; nor parallel to the baſe, except when the radiant point and the eye are at the ſame height; the reflection is therefore uſually the ſame as in an elliptic one. 3. If a hollow cylindric mirror be directly oppoſed to the ſun, inſtead of a focus of a point, the rays will be reflected into a lucid line parallel to its axis, at a diſtance ſomewhat leſs than a fourth of its diameter. Hence ariſes a method of drawing anamorphoſes, that is, wild deformed figures on a plane, which appear well proportioned, when viewed in a cylindric mirror.

In an elliptic mirror, if a ray ſtrike on it from one of its focuſes, it is reflected into the other.

In parabolic mirrors, as all the rays they reflect meet in one point, they make the beſt burning-glaſſes.

MISCHNA, or MISNA, the code or collection of the civil law of the Jews. The Jews pretend, that when God gave the written law to Moſes, he gave himſelf alſo another not written, which was preſerved by tradition among the doctors of the ſynagogue, till Rabbi Juda, ſurnamed the Holy, ſeeing the danger they were in, through their diſperſion, of departing from the traditions of their fathers, judged it proper to reduce them to writing.

MISDEMEANOUR, in law, ſignifies a heinous offence or fault, particularly in the execution of an office.

MISERERE MEI, in medicine, a name by which ſome call the iliac paſſion. See ILIAC PASSION.

MISLETOE, in botany, a buſhy evergreen plant; with woody branches variouſly interwoven; firm narrow leaves, narroweſt at the bottom, ſet in pairs; and imperfect white flowers in their boſoms, followed each by a tranſparent white berry containing a ſingle ſeed. It grows only on the trunks and branches of trees, and may be propagated by rubbing the glutinous berries on the bark that the ſeeds may adhere.

The leaves and branches of miſletoe, formerly recommended as ſpecifics in convulſive and other nervous diſorders, and now fallen into general neglect, do not appear to have any conſiderable medicinal power. Inſtances have indeed been produced of their ſeeming to prove beneficial: but as there are, perhaps, no diſorders whoſe nature is ſo little underſtood, whoſe cauſes are ſo various, and whoſe mitigations and exaſperations have leſs dependence upon ſenſible things; there are none in which medicines operate more precarioufly, and in which the obſerver is more liable to deception.

MISPRISION ſignifies in general, ſome neglect or over-ſight, as where a perſon is privy to a treaſon or felony committed by another, and neglects to reveal it to the king or his council, or to a magiſtrate, but entirely conceals them; this is called miſpriſion of thoſe crimes. In caſes of miſpriſion of treaſon, the offender is to be impriſoned for life, and to forfeit his goods and chattels, together with the profits of his lands, &c. but in miſpriſion of felony, the offender is only to be puniſhed with fine and impriſonment, and to remain in priſon till the fine is paid.

MISSAL, the Romiſh maſs-book, containing the ſeveral maſſes to be ſaid on particular days.

MISSEL-BIRD, in zoology, the common Engliſh name of the larger ſpecies of thruſh, called alſo the ſhrite, and by authors the turdus viſcivorus major. It is much larger than any other of the thruſh kind. Its legs and feet are yellow; its head of a browniſh lead colour; and its back, tail, and rump, of the ſame colour, with an admixture of yellow; but in the ſummer months it a little changes its colour, and becomes more grey, or of the colour of unripe pickled olives; its throat, breaſt, and belly, are all variegated with black ſpots; the middle of its belly whitiſh, and the upper part of its breaſt, and part of its ſides, and the under feathers of its tail yellowiſh. *Ray's Ornithology.*

MISSIONARIES, ſuch eccleſiaſtics as are ſent by any Chriſtian church, into pagan or infidel countries, to convert the natives, and eſtabliſh the Chriſtian religion among them.

MISSIVE, ſomething ſent to another, as miſſive letters, meaning letters ſent from one to another upon buſineſs, in contradiſtinction to letters of gallantry, points of learning, diſpatches, &c.

MIST, the ſame with fog. See FOG.

MITE, a ſmall coin formerly current, equal to about one third part of a farthing.

It alſo denotes a ſmall weight uſed by the moneyers. It is equal to the twentieth part of of a grain, and is divided into twenty-four doits.

MITHRIDATE, *Mithridatium*, in pharmacy, an antidote, in form of an electuary, chiefly againſt poiſon.

It is ſo called from its inventor Mithridates, king of Pontus; though its preſent form is different from what he made it.

It is one of the capital officinals, conſiſting of a vaſt number of ingredients, many of which might have been better left out, as they bear no affinity to the main deſign of the whole. It would make a much better medicine, if the other ingredients of the right intention were proportionably increaſed, ſo as to make the opium ſtill bear the ſame proportion to the whole.

MITHRIDATE is greatly uſed as a cordial, an opiate, and a ſudorific. Its doſe is from one ſcruple to two drachms, and is a much better medicine, as a cordial and alexipharmic, than the Venice treacle.

MITRALES-VALVULÆ, *Mitral Valves*, in anatomy, two valves ſituated in the left ventricle of the heart, at the ngreſs of the pulmonary vein, ſerving to hinder the ingreſs and regreſs of the blood from the heart into the veins again, while they are conſtricted. See the article HEART.

MITRE, a ſacerdotal ornament worn on the head by biſhops and certain abbots, on ſolemn occaſions; being a ſort of a cap, pointed and cleft at top.

MITTIMUS, as generally uſed, hath two ſignifications: 1. It ſignifies a writ for removing and transferring

ing of records from one court to another. 2. It ſignifies a precept or command in writing, under the hand and ſeal of a juſtice of the peace, directed to the goaler or keeper of ſome priſon, for the receiving and ſafe keeping of an offender charged with any crime, until he be delivered by due courſe of law.

MIXT, or MIXT BODY, in philoſophy and chemiſtry, that which is compounded of different elements or principles; in which ſenſe it ſtands contradiſtinguiſhed from ſimple or elementary, which is applied to bodies conſiſting of one principle only, as the chemiſts take ſulphur, ſalt, &c. to do. The buſineſs of chemiſtry is, to reſolve mixt bodies into their principles, or component parts.

MIXT ACTION, in law, is an action partly real and partly perſonal, which lies both for the thing detained, and againſt the perſon of the detainer. See the article ACTION.

MIXTURE, a compound, or aſſemblage of ſeveral different bodies in the ſame maſs.

MIZEN, the aftmoſt or hindmoſt ſtanding ſail in a ſhip of three maſts. We ſay ſtanding ſail, becauſe there can occaſionally be ſet ſeveral flying ſails behind it, as the driver, ringſail, &c.

The mizen is in ſhape a ſort of trapezia or oblong, peaked or ſloped at the upper end. It is ſometimes faſtened above to a gaff, and ſometimes to a yard; the gaff only reaches into the maſt, but the yard croſſes the maſt at oblique angles, the lower end reaching almoſt down to the deck.

MIZEN-MAST, the maſt on which the mizen is faſtened, which is the aftmoſt or hindmoſt in the ſhip. See the article MAST.

MIZEN-BRAILS.	See	BRAILS
MIZEN-JEARS.		JEARS
MIZEN-SHEET		SHEET
MIZEN-TOP		SHROWDS
MIZEN-SHROWDS		TOP
MIZEN-TOPMAST		TOP-MAST
MIZEN-TOPSAIL		TOP-SAIL
MIZEN-TOPGALLANT MAST		TOP-GALLANT-MAST
MIZEN-VANGS		VANGS
MIZEN-YARD		YARD.

MNEMONICS, an art invented for the aſſiſtance of the memory.

The word is derived from the Greek μνημονικος, ſomething relating to the memory, which is formed from μνημων, mindful; and that from μναομαι, to remember. See MEMORY.

MOAR-LOVRE, in huſbandry, a ſort of blight, which happens moſtly on light land, from the earth's ſinking away from the roots, ſo that the plants fall down to the earth.

To remedy this, they turn a ſhallow furrow againſt the rows, when they are ſtrong enough to bear it, and when the mould is fine and dry; for then the motion of the ſtalks by the wind, will cauſe ſuch earth to run through the rows, and ſettle about the roots, and cover them.

MOAT, or DITCH, in fortification, a deep trench dug round the rampart of a fortified place, to prevent ſurprizes.

The brink of the moat, next the rampart, is called the ſcarpe; and the oppoſite one, the counterſcarpe.

A dry moat round a large place, with a ſtrong garriſon, is preferable to one full of water; becauſe the paſſage may be diſputed inch by inch, and the beſiegers when lodged in it, are continually expoſed to the bombs, granades, and other fire-works, which are thrown inceſſantly from the rampart into their works. In the middle of dry moats, there is ſometimes another ſmall one, called cunette: which is generally dug ſo deep, till they find water to fill it.

The deepeſt and broadeſt moats are accounted the beſt, but a deep one is preferable to a broad one: the ordinary breadth is about twenty fathoms, and the depth about ſixteen.

To drain a moat that is full of water, they dig a trench deeper than the level of the water, to let it run off; and then throw hurdles upon the mud and ſlime, covering them with earth or bundles of ruſhes, to make a ſure and firm paſſage.

MOBILE, or PRIMUM MOBILE, the ninth ſphere in the Ptolemaic ſyſtem of aſtronomy. See the article PTOLEMAIC.

MODE, *Modus*, in philoſophy, denotes the manner of a thing's exiſtence, which is two-fold, viz. ſimple or mixed.

Simple modes are only combinations of the ſame ſimple idea: thus by adding units together, in diſtinct ſeparate collections, we come by all the ſeveral modes of numbers, as a *dozen*, a *ſcore*, a *thouſand*, &c. Mixed modes, on the contrary, are compounded of ſimple ideas of different kinds, as *beauty*, which conſiſts in a certain compoſition of colour and figure, cauſing delight in the beholder: ſuch alſo is *theft*, which is the concealed change of the poſſeſſion of a thing, without the conſent of the proprietor.

Immediate MODES are thoſe immediately attributed to their ſubjects, as motion in a body, knowledge, &c.

Mediate MODES are thoſe attributed to ſubjects by the intervention of ſome other mode, as ſwiftneſs and ſlowneſs, which are attributable to a body, only in reſpect of motion.

Eſſential or *Inſeparable* MODES are attributes without which the ſubſtance cannot ſubſiſt, as wiſdom, &c. in God, &c.

Non-eſſential or *Separable* MODES are attributes affecting created ſubſtances, and affixed thereto as long as is neceſſary, as coldneſs in water, &c.

Poſitive MODES are thoſe which give ſomething poſitive to their ſubſtance, as roundneſs in a globe.

Privative MODES are attributed to ſubjects, when the mind, perceiving ſomething wanting therein, frames a word which at firſt ſight ſeems to note ſomething poſitive, but in reality denotes the want of ſome mode.

MODES *of Spirit* are two, knowledge and willing.

MODES *of Body* are three, figure, reſt, and motion.

MODE, or MOOD *of Syllogiſms*, among logicians. See SYLLOGISM.

MODE, in muſic, the particular order of the concinnous degrees of an octave; the fundamental note whereof may be called the key, as it ſignifies that principal note which regulates the reſt.

The proper difference therefore, between a mode and a key is this, that an octave, with all its natural and concinnous degrees, is called a mode, with reſpect to the conſtitution or manner of dividing it; and, with reſpect to its place in the ſcale, it is called a key. Now it may be farther obſerved, that of the natural notes of every mode, three go under the name of the eſſential notes, namely, the fundamental, the third and fifth; their octaves being reckoned the ſame, and marked with the ſame letters in the ſcale; the reſt are called dependents: again, the fundamental is alſo called the final, the fifth the dominante, and the third, as being between the other two, the mediante.

MODERATOR, in the ſchools, the perſon who preſides at a diſpute, or in a public aſſembly: thus the preſident of the annual aſſembly of the church of Scotland is ſtiled moderator.

MODERATOR-RING, in anatomy, is uſed by Valſalva for that ring which the muſcles of the eye make round the optic nerve at the bottom of the orbit.

MODERN, in a general ſenſe, ſomething new, or of our time, in oppoſition to what is antique or ancient.

MODIFICATION, in philoſophy, that which modifies a thing, or gives it this or that manner of being.

Quantity and quality are accidents which modify all bodies. According to Spinoſa's ſyſtem, all the beings that compoſe the univerſe are only ſo many different modifications of one and the ſame ſubſtance; and it is the different arrangement and ſituation of their parts, that make all the difference between them.

MODILLIONS, in architecture, ornaments in the corniche of the Ionic, Corinthian, and Compoſite columns. See the articles IONIC, CORINTHIAN, and COMPOSITE.

The

The modillions are little inverted conſoles, or brackets, in form of an S under the ſoffit of the corniche, ſeeming to ſupport the projecture of the larmier; though in reality they are no more than ornaments. See plate LXXXIX. *fig.* 1.

They ought always to be placed over the middle of the column. They are particularly affected in the Corinthian order, where they are uſually enriched with ſculpture. Their proportions ought to be ſo adjuſted, as to produce a regularity in the parts of the ſoffits. The intermodillions, i. e. the diſtances between them, depend on the inner columns, which oblige the modillions to be made of a certain length and breadth, in order to render the intervals perfect ſquares, which are always found to have better effects than parallelograms. To this it muſt be added, that in adjuſting the modillions, care ſhould be taken that they have ſuch a proportion as that when the orders are placed over one another, there be the ſame number in the upper order as in the lower, and that they fall perpendicularly over one another.

Modillions are alſo uſed under the corniches of pediments, though Vitruvius obſerves, that they were not allowed in his time, becauſe modillions were intended to repreſent the ends of rafters. Daviler rather takes them for a kind of inverted conſoles, or corbels. The modillion is ſometimes called a mutule, though cuſtom has introduced a little difference between the idea of a modillion and a mutule; the mutule being peculiar to the Doric order, and the modillions to the higher orders. In the Ionic and Compoſite orders, modillions are more ſimple, having ſeldom any ornaments except ſometimes a ſingle leaf underneath. M. Le Clerc obſerves on the Corinthian order, that it is uſual to have a leaf that takes up their whole breadth, and almoſt their whole length too; but he is of opinion, that the modillions would be more graceful, if this leaf was leſs both in length and breadth.

MODIOLUS, in ſurgery, an inſtrument otherwiſe called a trepan. See the article TREPAN.

MODULATION, in muſic, the art of keeping in, or changing the mode or key. See the articles KEY and MODE.

MODULE, in architecture, a certain meaſure or bigneſs, taken at pleaſure, for regulating the proportions of columns, and the ſymmetry, or diſpoſition of the whole building. Architects generally chooſe the ſemi-diameter of the bottom of the column for their module, and this they ſubdivide into parts or minutes. The module of Vignola, which is a ſemi-diameter, is divided into twelve parts in the Tuſcan and Doric, and into eighteen for the other orders. The module of Palladio, Scamozzi, M. Cambray, Deſgodetz, Le Clerc, &c. which is alſo equal to the ſemi-diameter, is divided into thirty parts or minutes in all the orders. The whole height of the column is divided by ſome into twenty parts for the Doric, twenty-two and a half for the Ionic, twenty-five for the Roman, &c. and one of theſe parts is made a module to regulate the reſt of the building by.

There are two ways of determining the meaſures, or proportions of buildings. The firſt is by a fixt ſtandard-meaſure, which is uſually the diameter of the lower part of the column, called a module, ſubdivided into ſixty parts called minutes. In the ſecond there are no minutes, nor any certain or ſtated diviſion of the module, but it is divided occaſionally into as many parts as are judged neceſſary; thus the height of the Attic baſe, which is half the module, is divided either into three, to have the height of the plinth, or into four, for that of the greater torus; or into ſix, for that of the leſſer. Both theſe manners have been practiſed by the ancient as well as the modern architects, but the ſecond, which was that chiefly uſed among the ancients, is, in the opinion of M. Perrault, the preferable. As Vitruvius has leſſened his module in the Doric order, which is the diameter of the lower part of the other orders, and has reduced that great module to a mean one, which is the ſemi-diameter, the module is here reduced to the third part, for the ſame reaſon, viz. to determine the ſeveral meaſures without a fraction. For in the Doric order, beſides that the height of the baſe, as in the other orders, is determined by one of thoſe mean modules, the ſame module gives likewiſe the height of the capital, architrave, triglyphs, and metopes. But our little module, taken from the third of the diameter of the lower part of the column, has uſes much more extenſive; for by this the height of the pedeſtals or columns and entablatures in all the orders are determined without a fraction. As then the great module or diameter of the column has ſixty minutes, and the mean module, or half the diameter, thirty minutes, our little module has twenty.

MOERHINGIA, moſſy chickweed, in botany, a genus of plants, the flower of which is compoſed of four ſhort, undivided petals; and its fruit is a ſubgloboſe capſule, with one cell, in which are contained numerous round ſeeds.

MOHAIR, in commerce, a kind of ſtuff made of ſilk and hair.

MOINEAU, in fortification, is a flat baſtion raiſed between two other baſtions, when a re-entering angle before a curtain is too long. The moineau is commonly joined to the curtain, but it is ſometimes ſeparated from it by a foſs, in which caſe it is called a detached baſtion. The moineau is not raiſed ſo high as the works of the place, becauſe it ought to be expoſed to the fire of the place in caſe the enemy ſhould lodge themſelves in it.

MOISTURE, a term ſometimes uſed to denote animal fluids, the juices of plants, or dampneſs of the air or other bodies. See FLUID, JUICE, &c.

Radical MOISTURE, among phyſicians, ſignifies a vital fluid, which nouriſhes and maintains life, as oil does a lamp. However, Dr. Quincy obſerves, that ſuch a fluid is a mere chimera, unleſs we thereby mean the maſs of blood. See BLOOD.

MOLARES, or DENTES MOLARES, in anatomy, the large teeth, called in Engliſh grinders. See the article TEETH.

MOLE, *Talpa*, in zoology, makes a genus of quadrupeds, of the order of the feræ, thus characteriſed: the feet are formed like hands, and calculated for digging; and it has no external ears.

Of this genus there are two ſpecies: 1. The common mole, a well known little animal, of a bluiſh black colour; very miſchievous to the farmers, by throwing up the ground of their paſtures. 2. The pointed tail-leſs mole, ſomewhat larger than the common kind: it is of a mixed colour, in which a purpliſh and yelloviſh tinge ſeem the prevailing ones. It is a native of Aſia, and lives under ground, like the common mole.

MOLE, *Mola carnea*, in medicine, a maſs of fleſhy matter, of a ſpherical figure, generated in the uterus, or womb, and ſometimes miſtaken for a child. Its ſize is various, from that of a large nut to that of a fœtus. Some moles are ſoft and ſpongy, and others membranous, with a cavity in the middle. Sometimes they are filled with ſerous matter, and ſometimes with hydatides.

The ſymptoms of a mole, at firſt, are like thoſe of a real pregnancy; but afterwards they vary; for the woman feels a dull heavy weight, like that of a ball of lead; her belly being round and ſpherical, without any motion like that of a living fœtus.

The mole itſelf threatens no danger, all the difficulty lying in being delivered of it. Some women are troubled with them for ſeveral years, and others all their life, without any other inconvenience than uneaſineſs and weight.

The cure conſiſts in expelling the mole; for which purpoſe the aſſiſtance of an expert midwife or ſurgeon becomes neceſſary. If the mouth of the uterus ſhould be too ſtrongly contracted to admit the hand of the operator, it is proper to excite the woman's throws by briſk cathartics and ſtrong clyſters; while the os uteri, and parts adjacent, are in the mean time gradually relaxed by the application of emollient fomentations, &c. which done, one or two of the fingers are to be firſt gently inſinuated, and then the whole hand by degrees, in order to extract the mole, as directed for the fœtus. See the article DELIVERY.

If the mole adheres to the uterus, as it frequently does, it is to be gently ſeparated before extraction; and if it be too large to be got out entire, it may be carefully ſeparated and extracted in pieces, either with the fingers, or a falciform hook. To conclude, ſays Heiſter, if a mole does

not occaſion any bad ſymptoms, or uneaſineſs in the mother, and its extraction appears difficult, no violence ſhould be uſed; ſince we have many inſtances of moles retained in the uterus, without any great detriment to the patient, as long as they lived.

MOLE, *Moles*, is alſo a maſſive work of large ſtones laid in the ſea by means of coffer-dams; extending before a port, either to defend the harbour from the impetuoſity of the waves, or to prevent the paſſage of ſhips without leave.

MOLE, *Moles*, in antiquity, a kind of mauſoleum, in form of a round tower, built upon a ſquare baſe.

MOLE, a ſort of harbour, wherein ſhipping may ride ſheltered from the winds and ſeas: it is formed by erecting a mole-head; theſe are not frequent in Great-Britain or Ireland, but are more common in the Mediterranean, as Leghorn-mole, Algiers-mole, Alexandria-mole, &c.

MOLE-HEAD, a ſort of pier, mound, or artificial iſthmus, built athwart the outer-part of a little bay, and joining to ſome head or iſland, to form a retreat for ſhipping.

MOLE-HILLS. — Theſe little hillocks of earth are a very great prejudice to the paſture lands, not only waſting ſo much of the land as they cover, but hindering the ſcythe in mowing. In the weſt of England, they uſe a peculiar inſtrument for the breaking up of theſe; it is a flat board, very thick, and of about eight inches in diameter, into which there is faſtened a perpendicular handle of three or four feet long. It has four broad and ſharp iron teeth at the front, which readily cut through the hill, and ſpread the earth it conſiſts of; and behind there is a very large knob, proper for breaking the clods with, if there are any. Some uſe a ſpade, or other common inſtrument, in the place of this, but not ſo well. There is, however, a much better inſtrument even than this, for deſtroying theſe hills, where they are in very great numbers. This is a kind of horſe machine; it has a ſharp iron about three feet over, and with a ſtrong back. It is about four or five inches broad, and has two long handles for a horſe to be harneſſed to, and a croſs bar of iron to ſtrengthen it at the bottom of the handles, reaching from one handle to the other. The middle of this croſs-bar is furniſhed with one, two, or more, ſharp pieces of iron, like ſmall plough-ſhares, to cut the mole-hills into two, three, or more parts. The iron behind is of a ſemicircular figure. A ſingle horſe is harneſſed to this machine, and a boy muſt be employed to drive it, and a man to hold and guide it; the ſharp irons or ſhares are the firſt thing that meets the hills; they run through it, break its texture, and cut it into ſeveral parts, and the circular iron, following immediately behind them, cuts up the whole by the roots, and leaves the land level. This inſtrument will deſtroy as many mole-hills in one day as a common labourer can in eight, and would be of very great advantage to the kingdom, if brought into general uſe. *Mortimer's Huſbandry.*

MOLLUGO, baſtard-madder, in botany, a plant without any flower-petals: its fruit is a capſule of a ſomewhat oval figure, with three cells; in each of which there are a number of kidney-ſhaped ſeeds.

MOLOSSES, in commerce, the thick fluid matter remaining after the ſugar is made, reſembling ſyrup. See SUGAR.

MOLOSSUS, in Greek and Latin poetry, a foot compoſed of three long ſyllables, as *delectant*.

MOLTING, the change of feathers, hair, or horns, in birds and beaſts. See MEWING.

MOLUCCA-BEANS, *Moluccella*, in botany, a genus of plants, the flower of which is monopetalous and labiated; the upper-lip being entire, and the lower one trifid: the ſeeds are turbinated, and contained in the bottom of the cup.

MOMENT, in the doctrine of time, an inſtant, or the moſt minute and indiviſible part of duration. See TIME.

Strictly ſpeaking, however, a moment ought not to be conſidered as any part of time, but only as the termination or limit thereof.

MOMENT, in the doctrine of infinites, denotes the ſame with infiniteſimal. See INFINITESIMAL.

Leibnitz, and other foreigners, call theſe moments differences. See CALCULUS DIFFERENTIALIS.

MOMENT, *Momentum*, in mechanics, ſignifies the ſame with impetus, or the quantity of motion in a moving body; which is always equal to the quantity of matter, multiplied into the velocity; or, which is the ſame thing, it may be conſidered as a rectangle under the quantity of matter and velocity. See MOTION.

MOMORDICA, the wild cucumber, in botany, a genus of plants, with a monopetalous flower, divided into five ſegments; the fruit is an apple, burſting open with great elaſticity, and containing a number of compreſſed ſeeds.

This genus comprehends the momordica and luffa of Tournefort, and the elaterium of Boerhaave; and indeed the elaterium of the ſhops, a violent purge, is the fruit of this plant.

MONADELPHIA, in botany, a claſs of plants, the ſixteenth in order, ſo called becauſe the ſtamina of the flowers are ſo interwoven as to form one body; or rather, becauſe the ſtamina are connected, or coaleſce at the baſe. See BOTANY.

MONANDRIA, in botany, a claſs of plants, the firſt in order, with only one ſtamen, or male part, in each flower.

The monandria are ſubdivided into two orders, which are denominated monandria-monogynia, and monandria-digynia, according as they contain one or two ſtyles. See the article STYLE.

MONARCHY, a government in which the ſupreme power is inveſted in a ſingle perſon. There are ſeveral kinds of monarchies, as where the monarch is inveſted with an abſolute power, and is accountable to none but God. It is an error to ſuppoſe, that a deſpotic or abſolute monarch is a ſoleciſm in politics, and that there can be none ſuch legally; for the contrary is true, and that in different parts of the world, and from various principles. In China it is founded on paternal authority, and is the baſis of the government; in Turky, Perſia, Barbary, and India, it is the effect of religion; and in Denmark, the king is legally abſolute by the ſolemn ſurrender which the people made to his predeceſſor of their liberties. Another kind of monarchy is that which is limited, where the ſupreme power is virtually in the laws, though the majeſty of government, and the adminiſtration, is veſted in a ſingle perſon. Monarchies are alſo either hereditary, where the regal power deſcends immediately from the poſſeſſor to the next heir by blood; or elective, where the choice depends upon all who enjoy the benefit of freedom, as in Poland; or upon a few perſons in whom the conſtitution veſts the power of election, as in the German empire. See KING and GOVERNMENT.

MONASTERY, a convent, or houſe built for the reception and entertainment of monks, mendicant friars, or nuns, whether it be an abbey, priory, &c.

Monaſteries are governed by different rules, according to the different regulations preſcribed by their founders. The firſt regular and perfect monaſteries were founded by St. Pachomius in Egypt; but St. Baſil is generally conſidered as the great father and patriarch of the eaſtern monks; ſince in the fourth century he preſcribed rules for the government of the monaſteries, to which the Anachorets and Cœnobites, and the other ancient fathers of the deſarts ſubmitted. In like manner St. Benedict was ſtiled the patriarch of the weſtern monks; he appeared in Italy towards the latter end of the fifth century, and publiſhed his rule, which was univerſally received throughout the Weſt. St. Auguſtine being ſent into England by St. Gregory the pope, in the year 596, to convert the Engliſh, he at the ſame time introduced the monaſtic ſtate into this kingdom, which made ſuch progreſs here, that within the ſpace of two hundred years, there were thirty kings and queens who preferred the religious habit to their crowns, and founded ſtately monaſteries, where they ended their days in ſolitude and retirement.

MONASTIC, ſomething belonging to monks. See MONK.

MONDAY, *Dies Lunæ*, the ſecond day of the week, ſo called as being anciently ſacred to the moon, q. d. moon-day.

MONEY, *Moneta*, a piece of matter, commonly metal, to which public authority has affixed a certain value and weight, to ſerve as a medium in commerce.

The æra of the invention of money is not eaſily to be ſettled. There is no room to doubt but that in the earlieſt ages the ordinary way of traffic among men, was by trucking or exchanging one commodity for another; but in courſe of time it was found neceſſary, in the way of commutative juſtice, to have ſome common meaſure or ſtandard, according to which all things ſhould be eſtimated. See EXCHANGE.

Money is uſually divided into real and imaginary. Real money includes all coins, whether of gold, ſilver, copper, or the like; ſuch as guineas, crowns, piſtoles, pieces of eight, ducats, &c.

Imaginary money, or money of account, is that which has never exiſted, or at leaſt, which does not exiſt in real ſpecie; but is a denomination invented or retained to facilitate the ſtating of accounts, by keeping them ſtill on a fixed footing, not to be changed in current coins, which the authority of the ſovereign ſometimes raiſes or lowers, according to the exigencies of the ſtate, of which kinds are pounds, livres, marks, maravedies, &c.

Engliſh MONEY *of Account* is the pound, ſhilling, and pence; the firſt and laſt being imaginary money, and exchanges calculated in one of them two: the pound contains twenty ſhillings, and the ſhilling twelve pence.

Scotch MONEY *of Account* is the pound, ſhilling, and penny; the pound containing twenty ſhillings, being equivalent to one ſhilling and eight pence Engliſh; and the ſhilling containing twelve pennies, equal to a penny Engliſh. There is alſo among them an account of marks, the mark being equivalent to one ſhilling $1\frac{1}{3}$ penny Engliſh: of this laſt kind they had formerly a ſilver-coin.

French MONEY *of Account* is in livres, ſols, and deniers, of which twelve deniers make a ſol, and twenty ſols a livre: their exchange is by the crown of three livres, or ſixty ſols.

Dutch MONEY *of Account* is kept at Amſterdam and Rotterdam, the two chief trading places, in guilders, ſtivers, and penins; ſo that though goods are ſold for other ſpecie, ſuch as livre de gros, &c. yet all are reduced to the above denominations for the entries into their books. The exchanges are made with us in ſo many ſhillings to a pound ſterling, though in moſt other places in deniers-de-gros.

Spaniſh MONEY *of Account* is at Cadiz kept in rials of plate and its fractions; at Caſtile, in maravedies; at Valencia, in livres or dollars, ſueldos and dineros; of which laſt, twelve make a ſueldo, and twenty ſueldos a livre or dollar. Seventeen quartos at Cadiz and Caſtile make two rials vellon, which is now an imaginary coin, though formerly it was the principal one of the kingdom. A maravedie is another imaginary ſpecie, of which ſeventeen is reckoned to a rial vellon. The ducat is alſo a fictitious coin of eleven rials of plate in purchaſes, ſales, and other mercantile tranſactions, except in exchanges, when it is valued at eleven rials of plate and one maravedie, or 375 maravedies.

Portugueſe MONEY *of Account* is kept in reas, or rés, making a ſeparation at every hundred, thouſandth, &c. 800 reas go to a moidore.

German and Swiſs MONEY *of Account*. At Coningſberg, Elbing, and Dantzick, accounts are kept in rixdollars and gros, or in Poliſh guilders, gros, and deniers, or penins. They exchange on Amſterdam in Poliſh gros for a livre de gros of ſix guilders current money of Amſterdam, and on Hamburg for the rixdollar. At Lubeck, accounts are kept in marks, ſchellings, and deniers or penins-lubs, in which their exchanges are made. At Breſlaw, accounts are kept in rixdollars and ſilver gros and penins; in the firſt of which ſpecies exchanges are made on Amſterdam for a certain number of ſtivers, bank money, and on Hamburg for rixdollars of Breſlaw, againſt rixdollars of Hamburg bank. At Hamburg, accounts are kept in marks, ſchellings, and deniers-lubs bank money, by thoſe who have caſh in the bank; but by thoſe who have not, their books are generally kept in rixdollars, ſchellings, and denier current money. At Bremen, accounts are kept in rixdollars and gros, and it exchanges on Amſterdam rixdollars of ſeventy-two gros, for rixdollars of fifty ſtivers banco. At Leipſic and Naumbourg, accounts are kept in rixdollars, crowns, gros, and penins. At Berlin, and in all this kingdom, accounts are kept in guilders, gros, and penins. At Zurich, accounts are kept in rixdollars, worth about 4s. 6d. ſterling, at 108 of their creutzers. At Frankfort on the Maine, and Hanau, accounts are kept in rixdollars and creutzers. At Vienna, accounts are kept in guilders, creutzers, and penins, reckoning eight penins to a creutzer, and ſixty creutzers to a guilder. At Nuremberg and Augſbourg, accounts are kept in guilders, creutzers, and hellers; at Liege, in livres, ſols, and deniers.

In the canton of St. Gall, in Switzerland, accounts are kept in guilders, creutzers, and penins; or under the ſame denomination with the coins of the empire. In the canton of Baſil, accounts are variouſly kept, ſome in rixdollars, ſchellings, and deniers; ſome in livres, ſchellings, and deniers; ſome in rixdollars, creutzers, and penins; and ſome in guilders, creutzers, and penins.

Italian MONEY *of Account*. In the cities of Genoa and Novi, accounts are kept in livres, ſoldi, and denari; or in dollars of 100 ſoldis. At Milan, accounts are kept in livres, ſoldis, and denari, to be counted like pounds, ſhillings, and pence, viz. twelve denaris to a ſoldi, &c. At Rome, accounts are kept in crowns, julios, and bajoches, or grains and quartrins; the crown is divided into ten julios, and the julio into ten bajoches. At Leghorn, accounts are generally kept in dollars, ſoldi, and denari. At Florence, they keep their books and accounts in crowns, ſoldi, and denari, picoli or current money. At Naples, accounts are kept in ducats, florins, and grains. The accounts in Sicily are kept the ſame as at Naples. At Lucca they keep their accounts in crowns, livres, ſoldi, and denari; the crown is worth 7 livres 10 ſoldi; the livre, 20 ſoldi; and the ſoldi, 12 denari. At Venice, accounts are kept in livres, ſoldi, and denari, picoli or current; but the bank-entries are in livres, ſoldi, and groſſes: both the current and bank-ducats of Venice make 24 ſoldi, or 6 livres and four ſoldi. At Bologna, accounts are kept in livres, ſoldi, and denari; the livre being 20 ſoldi, and the ſoldi 12 denari. At Bergam, the money of account is the ſame as at Bologna, and its proportions the ſame. At Parma accounts are kept in crowns, ſoldi, and denari; the crown is 20 ſoldi, and the ſoldi 20 denari. At Modena and Mantua, accounts are kept in livres, ſoldi, and denari. In Savoy and Piedmont, accounts are kept in livres, or lires, ſoldi, and quartrins. At Placentia, accounts are kept in crowns, ſoldi, and denari of mark; of which 12 denari make a ſoldi, and 20 ſoldi the crown. In the iſland of Sardinia, accounts are kept as in moſt parts of Italy, in livres, ſoldi, and denari. In the iſland of Malta, the money of account is the ſame with that of Sicily. In the iſland of Candia, the account is the ſame as at Venice.

Ruſſian, Swediſh, Daniſh, and Poliſh MONEY *of Account*. In the trading places of the Ruſſian empire, accounts are kept in roubles, grives, and moſcoſques, or in roubles and coppecks; 10 coppecks, each of which is equal to two moſcoſques, make a grive, and 100 coppecks, or 10 grives, is a rouble. In the kingdom of Sweden, accounts are kept in dollars, marks, and oorts; the dollar being worth four marks, and the mark eight oorts. In Denmark, accounts are kept in marks and ſchellings; the rixdollar is worth ſix marks; the mark, 16 ſchellings; and the ſchelling, three penins. Accounts are kept at Bergen, and in other places in Norway, in Daniſh rixdollars, marks, and ſchellings. In Poland, accounts are kept in guilders, gros, and deniers, of which 18 deniers make a gros, and 30 gros a guilder: they here keep accounts alſo in rixdollars and gros, reckoning 90 of the latter to one of the former. At Riga, accounts are kept in rixdollars and gros, the former of which ſpecies conſiſts of 90 of the latter.

Turkiſh MONEY *of Account*. The Turks, both in Europe, Aſia, and Africa, account by purſes, either of ſilver or gold, the laſt being only uſed in the ſeraglio, with half purſes of gold, called alſo rizes: the purſe of ſilver is equal to 1500 French livres, or about 65 l. ſterling; and the half purſe in proportion: the purſe of gold is 15000 ſequins, equal to 30000 French crowns, or about 3750 l. ſterling: this is ſeldom uſed but for preſents to favourites, ſo that a purſe ſimply ſignifies a purſe of ſilver, or 1500 livres. The merchants alſo uſe Dutch dollars, called aſtani or abouquels, with medins and aſpers: the dollar

dollar is equal to 35 medins, and the medin to three aſpers; the aſper to a halfpenny ſterling money.

Aſiatic MONEYS *of Account* are as follow. In Perſia they account by the taman, called alſo man and tumein, and dinar-biſti; the taman is compoſed of 50 abaſſis, or 100 mamodies, or 200 chapes, or 10000 dinars; which, accounting the abaſſi on the foot of 18 French ſols, or the dinar on that of a denier, amounts to 3l. 12s. 6d. ſterling the taman. They alſo account by larins, eſpecially at Ormus, and on the coaſt of the Perſian gulph: the larin is equivalent to 11 d. ſterling; and on that footing is uſed alſo in Arabia, and through a great part of the Eaſt-Indies.

Chineſe MONEYS *of Account* are the pic, picol, and tael; which, though in effect weights, do likewiſe ſerve as money of account, obtaining in Tonquin as well as China: the pic is divided into 100 catis, ſome ſay 125; the cati into 16 taels, each tael equal to one ounce two drachms: the picol contains 66 ⅔ caties; the tael is equivalent to 6s. 8 d. ſterling.

Japoneſe MONEYS *of Account* are the ſchuites, cockiens, oebans or oubans, and taels: 200 ſchuites are equal to 500 Dutch pounds, the cockien equal to 10 Low-country pounds, 1000 oebans make 45000 taels.

Mogul MONEY *of Account*. At Surat, Agra, and the reſt of the eſtates of the great mogul, they uſe lacres, acrees, or leeths, implying one hundred thouſand; thus a lacre of rupees is 100,000 rupees; the lacre being nearly on the footing of the tun in Holland, and the million of France.

MONEYS *of Account* of other iſlands and coaſts of India. Throughout Malabar, and at Goa, they uſe tangas, vintins, and pardos-xeraphin; the tanga is of two kinds, viz. of good and bad alloy; hence their cuſtom is to count by good or bad money; the tanga of good alloy is better by one fifth than the bad, ſo that four tangas good being allowed the pardos-xeraphin, there will be required five of the bad; four vintins good make a tanga likewiſe good; fifteen barucos, a vintin; a good baruco is equal to a Portugueſe ree, a French denier, or one thirteenth of a penny ſterling. In the iſland of Java they uſe the ſonta, ſapacou, fardos, and catis; which laſt money, together with the leeth or lacre, is much uſed throughout all the Eaſt-Indies; the ſonta is 200 caxas, or little pieces of that country, hung on a ſtring, and is equal to eleven twelfths of a penny ſterling; five ſontas make the ſapacou. The fardos equal to 2 s. 8 d. ſterling; the cati contains 20 taels; the tael 6 s. 8 d. ſterling. There are iſlands, cities, and ſtates of the Eaſt-Indies, whoſe monies of account are not here expreſſed, partly becauſe reducible to ſome of the above-mentioned, and partly becauſe we find no certain conſiſtent account of them.

African MONEY *of Account*. From Cape Verd to the Cape of Good-Hope, all exchanges and valuations of merchandize are made on the foot of the macoute and piece; which, though no monies of account, for thoſe barbarians have no real monies, and therefore need imaginary ones to eſtimate them by, yet ſerve in lieu thereof. At Loango de Boirie, and other places on the coaſt of Angola, the eſtimations are made by macoutes; and at Malimbo and Cabindo, on the ſame coaſt, the negroes reckon by pieces: among the firſt the macoute is equal to 10 pieces; ten macoutes make 100, which likewiſe gives us a kind of imaginary money to eſtimate any purchaſe, exchange, &c. they fix on the one ſide the number of macoutes required; e. gr. for a negro; ſo that there are ſeveral bargains made for one; ſuppoſe, for inſtance, the ſlave to be fixed at 3500 pieces, this amounts to 350 macoutes in merchandize, they fix the price of each in macoutes. Two Flemiſh knives, e. gr. are accounted one macoute; a copper-baſon, 2 ℔ weight, three; a barrel of gunpowder, three, &c. For the piece, it ſerves in like manner to eſtimate the value of goods, duties, &c. on either ſide: thus the natives require ten pieces for a ſlave; and the Europeans put, for inſtance, a fuſee at one piece, a piece of ſalampours at four pieces, &c. The cities of Barbary and Egypt, whither the Europeans traffic, reckon much after the ſame manner as in the Levant, and the dominions of the grand ſignior; for the reſt, through that vaſt extent of coaſt where we trade for negroes, gold-duſt, elephants teeth, wax, leather, &c. either the inhabitants do not know what money of account is, or, if they have any, it is only what ſtrangers, ſettled among them, have introduced.

MONEYERS, MONEYORS, or MONIERS, officers of the mint, who work and coin gold and ſilver money, and anſwer all waſte and charges.

MONITORY LETTERS are letters of warning and admonition, ſent from an eccleſiaſtical judge, upon information of ſcandals and abuſes, within the cognizance of his court.

MONK, a perſon who wholly dedicates himſelf to the ſervice of religion, in ſome monaſtery, under the direction of ſome particular ſtatutes and rules.

The moſt probable account of the original of the monks is, that in the Decian perſecution, in the middle of the third century, many perſons in Egypt, to avoid the fury of the ſtorm, fled to the neighbouring deſarts and mountains, where they not only found a ſafe retreat, but alſo more time and liberty to exerciſe themſelves in acts of piety and divine contemplations; which ſort of life became ſo agreeable, that when the perſecution was over, they refuſed to return to their habitations again, chooſing rather to continue in thoſe cottages and cells, which they had made for themſelves in the wilderneſs. From that time to the reign of Conſtantine, monachiſm was confined to the hermits or anachorets, who lived in private cells in the wilderneſs; but when Pachomius had erected monaſteries, other countries preſently followed the example.

MONKEY, *Simia*, in zoology, a numerous genus of quadrupeds of the order of the anthropomorpha, or quadrupeds that reſemble the human figure: their face is naked; the claws are rounded and flattiſh, in ſome degree like the nails on the human hand; and they have both an upper and lower eye-lid.

Of all the animals of the monkey-kind, the ſatyr reſembles mankind moſt; its face is naked, and is very like that of an aged and not handſome man; it has no tail, and in other reſpects greatly reſembles the human form. The moſt like, next to this, is the oran-outang, or black-faced monkey, called the ſavage; and the next to this is the baboon, or whiſkered-ſimia, with a ſhort tail: the reſt of the monkeys, of which there are a great many kinds, differing widely both in ſize and figure, have nevertheleſs ſomething of the human aſpect; and as they are tractable animals, people make them walk erect with a ſtaff, and perform many tricks, to ſhew their reſemblance; but, in general, ſuch monkeys as have no tails, have more of this likeneſs than thoſe that have.

MONOCHORD, a muſical inſtrument, compoſed of one ſtring, uſed to try the variety and proportion of ſounds.

MONODY, in ancient poetry, a mournful kind of ſong, ſung by a perſon all alone, to give vent to his grief.

MONOECIA, in botany, one of Linnæus's claſſes of plants, the twenty-firſt in order; in which the male and female flowers are placed ſeparately on the ſame plant, or rather on different ſtalks growing from the ſame root.

Of the plants belonging to this claſs, ſome have only one ſtamen, and others have three, four, five, ſix, or more ſtamina; whence the ſubordinate orders of monoecia-monandria, monoecia-triandria, &c. others again are monadelphous, others ſyngeneſious, and others gynandrous.

MONOGRAM, a character or cypher, compoſed of one, two, or more letters, interwoven; being a kind of abbreviation of a name, anciently uſed as a ſeal, badge, arms, &c.

MONOLOGUE, a dramatic ſcene, in which a perſon appears alone on the ſtage, and ſpeaks to himſelf.

The word is derived from the Greek, μονος, alone, and λογος, diſcourſe.

MONOMIAL, in algebra, a root or quantity, that has only one name or member, as ab, aab, &c.

A monomial may be either rational or irrational.

MONOPETALOUS, in botany, is applied to flowers that have only one undivided leaf.

The word is derived from the Greek μονος, alone, and πεταλον, a leaf.

MONOPOLY, in commerce, denotes when a perſon makes himſelf ſole maſter of a commodity, manufacture, &c. in order to enhance the price thereof.

The word is derived from the Greek μονος, alone, and πωλεω, to ſell.

There are two kinds of monopoly, when a perſon buys up corn, &c. to retail it again at an advanced price; or when a patent is procured, prohibiting any other perſon to ſell a certain commodity but the patentee.

MONOPTERE, in architecture, a kind of temple, round, and without walls, having a dome ſupported by columns.

MONOPTOTON, in grammar, a noun that has only one caſe, as *inficias*.

MONOPYRENEOUS, in botany, ſuch fruit as contains only one ſeed or kernel.

MONORHYME, a piece of poetry, in which all the verſes end with the ſame rhyme.

MONOSTICH, an epigram that conſiſts of only one ſingle verſe.

MONOSYLLABLE, in grammar, a word that conſiſts of only one ſyllable, and is compoſed of either one or more letters pronounced at the ſame time.

MONOTHELITES, a ſect of Chriſtians in the ſeventh century, ſo called from their maintaining that, though there were two natures in Jeſus Chriſt, the human and divine, there was but one will, which was the divine.

MONOTONY, an uniformity of ſound, or a fault in pronunciation, when a long ſeries of words are delivered in one unvaried tone.

MONSOON, in phyſiology, a ſpecies of trade-wind, in the Eaſt-Indies, which for ſix months blows conſtantly the ſame way, and the contrary way the other ſix months. See WIND.

MONTH, *Menſis*, in chronology, the twelfth part of a year. See YEAR.

Time being duration, marked out for certain uſes, and meaſured by the motion of the heavenly bodies, there thence reſults divers kinds of months as well as years, different from one another, according to the particular luminary by whoſe revolution they are determined, and the particular purpoſes they are deſtined for; hence months are of two kinds, aſtronomical and civil.

An aſtronomical month is that which is governed either by the motion of the ſun or moon, and is conſequently of two kinds, ſolar and lunar: a ſolar month is that time, in which the ſun ſeems to run through a whole ſign, or the twelfth part of the ecliptic.

Hence, if regard be had to the ſun's true apparent motion, the ſolar month will be unequal, ſince the ſun is longer in paſſing through the winter-ſigns than through thoſe of the ſummer; but as he conſtantly travels through all the twelve ſigns in 365 days, 5 hours, and 49 minutes, the quantity of a mean month will be had, by dividing that number by 12; on this principle, the quantity of a ſolar month will be found to be 30 days, 10 hours, 29 minutes, 5 ſeconds. See EARTH.

A lunar month is that ſpace of time which the moon takes up in performing its courſe through the zodiac, or that meaſured by the motion of the moon round the earth; and is of three kinds, viz. periodical, ſynodical, and that of illumination. The lunar periodical month is the ſpace of time wherein the moon makes her round through the zodiac, or wherein ſhe returns to the ſame point, being 27 days, 7 hours, 43 minutes, 5 ſeconds. See MOON.

The lunar ſynodical month, called alſo abſolutely the lunar month and lunation, is the ſpace of time between two conjunctions of the moon with the ſun; or the time it takes from one conjunction with the ſun to the next; or from one new moon to another: the quantity of a ſynodical month is 29 days, 12 hours, 44 minutes, 3 ſeconds, and 11 thirds. The quantity of a ſynodical month is not the ſame at all times, for in the ſummer ſolſtice, when the ſun ſeems to move ſloweſt, the ſynodical month appeareth leſs, being about 29 days, 6 hours, 42 minutes; but in the winter, when the ſun's motion ſeems faſter, the moon does not fetch up the ſun ſo ſoon, for which reaſon the ſynodical month then ſeems greater, viz. 29 days, 19 hours, and 37 minutes, according to the obſervation of the ſame aſtronomers: ſo that the firſt quantity given of the ſynodical month, is to be underſtood as to the mean motion. From what has been ſaid, it may eaſily appear that the difference between a periodical and ſynodical month is this; the firſt is called periodical in reſpect of the moon's orbit: but the ſynodical is ſo called in reſpect of its connection with the other luminary. Now after the time of its conjunction, the ſun does not continue in the ſame place of the zodiac, but moves forwards towards the eaſt; upon which it falls out that the moon, finiſhing its courſe, does not find the ſun again in the ſame place where it left him, he being removed almoſt a whole ſign from his former place; ſo that to overtake the ſun again, it plainly appears that a certain ſpace of time is requiſite beſides the periodical, which makes up the ſynodical month.

The ancient Romans made uſe of the lunar months, and made them alternately of 29 and 30 days; and they marked the days of each month by three terms, viz. calends, nones, and ides.

The lunar month of illumination, or appoſition, or illuminative month, is the ſpace from the firſt time of the moon's appearance after new moon, to her firſt appearance after the new moon following. The lunar month of illumination is not of any determined quantity, becauſe the moon appears ſometimes ſooner, and ſometimes later, after the conjunction; for which diverſity aſtronomers give us ſeveral reaſons, particularly the obliquity of the zodiac, the variable latitude of the moon, the apparent inequality of its motion, the different qualities of the ſummer and winter-air, &c. By this month, however, the Turks and Arabs go; and it is ſaid that the ancient Britons went by the phaſes of the moon.

A civil or political month conſiſts of a certain number of days, according to the laws and cuſtoms of the different countries wherein it is uſed, either having no regard to the ſolar or lunar months, as thoſe of the Egyptians in their equal year, of the Romans in the year of Romulus, &c. or coming pretty near to the ſolar aſtronomical month, as the Julian; or elſe the lunar aſtronomical, as the Jewiſh, Turkiſh, and others. The Britiſh and moſt European nations make twelve months in the year, viz. January, February, &c. See the articles JANUARY, &c.

Civil ſolar months are ſuch civil months as are accommodated to the aſtronomical months, or thoſe which are to conſiſt alternately of 30 and 31 days, excepting one month of the twelve, which, for every fourth year, conſiſted of 30 days, and for the other years of 29. This form of civil months was introduced by Julius Cæſar; but under Auguſtus the ſixth month, till then, from its place, called Sextilis, was denominated Auguſtus, in honour of that prince; and to make the compliment yet the greater, a day was added to it, ſo that it now conſiſts of 31 days, though till then it had only 30; to make up for which, a day was taken from February, ſo that from thenceforward it only conſiſted of 28 days, and every fourth year of 29; though before it had ordinarily conſiſted of 29 days, &c. and ſuch are the civil or calendar months which now obtain throughout Europe.

Civil lunar months are to conſiſt alternately of 29 and 30 days: thus will two civil months be equal to two aſtronomical ones, abating for the odd minutes, and conſequently the new moon will be hereby kept to the firſt day of each ſuch civil month, for a long time together. However, to make them keep conſtantly pace with the civil months, at the end of each 948 months, a month of 29 days muſt be added, or elſe every 33d month muſt conſiſt of 30 days. This was the month in civil or common uſe among the Jews, Greeks, and Romans, till the time of Julius Cæſar.

MONTPAGNOTE, or POST *of the Invulnerable*, in the military art, an eminence choſen out of the reach of the cannon of a place beſieged, where curious perſons poſt themſelves, to ſee an attack, and the manner of the ſiege, without being expoſed to any danger.

MONUMENT, in architecture, a building deſtined to preſerve the memory, &c. of the perſon who raiſed it, or for whom it was raiſed; ſuch are a triumphal arch, a mauſoleum, a pyramid, &c.

MONYCHA, among naturaliſts, an appellation given to animals with ſingle or undivided hoofs.

MOOD, or MODE, in logic, called alſo ſyllogiſtic mood, a proper diſpoſition of the ſeveral propoſitions of a ſyllogiſm, in reſpect of quantity and quality.

As in all the ſeveral diſpoſitions of the middle term, the propoſitions of which a ſyllogiſm conſiſts, may be either univerſal or particular, affirmative or negative; the due determination of theſe, and putting them together, as the laws of argumentation require, conſtitute what logicians call the moods of ſyllogiſms. Of theſe moods there are a determinate number to every figure, including all the poſſible ways in which propoſitions, differing in quantity or quality, can be combined, according to any diſpoſition of the middle term, in order to arrive at a juſt concluſion. There are two kinds of moods, the one direct, the other indirect.

The direct mood is that wherein the concluſion is drawn from the premiſes directly and immediately, as, "Every animal is a living thing, every man is a living animal; therefore, every man is a living thing." There are fourteen of theſe direct moods, four of which belong to the firſt figure, four to the ſecond, and ſix to the third. They are denoted by ſo many artificial words framed for that purpoſe, viz 1 Barbara, celarent, darii, ferioque. 4 Baralip, celantes, dabitis, fapeſino, friſeſom. 2 Ceſare, cameſtres, feſtino, baroco. 3 Darapti, felapton, diſamis, datiſi, bocardo, feriſon. The uſe and effect of which words lie wholly in the ſyllables, and the letters of which the ſyllables conſiſt; each word, for inſtance, conſiſts of three ſyllables, denoting the three propoſitions of a ſyllogiſm, viz. major, minor, and concluſion; add, that the letters of each ſyllable are either vowels or conſonants; the vowels are A, which denotes an univerſal affirmative; E, an univerſal negative; I, a particular affirmative; and O, a particular negative: thus Barbara is a ſyllogiſm or mood of the firſt figure, conſiſting of three univerſal affirmative propoſitions: Baralip, one of the fourth figure, conſiſting of two univerſal affirmative premiſes, and a particular affirmative concluſion. The conſonants are chiefly of uſe in the reduction of ſyllogiſms. See the articles FIGURE and REDUCTION.

The indirect mood is that wherein the concluſion is not inferred immediately from the premiſes, but follows from them by means of a converſion; as, "Every animal is a living thing, every man is an animal; therefore ſome living thing is a man."

MOOD, or MODE, in grammar, the different manner of conjugating verbs, ſerving to denote the different affections of the mind. See VERB.

Hence ariſe four moods, viz. the indicative, ſubjunctive, and imperative: of thoſe the three firſt are called finite moods, becauſe they define a certain perſon and number; but the fourth is called the infinite, becauſe in it there is no diſtinction of either perſon or number. See INDICATIVE, &c.

Some grammarians reckon five moods, viz. the indicative, ſubjunctive, optative, imperative, and infinitive; and ſome make ſix, dividing the optative into potential and optative. See the articles OPTATIVE and POTENTIAL.

MOON, *Luna*, ☽, in aſtronomy, a ſatellite, or ſecondary planet, always attendant on our earth.

Of the ſix primary planets, we find but three that are certainly attended with moons, viz. the earth, Jupiter, and Saturn; for though Mr. Short has given an account of a phænomenon that he obſerved ſome years ago, which ſeems extremely like a moon about Venus, yet, as it was never obſerved before nor ſince through the beſt of teleſcopes, it does not appear to be a moon: however, that the reader may uſe his own judgment, we refer him to the account given of it in the Philoſophical Tranſactions.

The diſtance of our moon from the earth is determined by her horizontal parallax, or the angle which the ſemidiameter of the earth ſubtends at the moon, viz. the angle AOC (plate LXXXIX. *fig.* 2) which is the difference between the true place of the moon's center O, when in the horizon, and the apparent place thereof, as viewed from the ſurface of the earth at A. The former is known by aſtronomical tables, the latter by obſervation: and the quantity of this difference or angle at a mean is $57' 12'' = AOC$.

If therefore we ſay, As the tangent of $57' 12''$ is to radius, ſo is $AC = 1$ to $CO = 60,1$; this will be the mean diſtance of the moon in ſemidiameters of the earth. Therefore, ſince one ſemidiameter of the earth contains 3982 miles, we have $3982 \times 60,1 = 239318,2 = CO$ the mean diſtance of the moon.

The moon's apparent ſemidiameter MO meaſures (at her mean diſtance) $15' 38'' = 938''$ by the micrometer, which is the quantity of the angle MCO. The earth's diameter therefore is to the moon's as $3432''$ to $938''$, that is, as 109 to 30, or as 3,63 to 1. Wherefore $\frac{30}{109} \times 7964 = 2192$ miles the moon's diameter.

Therefore the face of the earth, as it appears to the lunarians, is to the face of the moon, as it appears to us, as 109×109 to 30×30, viz. as 11881 to 900, or as 13,2 to 1. And the real bulk of the earth is to that of the moon as $109 \times 109 \times 109$ to $30 \times 30 \times 30$, viz. as 1295029 to 27000, that is, as 1295 to 27, or as 48 to 1 very nearly.

Sir Iſaac Newton mentions the atmoſphere about the moon, but other aſtronomers think there is reaſon (not to ſay a demonſtration) for the contrary: for, were there an atmoſphere of air like ours, it muſt neceſſarily obſcure the fixed ſtars in the moon's appulſe to them; but it has been obſerved that this never happens; on the contrary, they preſerve all their ſplendor to the moment of their occultation, and then diſappear inſtantaneouſly, and in the ſame manner they recover their light, when they appear again on the other ſide. And this I am very certain of from a remarkable occultation of Jupiter, which I obſerved with a good reflecting teleſcope from the beginning to the end with all the attention poſſible, becauſe I was very deſirous to be ſatisfied about that matter; and all the phænomena conſpired to convince me, there was nothing like an atmoſphere about the moon.

That the ſurface of the moon is not ſmooth or even, but diverſified with hills and vales, continents and ſeas, lakes, &c. any one would imagine who views her face through a large teleſcope. That ſhe has variety of hills and mountains is demonſtrable from the line which bounds the light and dark parts not being an even regular curve, as it would be upon a ſmooth ſpherical ſurface, but an irregular broken line, full of dents and notches, as repreſented in *fig.* 3. Alſo becauſe many ſmall (and ſome large) bright ſpots appear in the dark portion, ſtanding out at ſeveral ſmall diſtances from the boundary line; which ſpots in a few hours become larger, and at laſt unite with the enlightened portion of the diſk.

On the other hand, we obſerve many ſmall ſpots interſperſed all over the bright part, ſome of which have their dark ſides next the ſun, and their oppoſite ſides very bright and circular, which infallibly proves them to be deep, hollow, round cavities; of which there are two very remarkable ones near together on the upper part, and may be viewed exceeding plain, when the moon is about four or five days old.

To meaſure the height of a lunar mountain is a curious problem, and at the ſame time very eaſy to effect in the following manner. Let C (plate LXXXIX. *fig.* 4.) be the moon's center, EDB a ray of the ſun touching the moon's ſurface in D, and the top of a mountain in B. Draw CB and CD; the height of the mountain AB is to be found. With a micrometer in a teleſcope find what proportion the diſtance of the top of the mountain B, from the circle of illumination at D, bears to the diameter of the moon, that is, the proportion of the line DB to DF; and, becauſe DF is known in miles, DB will be alſo known in that meaſure.

Now admit that DB : DC :: 1 : 8, as in one of the hills it will be; then becauſe AC or DC the ſemidiameter of the moon is known to be 1096 miles, DB will be $\frac{1096}{8}$ or 137 miles; therefore the hypothenuſe BC will be found equal to 1104.5, from which ſubtract the radius AC, there remains 8.5 the height AB nearly. This mountain then, being $8\frac{1}{2}$ miles high, is near three times higher than the higheſt mountain on the earth.

Again, the cavities are proportionably large and deep. I have obſerved cavities in the moon more than the 100th part

part of the moon's diameter in breadth, which is about 200 miles upon the moon's ſurface; their depths appear likewiſe proportional. The lunar cavities therefore prodigiouſly exceed the height of the mountains; and conſequently the ſurface of the moon has but little ſimilitude to the ſurface of the earth in theſe reſpects.

Since the moon's ſurface appears to be ſo very mountainous and irregular, it has been a queſtion, how it comes to paſs that the bright circular limb of the diſk does not appear jagged and irregular, as well as the curve bounding the light and dark parts? In anſwer to this, it muſt be conſidered that, if the ſurface of the moon had but one row of mountains placed round the limb of the diſk, the ſaid bright limb would then appear irregularly indented; but ſince the ſurface is all over mountainous, and ſince the viſible limb is to be conſidered not as a ſingle curve line, but a large zone, having many mountains lying one behind another from the obſerver's eye, it is evident the mountains in ſome rows, being oppoſite to the vales in others, will fill up the inequalities in the viſible limb in the remoter parts, which diminiſh to the ſight and blend with each other, ſo as to conſtitute (like the waves of the ſea) one uniform and even horizon.

Whether there be ſeas, lakes, &c. in the moon, has been a queſtion long debated, but now concluded in the negative: for in thoſe large darker regions, which were thought to be ſeas, we view through a good teleſcope many permanent bright ſpots, as alſo caverns and empty pits, whoſe ſhadows fall within them, which can never be ſeen in ſeas or any liquid ſubſtance. Their dark and duſky colour may proceed from a kind of matter or ſoil which reflects light leſs than that of the other regions.

Theſe ſpots in the moon have continued always the ſame unchangeably, ſince they were firſt viewed with a teleſcope; though leſs alterations than what happen in the earth in every ſeaſon of the year, by verdure, ſnow, inundations, and the like, would have cauſed a change in their appearance. But, indeed, as there are no ſeas nor rivers in the moon, and no atmoſphere, ſo of courſe there can be no clouds, rain, ſnow, or other meteors, whence ſuch changes might be expected.

The aſtronomers have drawn the face of the moon, according as it is ſeen with the beſt teleſcopes; for which we are obliged to the accurate labours of the famous ſelenographers Florentius, Langrenus, John Hevelius of Dantzic, Grimaldus and Ricciolus, Italians; who have taken particular care to note all the ſhining parts of the moon's face, and, for the better diſtinguiſhing them, they have given to each part a proper name. Langrenus and Ricciolus have divided the lunar regions among the philoſophers and aſtronomers, and other eminent men: but Hevelius, fearing leſt the philoſophers ſhould quarrel about the diviſion of the lands, has ſpoiled them of this their property, and given the parts of the moon thoſe geographical names, that belong to the different iſlands, countries, and ſeas of our earth, without any regard to their ſituation or figure. See *fig.* 5.

Since, as we have ſhewn, the mean diſtance of the moon is about 60 ſemidiameters of the earth, at the diſtance of the moon one degree of the earth's ſurface will ſubtend an angle of one minute, and will therefore be viſible; but ſuch a deg. is equal to 69 ½ miles; therefore a ſpot or place 70 miles in diameter in the moon will be juſt viſible to the naked eye. Hence a teleſcope that magnifies about 100 times will juſt diſcover a ſpot whoſe diameter is $\frac{1}{100}$ of 70 miles, or $\frac{7}{10}$ of a mile, or 3698 feet: and a teleſcope that will magnify 1000 times will ſhew an object that is but $\frac{1}{1000}$ of a mile, that is, whoſe diameter is but 370 feet, or little more than 120 yards; and therefore will eaſily ſhew a ſmall town or village, or even a gentleman's ſeat, if any ſuch there be.

The time which the moon takes up in making one revolution about the earth, from a fixed ſtar to the ſame again, is 27 d. 7 h. 43′, which is called the periodical month. But the time that paſſes between two conjunctions, that is, from one new moon to another, is equal to 29 d. 12 h. 44′ 3″, which is called a ſynodical month: For, after one revolution is finiſhed, the moon has a ſmall arch to deſcribe to get between the ſun and the earth, becauſe the ſun keeps advancing forwards in the ecliptic. Now this ſurplus of motion takes up 2 d. 5 h. 1′ 3″, which added to the periodical month makes the ſynodical, according to the mean motions.

The moon moves about its own axis in the ſame time that it moves about the earth, from whence it comes to paſs that ſhe always ſhews the ſame face to us: for by this motion about her axis juſt ſo much of her ſurface is turned towards us conſtantly, as by her motion about the earth would be turned from us.

But ſince this motion about the axis is equable and uniform, and that about the earth, or common center of gravity, is unequal and irregular, as being performed in an ellipſis, it muſt follow, that the ſame part of the moon's ſurface preciſely can never be ſhewn conſtantly to the earth; and this is confirmed by the teleſcope, through which we often obſerve a little gore or ſegment on the eaſtern and weſtern limb appear and diſappear by turns, as if her body librated to and fro; which therefore occaſioned this phænomenon to be called the moon's libration.

The orbit of the moon is elliptical, more ſo than any of the planets, and is perpetually changing or variable, both in reſpect of its figure and ſituation; of which we ſhall treat more largely further on. The inclination of the moon's orbit to the plane of the ecliptic is alſo variable, from 5 degrees to 5° 18′. The line of nodes likewiſe has a variable motion from eaſt to weſt, contrary to the order of the ſigns, and compleats an entire revolution in a ſpace of time a little leſs than 19 years. Alſo the line of the apſides, or of the apogee and perigee, has a direct motion from weſt to eaſt, and finiſhes a revolution in the ſpace of about nine years. All which will be more copiouſly treated of when we come to explain the phyſical cauſes thereof.

The phaſes of the moon in every part of the orbit are eaſily accounted for from her different ſituation with reſpect to the earth and ſun: for though to an eye placed in the ſun ſhe will always exhibit a compleat illuminated hemiſphere, yet in reſpect to the earth, where that hemiſphere is viewed in all degrees of obliquity, it will appear in every degree from the greateſt to the leaſt; ſo that at E (*fig.* 6.) no part at all of the enlightened ſurface can be ſeen. At F a little part of it is turned towards the earth, and from its figure it is then ſaid to be horned. At G one half of the enlightened ſurface is turned to the earth, and ſhe is then ſaid to be dichotomiſed, and in her firſt quarter or quadrature. At H a part more than half is turned to the earth, and then ſhe is ſaid to be gibbous. At A her whole illuminated hemiſphere is ſeen, being then in oppoſition to the ſun; and this is called the full moon. At B ſhe is again gibbous, but on the other part; at C ſhe is again dichotomiſed, and in her laſt quarter; at D ſhe is horned, as before; and then becomes new again at E, where ſhe is in conjunction with the ſun.

If MN (*fig.* 7.) be drawn perpendicular to the line SL joining the centers of the ſun and moon, and OP perpendicular to the line TL joining the centers of the earth and moon, it is evident the angle OLM in the firſt half of the orbit, and PLN in the ſecond, will be proportional to the quantity of the illuminated diſk turned towards the earth; and this angle is every-where equal to the angle ETL, which is called the elongation of the moon from the ſun.

To find what quantity of the moon's viſible ſurface is illuſtrated for any given time, we are to conſider that the circle of illumination BFC (*fig.* 8.) is oblique to the view every-where (but at quarter and full), and therefore by the laws of the orthographic projection (which ſee under the article *Orthographic* PROJECTION) it will be projected into an ellipſe whoſe longeſt axis is the diameter of the moon BC, and the ſemi-conjugate is FL = coſine of the angle of elongation FBP. Hence FP = verſed ſine of the ſaid angle. But from the nature of the circle and ellipſe we have LP in a conſtant ratio to FP, wherever the line PO is drawn perpendicular to B; therefore alſo 2 LP = PO has a conſtant ratio to FP. But (by Euclid V. 12.) the ſum of all the lines OP = area of the circle is to the ſum of all the lines FP = area of the illuminated part, as the diameter of the circle OP to the verſed ſine of the elongation FP.

As the moon illuminates the earth by a reflex light, ſo does

does the earth the moon; but the other phænomena will be different for the moſt part. We ſhall inſert them for the reader's curioſity as follows. (1.) The earth will appear but to little more than one half of the lunar inhabitants. (2.) To thoſe to whom the earth is viſible, it appears fixed, or at leaſt to have no circular motion, but only that which reſults from the moon's libration. (3.) Thoſe who live in the middle of the moon's viſible hemiſphere ſee the earth directly over their heads. (4.) To thoſe who live in the extremity of that hemiſphere the earth ſeems always nearly in the horizon, but not exactly there, by reaſon of the libration. (5.) The earth in the courſe of a month would have all the ſame phaſes as the moon has. Thus the lunarians, when the moon is at E (*fig.* 9.) in the middle of their night, ſee the earth at full, or ſhining with a full face; at G it is dichotomiſed, or half light and half dark; at A it is wholly dark, or new; and at the parts between theſe it is gibbous. (6.) The earth appears variegated with ſpots of different magnitudes and colours, ariſing from the continents, iſlands, oceans, ſeas, clouds, &c. (7.) Theſe ſpots will appear conſtantly revolving about the earth's axis, by which the lunarians will determine the earth's diurnal rotation, in the ſame manner as we do that of the ſun.

To find the Age, or change of the MOON.

Janus 0, 2, 1, 2, 3, 4, 5, 6,
8, 8, 10, 10, theſe to the epact fix,
The ſum, bate 30, to the month's day add,
Or take from 30, age, or change, is had.

EXAMPLE. March 10, 1752.

Ep. = 14
1 = N° of the month.
15
10 = day of the month.
25 days = moon's age.

30
15
15 March = change.

To find the Time of the MOON's *coming to the South, and of High-Water at* London-Bridge.

Four times the moon's age, if by 5 you divide,
Gives the hour of her ſouthing; add 2 for the tide.

EXAMPLE. Moon's age = 9 days.

4
5) 36 (7 H.
1
12 M. = $\frac{1}{5}$ H.

7 H. 12 M. p. m. = ſouthing.
2
9 12 = high water.

To find the Time of the MOON's *beginning to ſhine.*—Multiply her age, if under 15, by 48, and divide the product by 60; the quotient gives the hour, and the remainder the minute. If her age be above 15 days, ſubtract the time thus found from 24; the remainder gives the time of ſhining in the morning.

The great Sir Iſaac Newton's *Theory of the* MOON.—By this theory what by all aſtronomers was thought moſt difficult and almoſt impoſſible to be done, the excellent Sir Iſaac Newton hath effected; viz. to determine the moon's place even in her quadratures and all other parts of her orbit, beſides the ſyzygies, ſo accurately by calculation, that the difference between that and her true place in the heavens ſhall ſcarce be two minutes, and is uſually ſo ſmall, that it may well enough be reckoned only as a defect in the obſervation. And this Sir Iſaac Newton experienced by comparing it with very many places of the moon, obſerved by Mr. Flamſteed, and communicated to him.

The royal obſervatory at Greenwich is to the weſt of the meridian of Paris 2 degrees 19 minutes. Of Uraniburgh 12 degrees, 51 minutes, 30 ſeconds. And of Dantzic 18 degrees, 48 minutes.

The mean motions or places of the ſun and moon accounted from the vernal equinox, at the meridian of Greenwich, I make to be as followeth.

The laſt day of December 1680, at noon (old ſtile) the mean motion or place of the ſun was 9 ſigns, 20 degrees, 34 minutes, 46 ſeconds. Of the ſun's apogee, was 3 ſigns, 7 degrees, 23 minutes, 30 ſeconds.

The mean motion or place of the moon at that time was 6 ſigns, 1 degree, 45 minutes, 45 ſeconds. And of her apogee, 8 ſigns, 4 degrees, 28 minutes, 5 ſeconds. Of the aſcending node of the moon's orbit, 5 ſigns, 24 degrees, 14 minutes, 35 ſeconds, &c.

And on the laſt of December 1700, at noon, the mean motion or place of the ſun was 9 ſigns, 20 degrees, 43 minutes, 50 ſeconds. Of the ſun's apogee, 3 ſigns, 7 degrees, 44 minutes, 30 ſeconds. The mean motion or place of the moon was 10 ſigns, 15 degrees, 19 minutes, 50 ſeconds. Of the moon's apogee, 11 ſigns, 8 degrees, 18 minutes, 20 ſeconds. And of her aſcending node, 4 ſigns, 27 degrees, 24 minutes, 20 ſeconds. For in 20 Julian years, or 7305 days, the ſun's motion is 20 revolutions, 0 ſigns, 0 degs. 9 minutes, 4 ſeconds; and the motion of the ſun's apogee 21 minutes, 0 ſeconds. The motion of the moon in the ſame time is 267 revolutions, 4 ſigns, 13 degrees, 34 minutes, 5 ſeconds; and the motion of the lunar apogee, is 2 revolutions, 3 ſigns, 3 degrees, 50 minutes, 15 ſeconds; and the motion of her node, 1 revolution, 0 ſigns, 26 degrees, 50 minutes, 15 ſeconds.

All which motions are accounted from the vernal equinox: wherefore if from each except the laſt (to which the motion of 16′ 40″ muſt be added becauſe the lunar nodes move in antecedentia) there be ſubtracted the receſſion or motion of the equinoctial point, in antecedentia, during that ſpace, which is 16 minutes, 40 ſeconds, there will remain the motions in reference to the fixed ſtars in 20 Julian years, viz. the ſun's 19 revolutions, 11 ſigns, 29 degrees, 52 minutes, 24 ſeconds. Of his apogee, 4 minutes, 20 ſeconds. And the moon's 267 revolutions, 4 ſigns, 13 degrees, 17 minutes, 25 ſeconds. Of her apogee, 2 revolutions, 3 ſigns, 3 degrees, 33 minutes, 35 ſeconds. And of the node of the moon, 1 revolution, 0 ſigns, 27 degrees, 6 minutes, 55 ſeconds.

According to this computation the tropical year is 365 days, 5 hours, 48 minutes, 57 ſeconds. And the ſydereal year is 365 days, 6 hours, 9 minutes, 14 ſeconds.

Theſe mean motions of the luminaries are affected with various inequalities, of which there are the annual equations of the aforeſaid mean motions of the ſun and moon, and of the apogee and node of the moon.

The annual equation of the mean motion of the ſun depends on the excentricity of the earth's orbit round the ſun, which is 16 $\frac{1}{2}$ of ſuch parts, as that the earth's mean diſtance from the ſun ſhall be 1000: whence it is called the equation of the center; and is, when greateſt, 1 degree, 56 minutes, 20 ſeconds.

The greateſt annual equation of the moon's mean motion is 11 degrees, 49 ſeconds; of her apogee, 20 minutes; and of her node 9 minutes, 30 ſeconds.

And theſe four annual equations are always mutually proportional one to another, wherefore, when any of them is at the greateſt, the other three will alſo be greateſt; and when any one leſſens, the other three will alſo be diminiſhed in the ſame ratio.

The annual equation of the ſun's center being given, the three other correſponding annual equations will be alſo given; and therefore a table of that will ſerve for all. For if the annual equation of the ſun's center be taken from thence, for any time, and be called P, and let $\frac{1}{15}$ P = Q, Q + $\frac{1}{65}$ Q = R, $\frac{1}{6}$ P = D, D + $\frac{1}{30}$ D = E, and D − $\frac{1}{60}$ D = 2 F; then ſhall the annual equation of the moon's mean motion for that time be R, that of the apogee of the moon will be E, and that of the node F.

Only obſerve here, that, if the equation of the ſun's center be required to be added, then the equation of the moon's mean motion muſt be ſubtracted, that of her apogee muſt be added, and that of her node ſubducted. And on the contrary, if the equation of the ſun's center were to be ſubducted, the moon's equation muſt be added, the equation of her apogee ſubducted, and that of her node added.

Facing Moon.

Fig. 1.

Modillions

of Scammozzi ils Plansond

ils Plansond of Vignola.

Fig. 2. Moon.

Fig. 3. Moon.

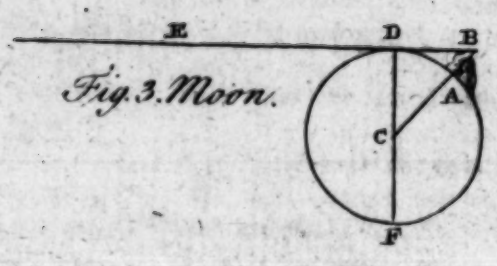


Fig. 4. Moon.

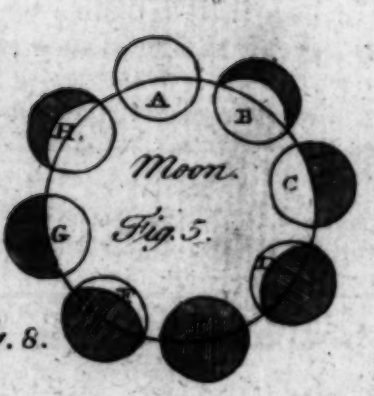


Fig. 8.

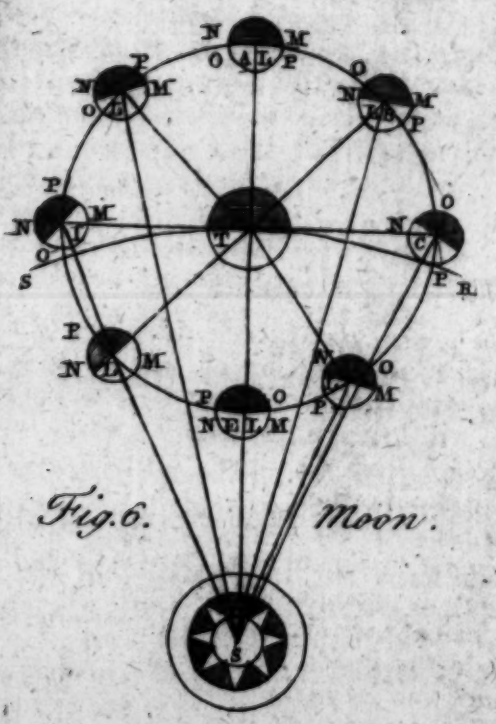
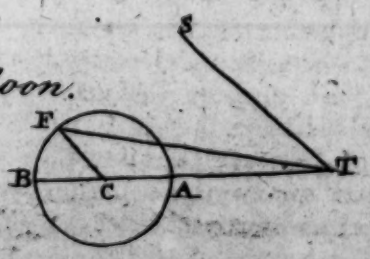


Fig. 6. Moon.

Fig. 7. Moon.

Fig. 10. Moon.

Fig. 9. Moon.



5 JA 59

There is alſo an equation of the moon's mean motion depending on the ſituation of her apogee, in reſpect of the ſun; which is greateſt when the moon's apogee is in an octant with the ſun, and is nothing at all when it is in the quadratures or ſyzygies. This equation, when greateſt and the ſun in perigæo, is 3 minutes, 56 ſeconds. But, if the ſun be in apogæo, it will never be above 3 minutes, 34 ſeconds. At other diſtances of the ſun from the earth, this greateſt equation is reciprocally as the cube of ſuch diſtance. But, when the moon's apogee is out of the octants, this equation grows leſs, and is to the greateſt equation (ſuppoſing the diſtance of the ſun from the earth to remain the ſame) as the ſine of the double diſtance of the moon's apogee from the next quadrature or ſyzygy to the radius.

This is to be added to the moon's motion, while her apogee paſſes from a quadrature with the ſun to a ſyzygy; but this is to be ſubtracted from it, while the apogee moves from the ſyzygy to the quadrature.

There is moreover another equation of the moon's motion which depends on the aſpect of the nodes of the moon's orbit with the ſun: and this is greateſt when her nodes are in octants to the ſun, and vaniſhes quite, when they come to their quadratures or ſyzygies. This equation is proportional to the ſine of the double diſtance of the node from the next ſyzygy, or quadrature, and at greateſt is but 47 ſeconds. This muſt be added to the moon's mean motion, while the nodes are paſſing from their ſyzygies with the ſun to their quadratures with him; but ſubtracted, while they paſs from the quadratures to the ſyzygies.

From the ſun's true place take the equated mean motion of the lunar apogee, as was above ſhewed, the remainder will be the annual argument of the ſaid apogee. From hence the excentricity of the moon and the ſecond equation of her apogee may be computed after the manner following (which takes place alſo in the computation of any other intermediate equations).

Let T (*fig.* 10.) repreſent the earth, T S a right line joining the earth and ſun, T A C B a right line drawn from the earth to the middle or mean place of the moon's apogee, equated as above: let the angle S T A be the annual argument of the aforeſaid apogee, T A the leaſt excentricity of the moon's orbit, T B the greateſt; biſſect A B in C, and on the center C, with the diſtance A C, deſcribe a circle A F B, and make the angle B C F = to the double of the annual argument. Draw the right line T F; that ſhall be the excentricity of the moon's orbit; and the angle B T F is the ſecond equation of the moon's apogee required.

In order to whoſe determination, let the mean diſtance of the earth from the moon, or the ſemidiameter of the moon's orbit, be 1000000; then ſhall its greateſt excentricity T A be 66782 ſuch parts; and the leaſt T A, 43319. So that the greateſt equation of the orbit, viz. when the apogee is in the ſyzygies, will be 7 degrees, 39 minutes, 30 ſeconds, or perhaps 7 degrees, 40 minutes (for I ſuſpect there will be ſome alteration according to the poſition of the apogee in Cancer or Capricorn). But, when it is in quadrature to the ſun, the greateſt equation aforeſaid will be 4 degrees, 57 minutes, 56 ſeconds; and the greateſt equation of the apogee 12 degrees, 15 minutes, 4 ſeconds.

Having from theſe principles made a table of the equation of the moon's apogee, and of the excentricities of her orbit to each degree of the annual argument, from whence the excentricity T F and the angle B T F (viz. the ſecond and principal equation of the apogee) may eaſily be had for any time required; let the equation thus found be added to the firſt equated place of the moon's apogee, if the annual argument be leſs than 90 degrees or greater than 180 degrees, and leſs than 270, otherwiſe it muſt be ſubducted from it; and the ſum or difference ſhall be the place of the lunar apogee ſecondarily equated; which being taken from the moon's place equated a third time ſhall leave the mean anomaly of the moon correſponding to any given time. Moreover from the mean anomaly of the moon, and before found excentricity of her orbit, may be found (by means of a table of equations of the moon's center made to every degree of the mean anomaly, and ſome excentricities, viz. 45000, 50000, 55000, 60000, and 65000) the proſtaphæreſis or equation of the moon's center, as in the common way: and this being taken from the former ſemicircle of the middle anomaly, and added in the latter to the moon's place thus thrice equated, will produce the place of the moon a fourth time equated.

The greateſt variation of the moon (viz. that which happens when the moon is in an octant with the ſun) is nearly reciprocally as the cube of the diſtance of the ſun from the earth; let that be taken 37 minutes, 25 ſeconds, when the ſun is in perigæo, and 33 minutes, 40 ſeconds, when he is in apogæo: and let the differences of this variation in the octants be made reciprocally as the cubes of the diſtances of the ſun from the earth; and ſo let a table be made of the aforeſaid variation of the moon in her octants (or its logarithms) to every 10th, 6th, or 5th diſtance of the mean anomaly: and for the variation out of the octants, make, as radius to the ſine of the double diſtance of the moon from the next ſyzygy or quadrature :: ſo let the aforeſaid variation in the octant be to the variation congruous to any other aſpect; and this added to the moon's place before found in the firſt and third quadrant (accounting from the ſun) or ſubducted from it in the ſecond and fourth, will give the moon's place equated a fifth time.

Again, as radius to the ſine of the ſum of the diſtances of the moon from the ſun, and of her apogee from the ſun's apogee (or the ſine of the exceſs of that ſum above 360 degrees) :: ſo is 2 minutes, 10 ſeconds, to a 6th equation of the moon's place, which muſt be ſubtracted, if the aforeſaid ſum or exceſs be leſs than a ſemicircle, but added, if it be greater. Let it be made alſo, as radius to the ſine of the moon's diſtance from the ſun :: ſo 2 degrees, 20 ſeconds, to a ſeventh equation: which, when the moon's light is increaſing, ſubtract, but when decreaſing, add; and the moon's place will be equated a ſeventh time, and this is her place in her proper orbit.

Note here, the equation, thus produced by the mean quantity 2 degrees, 20 ſeconds, is not always of the ſame magnitude, but is increaſed and diminiſhed according to the poſition of the lunar apogee. For if the moon's apogee be in conjunction with the ſun's, the beforeſaid equation is about 54 ſeconds greater. But when the apogees are in oppoſition, it is about as much leſs; and it librates between its greateſt quantity 3 minutes, 14 ſeconds, and its leaſt 1 minute, 26 ſeconds. And this is when the lunar apogee is in conjunction or oppoſition with the ſun's: but in the quadratures the aforeſaid equation is to be leſſened about 50 ſeconds, or 1 minute, when the apogees of the ſun and moon are in conjunction; but, if they are in oppoſition, for want of a ſufficient number of obſervations, I cannot determine whether it is to be leſſened or increaſed. And, even as to the augment or decrement of the equation 2 minutes, 20 ſeconds, abovementioned, I dare determine nothing certain, for the ſame reaſon, viz. the want of obſervations accurately made.

If the 6th and 7th equations are augmented or diminiſhed in a reciprocal ratio of the diſtance of the moon from the earth, i. e. in a direct ratio of the moon's horizontal parallax, they will become more accurate: and this may readily be done, if tables are firſt made to each minute of the ſaid parallax, and to every 6th or 5th degree of the augment of the 6th equation for the 6th, as of the diſtance of the moon from the ſun for the 7th equation.

From the ſun's place take the mean motion of the moon's aſcending node, equated as above; the remainder ſhall be the annual augment of the node, whence its ſecond equation may be computed after the following manner in the foregoing figure.

Let T, as before, repreſent the earth; T S a right line conjoining the earth and ſun: let alſo the line T A C B be drawn to the place of the aforeſaid node of the moon as above equated; and let S T A be the annual argument of the node. Take T A from a ſcale, and let it be to A B :: as 56 to 3, or as 11⅔ to 1. Then biſſect A B in C, and on C as a center, with the diſtance C A, deſcribe a circle as A F B, and make the angle B C F, equal to double the annual argument of the node before found: ſo ſhall the angle B T F be the ſecond equation of the aſcending node: which muſt be added when the node is paſſing from the

quadrature to a ſyzygy with the ſun, and ſubducted when the node moves from a ſyzygy towards a quadrature. By which means the true place of the node of the lunar orbit will be gained: whence, from tables made after the common way, the moon's latitude and the reduction of her orbit to the ecliptic may be computed, ſuppoſing the inclination of the moon's orbit to the ecliptic to be 4 degrees, 59 minutes, 35 ſeconds, when the nodes are in quadrature with the ſun; and 5 degrees, 17 minutes, 20 ſeconds, when they are in the ſyzygies.

And from the longitude and latitude thus found, and the given obliquity of the ecliptic 23 degrees, 29 minutes, the right aſcenſion and declination of the moon will be found.

The horizontal parallax of the moon when ſhe is in the ſyzygies at a mean diſtance from the earth, I make to be 57 minutes, 30 ſeconds; and her horary motion 33 minutes, 32 ſeconds, 32 thirds; and her apparent diameter 31 minutes, 30 ſeconds. But in her quadratures at a mean diſtance from the earth I make the horizontal parallax of the moon to be 59 minutes, 40 ſeconds; her horary motion 32 minutes, 12 ſeconds, 2 thirds; and her apparent diameter, 31 minutes, 3 ſeconds; the moon in an octant to the ſun and at a mean diſtance hath her center diſtant from the center of the earth about 60 $\frac{2}{3}$ of the earth's ſemidiameters.

The ſun's horizontal parallax I make to be 10 ſeconds, and its apparent diameter, at a mean diſtance from the earth, I make 32 minutes, 15 ſeconds.

The atmoſphere of the earth, by diſperſing and refracting the ſun's light, caſts a ſhadow as it were upon an opake body at leaſt to the height of 40 or 50 geographical miles. This ſhadow, falling upon the moon in a lunar eclipſe, makes the earth's ſhadow larger or broader. And to each mile of the earth's atmoſphere is correſpondent a ſecond in the moon's diſk, ſo that the ſemidiameter of the earth's ſhadow, projected upon the diſk of the moon, is to be increaſed about 50 ſeconds. Or, which is all one in a lunar eclipſe, the horizontal parallax of the moon is to be increaſed in the ratio of about 70 to 69.

Thus far the theory of this incomparable mathematician. And, if we had many places of the moon accurately obſerved, eſpecially about her quadratures; and theſe well compared with her places at the ſame time calculated according to this theory; it would then appear whether there yet remain any other ſenſible equations, which, when accounted for, might ſerve to improve and enlarge this theory. *Gregory's Aſtron.*

MOOR, in country affairs, denotes an unlimited tract of land, uſually over-run with heath. See GOUTY-LAND and HEATH.

MOOR-BUZZARD, the Engliſh name of the yellow legged falcon, with an iron-coloured body and yellow head. It is about the ſize of a common crow, and has its Engliſh name from building its neſt in mooriſh and boggy places.

MOOR-COCK, or GOR-COCK, a ſpecies of tretrao, with a forked tail, ſpotted with white underneath. It is a native of England, but very rare; the male is throughout of a very deep iron-grey, without any variegation; and the female is alſo grey, but variegated with tranſverſe lines of black.

MOOR-HEN, the Engliſh name of the gallinula or tringa. See TRINGA.

MOORING, in the marine, the act of faſtening a ſhip by two or more cables, in a road, haven, or river.

A ſhip may be either moored in a harbour, head and ſtern; that is, faſtened at both ends with cables, reaching from the fore and hind-parts, or with two cables from one end, viz. one from each bow; or ſhe may be ſecured by moorings, which always remain ſunk in the bottom for that purpoſe.

Moorings are compoſed of anchors, chains, and bridles. The anchors formed for this purpoſe have only one flook, and are ſunk on the two ſides of the river with a ſtrong chain faſtened to each of them, which reaches acroſs the ſtream. In the middle of this chain is fixed a ſwivel or large link, which turns round in the chain as the ſhip ſwings with the tide; and to this link the bridles are faſtened. The bridles are ſhort pieces of cable, whoſe upper ends are drawn into the ſhip at the mooring ports, and afterwards faſtened to the maſts.

MOOR-STONE, a valuable ſtone, much uſed in the coarſer works of the preſent builders; being truly a white granite, of a marbly texture.

MOOT, a difficult caſe argued by the young barriſters and ſtudents at the inns of Court, by way of exerciſe, the better to qualify them for practice, and to defend the cauſes of their clients. This, which is called mooting, is the chief exerciſe of the inns of Court. Particular times are appointed for the arguing moot-caſes: the place where this exerciſe is performed, was anciently called Moot-hall; and there is a bailiff, or ſurveyor of the moots annually choſen by the bench, to appoint the moot-men for the inns of Chancery, and to keep an account of the performance of exerciſes.

MORAL, ſomething belonging to manners, or the conduct of life. See the article GOOD, EVIL, MANNERS, &c.

MORAL PHILOSOPHY, the ſame with ethics. See ETHICS.

MORAL SENSE, that whereby we perceive what is good, virtuous, and beautiful in actions, manners, and characters.

MORALITY, the ſcience and doctrine of morals, otherwiſe called ethics. See ETHICS.

Morality may be defined to be the relation, conformity, or agreement of men's voluntary actions to a rule, to which they are referred, and by which they are judged of. Theſe moral rules ſeem to be of three ſorts, with their different enforcements. 1. The divine, whether known by the light of nature or the voice of revelation, which is the only true touchſtone of moral rectitude, the conſciences of men bearing witneſs either of the goodneſs or ſinfulneſs of their actions; that is, whether as duties or ſins they are like to procure them happineſs, or miſery, from the hands of the Almighty. 2. The civil law, which is the rule ſet by the commonwealth to the actions of thoſe that belong to it: this rule no body overlooks, the rewards and puniſhments being ready at hand to enforce it, extending to the protecting or taking away of the life, liberty, and eſtate of thoſe who obſerve and diſobey it. 3. The law of opinion and reputation, whereby virtue and praiſe, vice and blame are ever found to accompany each other: now thoſe who think not commendation and diſgrace ſufficient motives to engage mankind to accommodate themſelves to the opinions and rules of thoſe with whom they converſe, ſeem little ſkilled in the hiſtory of mankind, ſince moſt people govern themſelves chiefly by this law of faſhion. See the article RELATION.

Moral philoſophy contemplates human nature, its moral powers and connections, and from theſe deduces the laws of action; though it muſt be confeſſed, that different philoſophers have eſtabliſhed different ſyſtems concerning the foundation of morality, which the reader will find under the article ETHICS.

According to Mr. Locke, the idea of a Supreme Being, infinite in power, goodneſs, and wiſdom, whoſe workmanſhip we are, and on whom we depend, and the idea of ourſelves, as intelligent creatures, would, if duly conſidered, afford ſuch foundations of our duty and rules of action, as might place morality among the ſciences capable of demonſtration.

As to the reaſons why the mathematical ſciences have been thought more capable of demonſtration than the ideas of good and evil, right and wrong, &c. they are theſe. 1. That the former can be repreſented by ſenſible marks, as diagrams, which have a nearer correſpondence with them than any words. 2. Moral ideas are commonly more complex than thoſe of figures; whence it happens, that their names are of more uncertain ſignification; and beſides, the mind cannot eaſily retain theſe preciſe combinations ſo perfectly, as is neceſſary in the examination of the agreements and diſagreements of ſeveral of them one with another. See the article KNOWLEDGE.

One part of theſe diſadvantages in moral ideas, continues the ſame great author, may in a good meaſure be remedied by accurate definitions, ſetting down that collection of ſimple ideas which every term ſhall ſtand for

and then uſing the term ſteadily for that preciſe collection. See DEFINITION.

MORASS, a low, moiſt land, which receives the waters from the higher grounds, without having any deſcent to carry them off. See MARSH.

MORATUR, or DEMORATUR, in law, he demurs; a term uſed when one of the parties in a cauſe demurs, and does not proceed in pleading, but reſts upon the judgment of the court in ſome particular point, either in relation to the ſufficiency of the declaration, or the pleas of the contrary party; upon which the court, after taking ſome time to argue and adviſe, determine the point.

MORBID, among phyſicians, ſignifies diſeaſed or corrupt, a term applied either to an unſound conſtitution, or to thoſe parts or humours that are infected by a diſeaſe. See DISEASE.

MORBILLI, the meaſles, in medicine. See the article MEASLES.

MORESK, or MORISCO, is a kind of painting, carving, &c. done after the manner of the Moors; conſiſting of ſeveral groteſque pieces and compartiments, promiſcuouſly mingled, not containing any perfect figure of a man, or other animal; but a wild reſemblance of birds, beaſts, trees, &c.

MORNING, the beginning of the day, the firſt appearance of light, or the time from midnight till noon.

MOROCCO, the capital of the kingdom of the ſame name in Africa, ſituated in the ninth degree of weſt longitude; and in the thirty-ſecond degree of north latitude.

MOROCCO, *Marroquin*, in commerce, a fine kind of leather, prepared of the ſkin of an animal of the goat kind, and imported from the Levant, Barbary, &c.

The name was probably taken from the kingdom of Morocco, whence the manner of preparing it was borrowed, which is this: the ſkins being firſt dried in the hair, are ſteeped in clear water three days and nights; then ſtretched on a tanner's horſe, beaten with a large knife, and ſteeped afreſh in water every day, till they be well come; then they are thrown into a large vat in the ground full of water where quick-lime has been ſlaked, and there lie fifteen days; whence they are taken, and again returned every night and morning. Then they are thrown into a freſh vat of lime and water, and ſhifted night and morning for fifteen days longer; then rinſed in clear water, and the hair taken off on the leg with the knife, returned into a third vat and ſhifted as before for eighteen days; ſteeped twelve hours in a river, taken out, rinſed, put in pails, where they are pounded with wooden peſtles, changing the water twice; then laid on the horſe, and the fleſh taken off; returned into pails of new water, taken out, and the hair ſide ſcraped; returned into freſh pails, taken out, and thrown into a pail of a particular form, having holes at bottom: here they are beaten for the ſpace of an hour, and freſh water poured on from time to time; then being ſtretched on the leg, and ſcraped on either ſide, they are returned into pails of freſh water, taken out, ſtretched and ſewed up all around in manner of bags, leaving out the hinder legs as an aperture for the conveyance of a certain mixture.

The ſkins thus ſerved are put in luke-warm water where dogs excrements have been diſſolved. Here they are ſtirred with long poles for half an hour, left at reſt a dozen, taken out, rinſed in freſh water, and filled by a tunnel with a preparation of water and ſumac, mixed and heated over the fire till ready to boil; and, as they are filled, the hind legs are ſewed up to ſtop the paſſage. In this ſtate they are let down into the veſſel of water and ſumac, and kept ſtirring for four hours ſucceſſively; taken out and heaped on one another; after a little time their ſides are changed; and thus they continue an hour and a half, till drained. This done, they are looſened, and filled a ſecond time with the ſame preparation, ſewed up again, and kept ſtirring two hours, piled up and drained as before. This proceſs is again repeated, with this difference, that they are now ſtirred only a quarter of an hour; after which they are left till next morning, when they are taken out, drained on a rack, unſewed, the ſumac taken out, folded in two from head to tail, the hair-ſide outwards, laid over each other on the leg, to perfect their draining, ſtretched out and dried; then trampled under foot by two and two, ſtretched on a wooden table, what fleſh and ſumac remains ſcraped off, the hair-ſide rubbed over with oil, and that again with water.

Then they are wrung with the hands, ſtretched, and preſſed tight on the table with an iron inſtrument like that of a currier, the fleſh-ſide uppermoſt; then turned, and the hair-ſide rubbed ſtrongly over with a handful of ruſhes, to ſqueeze out as much of the oil remaining as poſſible. The firſt courſe of black is now laid on the hair-ſide, by means of a lock of hair twiſted and ſteeped in a kind of black dye, prepared of ſour beer, wherein pieces of old ruſty iron have been thrown. When half dried by hanging in the air, they are ſtretched on a table, rubbed over every way with a paumelle, or wooden-toothed inſtrument, to raiſe the grain, over which is paſt a light couche of water, then ſleeked by rubbing them with ruſhes prepared for the purpoſe. Thus ſleeked, they have a ſecond couche of black, then dried, laid on the table, rubbed over with a paumelle of cork, to raiſe the grain again; and, after a light couche of water, ſleeked over anew; and to raiſe the grain a third time, a paumelle of wood is uſed.

After the hair-ſide has received all its preparations, the fleſh-ſide is pared with a ſharp knife for the purpoſe; the hair-ſide is ſtrongly rubbed over with a woollen cap, having before given it a gloſs with barberries, citron, or orange. The whole is finiſhed by raiſing the grain lightly, for the laſt time, with the paumelle of cork; ſo that they are now fit for the market.

Manner of preparing Red MOROCCO.—After ſteeping, ſtretching, ſcraping, beating, and rinſing, as before, they are at length wrung, ſtretched on the leg, and paſſed after each other into water where alum has been diſſolved. Thus alumed, they are left to drain till morning, then wrung out, pulled on the leg, and folded from head to tail, the fleſh inwards.

In this ſtate they receive their firſt dye, by paſſing them after one another into a red liquor, prepared with laque, and ſome other ingredients, which the marroquineers keep a ſecret. This they repeat again and again, till the ſkins have got their firſt colour; then they are rinſed in clear water, ſtretched on the leg, and left to drain twelve hours; thrown into water, into which white galls pulverized have been paſt through a ſieve, and ſtirred inceſſantly for a day with long poles; taken out, hung on a bar acroſs the water all night, white againſt red, and red againſt white, and in the morning the water ſtirred up, and the ſkins returned into it for twenty-four hours.

MORPHEW, a leprous kind of ſcurf, which ſometimes breaks out upon the ſkin, particularly about the forehead. See LEPROSY.

MORSE, in zoology, a name by which ſome call the hippopotamus. See HIPPOPOTAMUS.

MORTALITY, or *Bills of* MORTALITY, properly denote weekly liſts of the perſons who die in any place.

In London, theſe bills are drawn up by the company of pariſh-clerks, and contain an account of the numbers, ages, diſeaſes, &c. of ſuch as die within the bills of mortality; that is, in London, Weſtminſter, and ten miles round.

The great diſparity between the births and burials in London, is owing to this, that the diſſenters of all ſorts baptize their children without ſending an account of them to the pariſh clerks; ſo that little dependance is to be had on theſe, with regard to calculating annuities for life. See INTEREST.

MORTAR, a preparation of lime and ſand, mixed up with water, which ſerves as a cement, and is uſed by maſons and brick-layers in building of walls of ſtone and brick.

Beſides the common mortar uſed in laying ſtones, bricks, &c. there are ſeveral other kinds; as, 1. white mortar, uſed in plaſtering walls and ceilings, which are often firſt plaſtered with loam, and is made of ox or cow-hair mixed and tempered with lime and water without any ſand. The common allowance is one buſhel of hair to ſix of lime; the hair binds the mortar, holds it faſt together, and keeps it from cracking. 2. Mortar for furnaces, &c. is made with red clay wrought in water in which horſe-

horſe-dung and chimney ſoot has been ſteeped, by which a ſalt is communicated to the water, which binds the clay and makes it fit to endure the fire: this clay ought not to be too fat, leſt it ſhould be ſubject to crack; nor too lean or ſandy, leſt it ſhould not bind enough. 3. Some workmen in metals, uſe a kind of mortar to plaſter over the inſide of the veſſels in which they refine their metals, to keep them from running out: this kind of mortar is made with quick-lime and ox-blood, the lime being firſt beaten to powder and ſifted, and afterwards mixed with the blood. 4. Mortar for ſun-dials on walls, may be made of lime and ſand tempered with linſeed-oil, or, for want of the latter, with ſkimmed milk; but oil is better. This ſpread upon the wall will become as hard as ſtone, and will endure the weather ſix times as long as the ordinary plaſter made of lime and hair with water. 5. For plaſtering the fronts of houſes in imitation of brick-work, ſome uſe a mortar made of ſharp ſand and lime, powder of brick, and ſome red ochre: and timber-houſes, plaſtered over with this kind of mortar, look well though they have been done twenty or thirty years. 6. The mortar uſed in Italy for making water courſes and ciſterns, and alſo in finiſhing or plaſtering of fronts is of two ſorts: the one is compoſed of lime and hogs-greaſe, mixt with the juice of figs, and the other is of the ſame ingredients, but has liquid pitch added to the reſt, and is firſt wet or ſlaked with wine, and then pounded or beaten with hogs-greaſe and juice of figs. 7. An extraordinary good mortar for floors, walls, ceilings, &c. may be made with ox-blood and fine clay tempered together. 8. And in buildings, one part of waſte ſoap aſhes, mixed with another of lime and ſand, make a very durable mortar.

MORTAR-PIECE, a ſhort piece of ordnance, conſiderably thick and wide; ſerving to throw bombs, carcaſſes, fire-pots, &c. See plate XC. *fig.* 1. which repreſents a mortar mounted on its carriage.

The uſe of mortars is thought to be older than that of cannon; they being employed in the wars in Italy to throw ſtones and balls of red-hot iron, long before the invention of bombs; which, as Blondel informs us, were firſt thrown at the ſiege of Wachtendonck, in Guelderland, in 1588.

It was formerly the opinion of gunners, that only one certain charge of powder was requiſite for each mortar, and that the horizontal range could not be altered but by changing the direction of the piece; but, at preſent, when a place lying in the ſame horizontal plane with the mortar, is to be bombarded, they elevate the piece to 45°, and augment or diminiſh the charge of powder until they can hit the mark. The following advantages introduced this practice: 1. The public powder is ſaved as much as poſſible; becauſe, at a direction of 45°, a leſs velocity, and conſequently a leſs charge of powder is required to make any horizontal range, than is neceſſary to make the ſame horizontal range at any other elevation. 2. In elevating mortars to their proper directions, gunners ſeldom come within a degree or two of the propoſed elevation, both on account of the imperfection of the inſtruments which they generally uſe for that purpoſe, and the hurry they are in at that time. And in bombarding towns from ſhips, it is ſcarce poſſible to come within two degrees of the deſigned elevation, becauſe of the agitation of the veſſel, which continually changes the direction of the mortar. But by raiſing the mortar to 45°, the bad conſequences of this inaccuracy of elevation are in a great meaſure prevented, becauſe a ſmall error above or below 45°, occaſions a very inconſiderable error of amplitude.

For the ſame reaſons, alſo, places lying above or below the horizontal plane, paſſing through the piece, are bombarded by directing the mortar ſo as its axis may biſſect the angle comprehended between a perpendicular to the horizon, at the point of projection, and a line drawn from that point to the mark aimed at; and then augmenting and diminiſhing the charge of powder until the object be hit.

When the buſineſs, therefore, can be effectually done by this middle elevation, it ought certainly to be preferred to any other.

In ſhooting with mortars, the following general rules ſhould be always obſerved. 1. To meaſure the diſtance of the object aimed at. 2. That the bombs be of equal weight, otherwiſe the ſhots will vary. 3. That the carriage be on an exact level, to prevent its leaping. 4. That the powder with which the piece is charged, be always of the ſame ſtrength and quantity. 5. That the charge be always equally rammed down. 6. That the wads be always of wood, tompions, or oakum. 7. That the fuſees be freſh made the days on which they are to be uſed; and that they be of a compoſition proportionable to the range of the ſhot in the air, ſo that the bomb may break at the very moment of, or ſoon after, its fall; which compoſition muſt be ſuch as not to be extinguiſhed though it fall in water, but continue burning till the bomb breaks. See BOMB.

MORTGAGE, in law, a pledge or pawn of lands, tenements, &c. for money borrowed; ſo called becauſe if the money is not paid at the day, the land dies to the debtor, and is forfeited to the creditor. The common method of making a mortgage, is by leaſe for a long term of years, wherein a pepper-corn rent has been uſually reſerved; or it may be made by aſſignment for a term, and by leaſe and releaſe. The creditor, who holds the eſtate according to the condition of the deed, is called the mortgagee; but the mortgager, who is the perſon that makes the mortgage, generally keeps poſſeſſion of the land till failure is made in the payment of the mortgage money; in which caſe, though the mortgagee enters for non-payment, the mortgager has a right to the equity of redemption in the court of chancery, where he may call the mortgagee to an account for the profits of the land mortgaged.

By a late ſtatute it is ordained, that when any action of ejectment is brought by a mortgagee, for the recovery of the poſſeſſion of the lands or tenements, &c. mortgaged, and there is no ſuit in equity for foreclоſing or redeeming the equity of redemption, in caſe the perſon intitled to redeem ſhall, *pendente lite*, or pending the action, bring all the principal and intereſt due, with coſts, into court, it ſhall be taken as a full ſatisfaction and diſcharge of the mortgage, and the mortgagee ſhall thereon be obliged to reconvey the land, &c. and deliver up all deeds, &c. 7 Geo. 2. c. 201.

MORTIFICATION, in medicine, the ſame with ſphacelus. See the article SPHACELUS.

MORTISE, or MORTOISE, in carpentry, &c. a kind of joint, wherein a hole of a certain depth is made in a piece of timber, which is to receive another piece called a tenon.

MORTMAIN, in law, is the alienation of lands or tenements to any religious houſe, corporation, or fraternity, and their ſucceſſors. Lands alienated in mortmain are different from others, for they never revert to the donor, or to any temporal or common uſe; on which accounts the lords by ſuch alienation loſe their eſcheats, and many ſervices that were formerly due to them; as bodies politic never die, nor can perform perſonal ſervice, commit treaſon, felony, or the like. By the ſtatute of mortmain lately made, it is enacted, that no manors, lands, &c. ſhall be given or granted to, or ſettled upon any perſons, bodies politic, &c. for any eſtate whatſoever, or charged in truſt for charitable uſes, unleſs it be done by deed indented and ſealed twelve months at leaſt before the donor's death, and inrolled in chancery within ſix months after executed. The two Univerſities, and the colleges of Eaton, Weſtminſter, &c. are excepted out of this act. 9 Geo. II. c. 36.

MORTUARY, in the eccleſiaſtical law, is a gift left by a man at his death to his pariſh-church, in recompence of perſonal tythes omitted to be paid in his life-time: or it is that beaſt, or other cattle, which after the death of the owner, by the cuſtom of the place, is due to the parſon or vicar, in lieu of tithes or offerings forgot, or not well and truly paid by him that is dead.

MOSAIC, or MOSAIC-WORK, an aſſemblage of little pieces of glaſs, marble, precious ſtones, &c. of various colours, cut ſquare, and cemented on a ground of ſtucco, in ſuch a manner as to imitate the colours and degradations of painting.

The materials uſed for theſe works are little pieces of glaſs of all the different ſhades in every tint or colour, like thoſe of the fine Engliſh worſted uſed in needle-work. They

Fig. 1. *Mortar-piece.*

Fig. 2. A Simple Muscle.

Fig. 3. A Simple Muscle laid open.

Fig. 5. A Compound Muscle laid open.

Fig. 4. Mouldings or Members.

Talon or Ogee.

erect *inverted*

Gorge & Doucine. Gula. Cyma. Cymatium.

erect *inverted*

Mouchette & Drip Larmier Corona.

Planfond & Soffite. Eggs & Anchors.

Roses *Ribbands*

Beeds *Paternoster* *Flowers.*

Bandellette or Annulet Reglet Listel List Fillet

Baguette or Astragal.

Tore or Baton

Trochilus. Canal. Scotia.

Lesbian & Boultin. Echinus. Round. Quarter Ovolo

Astragal. *erect* *inverted*

Cymatium. Doric & Conge. Semicanal. Cavetto.

Gorge.

5 JA 59

The glaſs is firſt caſt into thin cakes, which are afterwards cut into long pieces of a different thickneſs. Many of the pieces uſed in the works on roofs and cielings, which are conſequently ſeen only at a great diſtance, appear to be a finger's breadth; but the finer works conſiſt only of glaſs pins, if we may make uſe of that expreſſion, not thicker than a common ſewing needle, ſo that a portrait of four feet ſquare ſhall take up two millions of ſuch pins or ſtuds.

Theſe pins are ſo cloſely joined together, that after the piece is poliſhed, which is done in the ſame manner as looking-glaſſes are poliſhed, it can hardly be diſcerned to be an arrangement of an infinite number of particles of glaſs; but rather looks like a picture painted with the fineſt colours, with cryſtal placed before it. The ground in which theſe vitreous pieces are inlaid, is a paſte compounded of calcined marble, fine ſand, gum tragacanth, whites of eggs and oil. It is at firſt ſo ſoft, that the pieces are eaſily inſerted, and upon an overſight, may be taken out again, and the paſte new moulded for the admiſſion of other pins or ſtuds; but by degrees it grows as hard as a ſtone, ſo that no impreſſion can be made on the work. This paſte is ſpread within a wooden frame, which, for the large pieces, muſt not be leſs than a foot in breadth and thickneſs. This frame is faſtened with braſs tacks to a plate of the ſame metal, or to a ſtone ſlab; and as in capital pieces, which are often twenty feet by fifteen, this paſte-ground muſt be above three quarters of a foot deep, and the pins or ſtuds as long, it may eaſily be conceived of what weight ſuch a piece muſt be. The pieces deſigned for roofs, or any diſtant place, are not poliſhed; but in the altar-pieces, &c. nothing is wanting to give them the moſt beautiful and ſplendid appearance. A piece of about eighty feet ſquare, if performed with tolerable care and delicacy, will employ eight artiſts for the ſpace of two years. The ſtuds of the ſeveral colours lie ready before the artiſt in caſes, as the letters are laid before the compoſitors in a printing-houſe; and ſuch is their accuracy in imitating the fineſt ſtrokes of the pencil, that the only apparent difference betwixt the original painting and ſuch a copy, is, that the latter has a much finer luſtre, and the colours are more vivid.

Method of performing MOSAIC-WORK *of Marble and precious Stones.*—The ground of Moſaic-works, wholly marble, is uſually a maſſive marble, either white or black. On this ground the deſign is cut with a chiſſel, after it has been firſt calqued. After it has been cut of a conſiderable depth, i. e. an inch or more, the cavities are filled up with marble of a proper colour, firſt faſhioned according to the deſign, and reduced to the thickneſs of the indentures with various inſtruments. To make the pieces thus inſerted into the indentures cleave faſt, whoſe ſeveral colours are to imitate thoſe of the deſign, they uſe a ſtucco, compoſed of lime and marble-duſt; or a kind of maſtic, which is prepared by each workman, after a different manner peculiar to himſelf.

The figures being marked out, the painter or ſculptor himſelf draws with a pencil the colours of the figures, not determined by the ground, and in the ſame manner makes ſtrokes or hatchings in the place, where ſhadows are to be; and after he has engraven with the chiſſel all the ſtrokes thus drawn, he fills them up with a black maſtic, compoſed partly of burgundy-pitch poured on hot; taking off afterwards what is ſuperfluous, with a piece of ſoft ſtone or brick, which, together with water and beaten cement, takes away the maſtic, poliſhes the marble, and renders the whole ſo even, that one would imagine it only conſiſted of one piece.

This is the kind of Moſaic-work that is ſeen in the pompous church of the Invalids at Paris, and the fine chapel at Verſailles, with which ſome intire apartments of that palace are incruſtated.

As for Moſaic-work of precious ſtones, other and finer inſtruments are required than thoſe uſed in marble; as drills, wheels, &c. uſed by lapidaries and engravers on ſtone. As none but the richeſt marbles and ſtones enter this work, to make them go the further, they are ſawn into the thinneſt leaves imaginable, ſcarce exceeding half a line in thickneſs; the block to be ſawn is faſtened firmly with cords on the bench, and only raiſed a little on a piece of wood, one or two inches high. Two iron pins, which are on one ſide the block, and which ſerve to faſten it, are put into a vice contrived for the purpoſe, and with a kind of ſaw or bow, made of fine braſs wire, bent on a piece of ſpungy wood, together with emery ſteeped in water; the leaf is gradually faſhioned by following the ſtroke of the deſign, made on paper, and glued on the piece. When there are pieces enough faſtened to form an intire flower, or ſome other part of the deſign, they are applied to the ground.

The ground which ſupports this Moſaic-work is uſually of free-ſtone. The matter with which the ſtones are joined together, is a maſtic, or kind of ſtucco, laid very thin on the leaves as they are faſhioned; and this being done, the leaves are applied with plyers.

If any contour, or ſide of a leaf, be not either ſquared or rounded ſufficiently, ſo as to fit the place exactly, into which it is to be inſerted, when it is too large, it is to be brought down with a braſs file or raſp; and if it be too little, it is managed with a drill and other inſtruments uſed by lapidaries.

Moſaic-work of marble is uſed in large works, as in pavements of churches, baſilics, and palaces; and in the incruſtation and vaneering of the walls of the ſame edifices.

As for that of precious ſtones, it is only uſed in ſmall works, as ornaments for altar-pieces, tables for rich cabinets, precious ſtones being ſo very dear.

Moſaic-work of wood is more properly called marquetry. See MARQUETRY.

MOSQUE, a temple, or place of religious worſhip, among the Mahometans.

All moſques are ſquare buildings, generally built with ſtone; before the chief gate there is a ſquare court, paved with white marble, and low galleries round it, whoſe roof is ſupported by marble pillars. In theſe galleries the Turks waſh themſelves before they go into the moſque. In each moſque there is a great number of lamps; and between theſe, hang many cryſtal rings, oſtriches eggs, and other curioſities, which, when the lamps are lighted, make a fine ſhew. As it is not lawful to enter the moſques with ſhoes or ſtockings on, the pavements are covered with pieces of ſtuff ſewed together, each being wide enough to hold a row of men kneeling, ſitting, or proſtrate. The women are not allowed to enter the moſque, but ſtay in the porches without. About every moſque there are ſix high towers, called minarets, each of which has three little open galleries, one above another: theſe towers, as well as the moſques, are covered with lead, and adorned with gilding and other ornaments; and from thence, inſtead of a bell, the people are called to prayer by certain officers appointed for that purpoſe. Moſt of the moſques have a kind of hoſpital belonging to them, in which travellers, of what religion ſoever, are entertained during three days. Each moſque has alſo a place called Tarbé, which is the burying place of its founders; within which is a tomb ſix or ſeven feet long, covered with green velvet or ſattin, at the ends of which are two tapers, and round it ſeveral ſeats for thoſe who read the koran, and pray for the ſouls of the deceaſed.

MOSS, *Muſcus*, in botany, a very numerous order of plants, belonging to the cryptogamia claſs, the fructification of which is but little underſtood.

Moſſes are of conſiderable uſe in medicine; uſnea is eſteemed a good deſiccative and aſtringent; the cup-moſs is recommended in the chin-cough; the grey ground-lichen, or liverwort, againſt the bite of a mad dog; and other ſpecies, in other diſorders, as mentioned under their reſpective heads.

Moſs is frequently very injurious to fruit-trees, which grow upon cold barren ſoils, or where they are ſo cloſe planted as to exclude the free acceſs of the air; the only remedy, in ſuch caſes, is to cut down part of the trees, and to plough up the ground between thoſe left remaining; and in the ſpring-ſeaſon, in moiſt weather, you ſhould, with an iron inſtrument made a little hollow, the better to ſurround the branches of the trees, ſcrape off the moſs, carrying it off the place; and by two or three times thus cleanſing them, together with carefully ſtirring the ground, it may be entirely deſtroyed from the trees; but unleſs part of the trees are cut down, and the ground be well ſtirred, the rubbiſh of the moſs will ſignify little.

If the trees are covered with moſs, on account of the dryneſs of the ground, the proper remedy is to lay mud, from the bottom of a river or pond, pretty thick about their roots.

Moss is alſo a name given to boggy grounds in many parts of the kingdom. Theſe conſiſt of a turfy ſurface, below which is a black, moiſt, ſpongy earth, which being dug up with ſpades ſomewhat in the form of bricks, and dried, is what they call peats, uſed as fuel in ſeveral parts; and the upper ſcurf, being cut and dried, makes turfs, another coarſer ſort of fuel.

MOSTRA, in the Italian muſic, a mark at the end of a line or ſpace, to ſhew that if the firſt note be accompanied with a ſharp or flat, it is proper to place theſe characters along with the moſtra. Alſo if in a thorough-baſs this firſt note have any cyphers, theſe cyphers ſhould be put along with the moſtra, at the end of the preceding ſtaff. And, laſtly, if the part change its cleff with the firſt note, the cleff ought to be marked along with the moſtra, in the ſame manner.

MOTAZALITES, the name of a famous ſect among the Mahometans, properly ſignifying ſeparatiſts.

The Motazalites are not accounted orthodox muſſulmen, as they believe the alkoran to be created and not eternal; and beſides aſſert, that there are no attributes in God diſtinct from his eſſence.

MOTH, *Tinea*, or *Phalæna*, in zoology. See PHALÆNA.

MOTION is the continual and ſucceſſive change of place, and is either abſolute or relative.

Abſolute MOTION is the change of abſolute ſpace or place of bodies, as the flight of a bird, the motion of a projectile, &c.

Relative MOTION is the change of relative ſpace, or that which has reference to ſome other bodies; as of two ſhips under ſail, the difference of their velocities is the relative velocity or motion of the ſhip ſailing faſteſt; and is that alone which is diſcernible by us. The ſame is to be underſtood of abſolute and relative reſt.

To make this matter plainer, we are to conſider that ſpace is nothing elſe but an abſolute and infinite void, which it takes up or poſſeſſes; and that place may be conſidered either abſolutely or in itſelf alone; and then it is called the abſolute place of the body; or elſe with regard to the place of ſome other body, and then it is called the relative or apparent place of bodies. Now, as a motion is only the change of place in bodies, it is evident that it will come under the ſame diſtinction of abſolute and relative, or apparent. All motion is in itſelf abſolute, or the change of abſolute ſpace; but when the motions of bodies are conſidered and compared with each other, then are they relative and apparent only: they are relative, as they are compared to each other; and they are apparent only, inſomuch that not their true or abſolute motion, but the ſum or difference of the motions only is perceivable by us.

In comparing the motions of bodies we may conſider them as moving both the ſame way or towards contrary parts; in the firſt caſe the difference of motion is only perceived by us, in the latter the ſum of the motions. Thus for example; ſuppoſe two ſhips A and B ſet ſail from the ſame port upon the ſame rhumb, and that A ſails at the rate of five miles per hour, and B at the rate of three; here the difference of the velocity (viz. two miles per hour) is that by which the ſhip A will appear to go from the ſhip B forwards, or the ſhip B will appear at A to go with the ſame velocity backwards, to a ſpectator in either reſpectively.

If two ſhips A and B move with the ſame degree of velocity, then will the difference be nothing, and ſo neither ſhip will appear to the other to move at all. Hence it is that, though the earth is continually revolving about its axis, yet, as all objects on its ſurface partake of the ſame common motion, they appear not to move at all, but are relatively at reſt.

If two ſhips A and B, with the degrees of velocity as above, meet each other, the one will appear to the other to move with the ſum of both velocities, viz. at the rate of eight miles per hour; ſo that in this caſe the apparent motion exceeds the true, as in the other it fell ſhort of it. Hence the reaſon why a perſon, riding againſt the wind, finds the force of it much greater than it really is; whereas, if he rides with it, he finds it leſs.

The reaſon of all theſe phænomena of motion will be evident, if we conſider we muſt be abſolutely at reſt, if we would diſcern the true or real motion of bodies about us. Thus a perſon on the ſtrand will obſerve the ſhips ſailing with their real velocity. A perſon ſtanding ſtill will experience the true ſtrength and velocity of the wind; and a perſon placed in the regions between the planets, will view all their true motions, which he cannot otherwiſe do, becauſe in all other caſes the ſpectator's own motion muſt be added to, or ſubtracted from, that of the moving body, and the ſum, or difference, is therefore the apparent or relative motion, and not the true.

Motion is alſo either equable or accelerated.

Equable MOTION is that by which a body paſſes over equal ſpaces in equal times.

Accelerated MOTION is that which is continually augmented or increaſed, as retarded motion is that which continually decreaſes; and if the increaſe or decreaſe of motion be equal in equal times, the motion is then ſaid to be equally accelerated or retarded.

Equable MOTION is generated by a ſingle impetus or ſtroke; thus the motion of a ball from a cannon is produced by the ſingle action of the powder in the firſt moment, and therefore the velocity it firſt ſets out with would always continue the ſame, were it void of gravity, and to move in an unreſiſting medium, which therefore would be always equable, or ſuch as would carry it through the ſame length of ſpace in every equal part of time.

Hence we may determine the theorems for the expreſſions of the time, velocity, and the ſpace paſſed over in equable or uniform motion very eaſily thus:

Let T and t repreſent the times of a body moving with the velocities V and v, whereby the ſpaces S and s are reſpectively deſcribed; then as the ſpace deſcribed can only be influenced by the time and velocity, it follows, that $S=T\times V$, and $s=t\times v$; whence $S:s::T\times V:t\times v$; therefore $S\times t\times v=s\times T\times V$: from this general equation, we have $T:t::S\times v:s\times V$, and $V:v::S\times t:s\times T$; that is, the times are as the ſpaces directly, and the velocities inverſely; or in other words, they increaſe with the ſpaces, and decreaſe with the velocities, and the velocities are directly as the ſpaces, and inverſely as the times, and conſequently they increaſe with the ſpaces, and decreaſe with the times.

Accelerated motion is produced by a conſtant impulſe or power, which keeps continually acting upon the body, as that of gravity, which produces the motion of falling bodies; which motion is conſtantly accelerated, becauſe gravity every moment adds a new impulſe, which generates a new degree of velocity; and the velocity thus increaſing, the motion muſt be quickened each moment, or fall faſter and faſter the lower it falls.

In like manner a body thrown perpendicularly upward, and as a ball from a cannon, will have its motion continually retarded, becauſe gravity acts conſtantly upon it in a direction contrary to that given it by the powder, ſo that its velocity upwards be continually diminiſhed, and ſo its motion as continually retarded, till at laſt it be all deſtroyed. The body has then attained its utmoſt height, and is for a moment motionleſs, after which it begins to deſcend with a velocity in the ſame manner accelerated, till it comes to the earth's ſurface.

The motion generated by a uniformly accelerating force in any given time, is always proportional to that force, it being the genuine and natural effect thereof; and ſince in all the ſeveral parts of time, the force remains the ſame, and has the ſame efficacy; therefore the motion generated will alſo be as the time; whence univerſally the motion generated is in the compound ratio of both the force and the time of acting.

The quantity of motion is as the matter and velocity; therefore the velocity is as the motion directly and the matter reciprocally, and the velocity generated (or deſtroyed) in any time, is as the force and time directly, and the quantity of matter reciprocally.

The ſpace deſcribed from the beginning of the motion generated by an uniform accelerative force, is in the compound ratio of the laſt velocity, and the time wherein it

is generated. For imagine the time divided into an infinite number of equal parts, each of which call 1, and let the times from the beginning be 1, 2, 3, 4, &c. to t; and let c denote the velocity generated in the time 1; then the velocity generated in the ſame body, by the ſame force, in the times 1, 2, 3, 4, t, will be reſpectively c, $2c$, $3c$, $4c$, to tc; and it being well known that the ſpace deſcribed in each given part of time is as the time (1), and the velocity; it follows, that the ſpaces deſcribed in the ſeveral parts of time will be c, $2c$, $3c$, tc; and the ſum of theſe, or $\frac{tc}{2} \times t$, will repreſent the whole ſpace deſcribed by the moving body: but tc is the laſt velocity, and t the whole time; therefore the whole ſpace is as $tc \times t$, or the velocity and time conjunctly. It appears from hence, that if a body moves uniformly forward with the velocity acquired by an uniform accelerative force; it will deſcribe twice the ſpace in the ſame or an equal time that it deſcribed by the accelerative force.

But to illuſtrate this in a more general manner, let b repreſent any body or quantity of matter; F the accelerative force, acting uniformly on the body b; v the velocity generated in b by the force F; m, the motion generated in b; s, the ſpace deſcribed by the body b; and t, the time of deſcribing the ſpace s. Then $b = \frac{m}{v}$, $bv = \mathrm{F}t$, $v = \frac{s}{t}$, $\frac{\mathrm{F}t}{b} = \sqrt{\frac{\mathrm{F}s}{b}} = \frac{m}{b}$, $s = \frac{bvv}{\mathrm{F}} = \frac{\mathrm{F}tt}{b}$, $t = \frac{m}{\mathrm{F}}$, $\mathrm{F} = \frac{bv}{t} = \frac{bs}{tt} = \frac{bvv}{b} = \frac{m}{t}$.

If the accelerative force be ſuppoſed as the n power of the diſtance, then in order to inveſtigate the velocity acquired by a heavy body, falling from a ſtate of reſt, thro' a certain ſpace defined by x; let $\dot{x}$ repreſent the infinitely ſmall ſpace deſcribed by the falling body with the velocity acquired by the deſcent through x, which is here denoted by v, then will $\frac{\dot{x}}{v}$ repreſent the time of deſcribing $\dot{x}$. Now the force being as x^n, we ſhall have $x^n \times \frac{\dot{x}}{v} = \dot{v}$, it being well known that the velocity is always proportional to the time drawn into the given force; therefore $x^n \dot{x} = v\dot{v}$, and by taking the fluent of each ſide the equation, we have $\frac{x^{n+1}}{n+1} = \frac{vv}{2}$; conſequently $v = x^{\frac{n+1}{2}} \times \frac{2}{n+1}$; but as the factor $\frac{2}{n+1}$ is a conſtant quantity, it follows, that the velocity v is always as $x^{\frac{n+1}{2}}$, or as the ſquare-root of ſuch a power of the ſpace deſcribed, as is expounded by $n+1$.

MOTIONS, in war, the marches, counter-marches, &c. of an army in changing its poſt. See the article MARCH, &c.

MOTORY NERVES, in anatomy, the third pair, joining to the eyes.

MOTTO, in armoury, a ſhort ſentence or phraſe carried in a ſcroll, generally under, but ſometimes over the arms; ſometimes alluding to the bearing, ſometimes to the name of the bearer, and ſometimes containing whatever pleaſes the fancy of the deviſer.

MOVEABLE, in general, denotes any thing capable of being moved.

The moveable feaſts are ſuch as are not regularly held on the ſame day of the year or month, though they are always on the ſame day of the week. Thus Eaſter, which is that moveable feaſt on which all the reſt depend, is held on the Sunday which falls upon, or next after, the firſt full-moon following the twenty-firſt of March; and all the other feaſts keep a regular and certain diſtance from it; ſuch as Septuageſima, Sexageſima, Aſh-Wedneſday, Aſcenſion-day, &c. which ſee under their proper articles.

MOVEMENT, in mechanics, a machine that is moved by clock-work; for the theory of which, ſee the article CLOCK, WATCH, &c.

MOULD, or MOLD, in the mechanic arts, &c. a cavity cut with a deſign to give its form or impreſſion to ſome ſofter matter applied therein, of great uſe in ſculpture, foundery, &c.

MOULDS, in the manufacture of paper, are little frames compoſed of ſeveral braſs or iron-wires, faſtened together by another wire ſtill finer. Each mould is of the bigneſs of the ſheet of paper to be made, and has a rim or ledge of wood to which the wires are faſtened; theſe moulds are more uſually called frames, or forms.

Furnace and Crucible-makers MOULDS are made of wood, of the ſame form with the crucibles; that is, in form of a truncated cone: they have handles of wood to hold and turn them with, when, being covered with the earth, the workman has a mind to round or flatten his veſſel.

MOULDS *for Leaden Bullets* are little iron-pincers, each of whoſe branches terminates in an hemiſpherical concavity, which, when ſhut, form an entire ſphere: in the lips or ſides where the branches meet, is a little jet or hole through which the melted lead is conveyed.

Glaziers-MOULDS. The glaziers have two kinds of moulds, both ſerving to caſt their lead. In the one they caſt the lead into proper lengths fit to be drawn through the vice, and the grooves formed therein: this they ſometimes call ingot-mould. In the other they mould thoſe little pieces of lead a line thick, and two lines broad, faſtened to the iron-bars: theſe alſo go through the ſame apparatus as the former.

Goldſmith's-MOULDS. The goldſmiths uſe the bones of the cuttle-fiſh to make moulds for their ſmall works, which they do by preſſing the pattern between two bones, and leaving a jet or hole to convey the ſilver through, after the pattern has been taken out.

MOULD, among maſons, a piece of hard wood or iron hollowed withinſide, anſwerable to the contours of the mouldings or corniches, &c. to be framed: this is otherwiſe called caliber.

MOULDS, among plumbers, are the tables whereon they caſt the ſheets of lead. Theſe they ſometimes call ſimply tables; beſides which they have other real moulds wherewith they caſt pipes without ſoldering. See the article PLUMBERY.

MOULDS, among grinders of optic-glaſſes. See the article GRINDING.

MOULDS, among tallow-chandlers, are of two kinds: the firſt for the common dipped candles, being the veſſel wherein the melted tallow is diſpoſed, and the wick dipped: this is of wood, of a triangular form, and ſupported on one of its angles, ſo that it has an opening of near a foot at top: there is likewiſe one of lead ſubſtituted in the place of the former. The other, uſed in the fabric of mould candles, is of braſs, pewter, or tin; here each candle has its ſeveral mould. See the article CANDLE.

MOULD, among gold-beaters, a certain number of leaves of velom, or pieces of guts, cut ſquare, of a certain ſize, and laid over one another, between which they put the leaves of gold and ſilver, which they beat on the marble with the hammer. They have four kinds of moulds, two whereof are of velom, and two of gut; the ſmalleſt of thoſe of velom conſiſts of forty or fifty leaves, the largeſt contains an hundred: for the others, each contains five hundred leaves. The moulds have all their ſeveral caſes, conſiſting of two pieces of parchment, ſerving to keep the leaves of the mould in their place, and prevent their being diſordered in beating.

MOULD, in agriculture, a looſe kind of earth, every where obvious on the ſurface of the ground, called alſo natural or mother earth; by ſome alſo loam. See the article EARTH.

The goodneſs of a mould for the purpoſes of gardening, &c. may be known, according to Miller, by the ſight, ſmell, and touch. 1. Thoſe moulds that are of a bright cheſnut or hazelly colour, are counted the beſt: of this colour are the beſt loams, and alſo the beſt natural earth; and this will be the better yet, if it cut like butter, and does not ſtick obſtinately, but is ſhort, tolerably light, breaking into ſmall clods, is ſweet, will be tempered without cruſting or chopping in dry weather, or turning to mortar in wet. Next to that the dark grey and ruſſet moulds are accounted the beſt: but the light and dark aſh-coloured the worſt, ſuch as is uſually found on common heathy ground: the clear tawney is by no means to be approved; but that of a yellowiſh red colour is the worſt of all: this is commonly found in wild and waſte

parts

parts of the country, and for the moſt part produces nothing but goſs, furze, and fern, according as their bottoms are more or leſs of a light and ſandy, or of a ſpewey, gravel, or clayey nature. 2. All lands that are good and wholeſome, will, after rain, or breaking up by the ſpade, emit a good ſmell. 3. By the touch we may diſcover whether it conſiſts of ſubſtances entirely arenaceous, or clammy; or, as it is expreſſed by Mr. Evelyn, whether it be tender, fatty, deterſive, or ſlippery; or more harſh, gritty, porous, or friable.

MOULDINESS, a term applied to bodies which corrupt in the air, from ſome hidden principle of humidity therein; and whoſe corruption ſhews itſelf by a certain white down, or lanugo, on their ſurface, which, viewed through a microſcope, appears like a kind of meadow, out of which ariſe herbs and flowers, ſome only in the bud, others full blown, and others decayed, each having its root, ſtalk, and other parts. See CORRUPTION and VEGETATION.

MOULDING, any thing caſt in a mould, or that ſeems to have been ſo, though in reality it were cut with a chiſſel, or the ax.

Moulding of figures in paſte is done as follows: take the crumb of a new drawn white loaf, beat it, and roll it with a rolling-pin as fine and as far as it will go; then print it on the moulds; and when it has taken the ſuitable figure you deſire, dry it in a ſtove, and it will be very hard: and to preſerve it from vermin, you may mix a little powder of aloes with it.

To mould ſmall figures of jaſper-colour: oil your moulds with a fine pencil, and diverſify them with ſuch colours as you pleaſe, with gum-tragacanth; if they ſpread or run, put a little of the gall of an ox, for the thicker it is, the harder it will be; then mould your paſte of the colour of jaſper, or the like; put it in to fill the mould; tie it with a wire, and take it out; repair and varniſh it, and ſet it to harden.

MOULDINGS, in architecture, projectures beyond the naked wall, column, wainſcot, &c. the aſſemblage of which forms corniches, door-caſes, and other decorations of architecture. See plate XC. *fig.* 4.

Some mouldings are ſquare, others round, ſome are ſtraight, others curved, &c. and ſome are plain, others carved, or adorned with ſculpture, either hollowed or in relievo: ſome again are crowned with a fillet, others are without, as the doucine, talon, ovolo, torus, ſcotia, aſtragal, gula, corona, &c. See the articles DOUCINE, &c.

Mouldings are in architecture, what letters are in writing; by the various diſpoſitions and combinations of mouldings may be made an infinite number of different profiles, for all ſorts of orders and compoſitions, regular, or irregular; and yet all the kinds of mouldings may be reduced to three, viz. ſquare, round, and mixed, that is, compoſed of the other two: for this reaſon, thoſe who invented the Gothic architecture, reſolving to recede from thoſe perfect figures, and affecting to uſe others leſs perfect, to diſtinguiſh their architecture from the antique, introduced a new ſet of whimſical mouldings and ornaments. Regular mouldings are either large, as doucines, ovolos, gulas, talons, ſcotias, &c. or ſmall, as fillets, aſtragals, conges, &c.

MOULDING, in ſhip-building, the jettings or projectures beyond the level of the ſide. They are placed above one another, the intervals of which are generally ornamented with martial inſtruments, trophies of war, marine, and other emblematical figures, &c.

MOULINET is uſed, in mechanics, to ſignify a roller, which being croſſed with two levers, is uſually applied to cranes, capſtans, and other ſorts of engines of the like nature, to draw ropes, and heave up ſtones, &c.

MOULINET is alſo a kind of turnſtile, or wooden croſs, which turns horizontally upon a ſtake fixed in the ground, uſually placed in paſſages to keep out horſes, and to oblige paſſengers to go and come one by one. Theſe moulinets are often ſet near the outworks of forfeited places at the ſides of the barriers, through which people paſs on foot.

MOULTING, or MEWING. See the article MEWING.

MOUND, a term uſed for a bank or rampart, or other fence, particularly that of earth.

MOUND, in heraldry, a ball or globe with a croſs upon it, ſuch as our kings are uſually drawn with, holding it in their left hands, as they do the ſceptre in the right.

MOUNT-EGG. In the tin-works, after the tin from the burnt ore is melted down and remelted, there will ſometimes remain a different ſlag in the bottom of the float; this they call mount-egg; and though of a tin-colour, yet is of an iron-nature, as hath been found by applying a magnet to it.

MOUNT *of Piety*, certain funds or eſtabliſhments in Italy, where money is lent out, on ſmall ſecurity. We had alſo mounts of piety in England raiſed by contribution, for the benefit of people ruined by the extortions of the Jews.

MOUNTAIN, *Mons*, a part of the earth, riſing to a conſiderable height above the level of the ſurface thereof.

The origin of mountains is variouſly aſſigned by philoſophers: ſome will have them coeval with the world, and created along with it; others, among whom is Dr. Burnet, will have them to take their riſe from the deluge, urging that the extreme irregularity and diſorder viſible in them, plainly ſhews they do not come immediately out of the hand of God, but are the wrecks of the old world, broken into the abyſs. See DELUGE.

Others again allege, from hiſtory, that the roots of many hills being eaten away, the hills themſelves have ſubſided and ſunk into plains; whence they conclude, that where the corruption is natural, the generation is ſo too. It appears certain to many, that ſome mountains muſt have been generated gradually, and have thrown up in proceſs of time, from the ſea-ſhells, &c. found in them, which they ſuppoſe may be accounted for, from a violent wind blowing the ſand, &c. into huge heaps, which were made into a maſs by the rain, &c. The origin of mountains, in the opinion of Mr. Ray, ſeems to have been from exploſions, by means of ſubterraneous fires; and he thinks it very probable, that they all have vaſt hollows beneath them; and that this might have been the means uſed at the creation, to make the dry land appear, he thinks no way diſſonant to reaſon, ſince hiſtory proves that fires have raged in ſubterraneous caverns under the ſeas; and there is no natural impoſſibility in fire's ſubſiſting in ſuch caverns, even when the earth was all over covered with water, as at the firſt creation.

Mountains appear to many, defects and blemiſhes in the earth; but they are truly of the utmoſt uſe and neceſſity to the well-being both of man and other animals. They ſerve as ſcreens to keep off the cold and nipping blaſts of the northern and eaſtern winds; they ſerve for the production of a great number of vegetables and minerals, which are not found in any other ſoil; the long ridges and chains of lofty and topping mountains being generally found to run from eaſt to weſt, ſerve to ſtop the evagation of the vapours towards the poles, without which they would all run from the hot countries, and leave them deſtitute of rain. Mr. Ray adds, that they condenſe theſe vapours, like alembic heads, into clouds, and ſo, by a kind of external diſtillation, give origin to ſprings and rivers; and, by amaſſing, cooling, and conſtipating them, turn them into rain, and by that means render the fervid region of the torrid zone habitable.

MOUNTING, in the mechanic arts, ſomething that ſerves to raiſe or ſet off a work: thus, the frame and its dependences make the mounting of a looking-glaſs; the hilt, the mounting of a ſword; the fuſt, or but, the mounting of a carbine, muſquet, &c. and the mounting of a fan, is the ſticks which ſerve to open and ſhut it.

MOUNTING, in military affairs, ſignifies going upon duty: thus, mounting a breach, is running up to it; mounting the guard, is going upon guard; and mounting the trenches is going upon duty in the trenches: but mounting a cannon, mortar, &c. is the ſetting it on its carriage, or the raiſing its mouth.

MOURNERS, an order of penitents in the ancient Chriſtian church, who lay proſtrate in the porches of the churches, begging the prayers of the faithful, as they went in, and deſiring to do public penance in the church.

MOUSE,

MOUSE, in zoology, a ſpecies of mus, with a long and almoſt naked tail, and a white belly.

MOUSE, among ſailors, a ſort of riſing made on the ſtays and ſome other ropes in a ſhip, to prevent the eye, in one end of the rope, from ſlipping up above its proper place, or the body of it. The mouſe, which is a dump ſomething reſembling a pear, is raiſed by winding tarred canvas, called parſling, about the ſtay in one place, and afterwards a great many turns of ſpun-yarn: the whole is completed by weaving a coat or cover round the mouſe, very curiouſly, which laſt is called pointing. See the article POINTING.

MOUTH, in anatomy, a part of the face, conſiſting of the lips, the gums, the inſides of the cheeks, the palate, the ſalival glands, the os hyoides, the uvula, and the tonſils, which ſee under their proper articles.

MOXA, a ſort of cotton or downy ſubſtance, ſeparated from the leaves of a kind of Indian mugwort; uſed by the Eaſtern nations for cauterizing in certain parts of the body.

MUCILAGE, in pharmacy, is in general any viſcid and glutinous liquor.

MUCILAGE alſo denotes a thick pituitous matter, evacuated with the urine, in the gravel and dyſuria. See the articles STONE and DYSURIA.

MUCILAGE alſo imports the liquor which principally ſerves to moiſten the ligaments and cartilages of the articulations; and is ſupplied by the mucilaginous glands.

MUCILAGINOUS GLANDS, in anatomy, a very numerous ſet of glands, ſerving to ſecrete the mucilage of the joints. See GLAND.

MUCOUS GLANDS, in anatomy, three glands, which empty themſelves into the urethra; ſo called by their firſt diſcoverer, Mr. Cowper, from the tenacity of the liquor which they ſeparate.

MUCRO CORDIS, in anatomy, the lower or pointed end of the heart. See HEART.

MUCUS, a mucilaginous liquor ſeparated by the mucous glands, and the noſtrils.

MUFFLE, in metallurgy, an arched cover, reſiſting the ſtrongeſt fire, and made to be placed over coppels and teſts, in the operations of aſſaying, to preſerve them from the falling of coals and aſhes into them; though at the ſame time of ſuch a form as is no hindrance to the action of the air and fire on the metal, nor to the inſpection of the aſſayer. The muffles may be made of any form, providing they have theſe conditions; but thoſe uſed with coppels are commonly made ſemicylindrical; or when greater veſſels are employed, in form of a hollow hemiſphere. The muffle muſt have holes, that the aſſayer may look in; and the fore part of it muſt be always quite open, that the air may act better in conjunction with the fire, and be inceſſantly renewed: the apertures in the muffle ſerve alſo for the regimen of the fire, for the cold air ruſhing into the larger opening before, cools the bodies in the veſſel; but if ſome coals are put in it, and its aperture before be then ſhut, with a door fitted to it, the fire will be increaſed to the higheſt degree, much more quickly than it can be by the breathing holes of the furnace. Another uſe of theſe apertures is alſo, that the arſenical vapours of lead and antimony paſſing through the holes in the back part of the muffle, may not be offenſive to the aſſayer, who ſtands before it. As to the height, length, and depth of the muffles, theſe muſt be proportioned to the ſize and number of the veſſels they are intended to cover; and care muſt be taken in this, that all the parts of the inner ſurface of theſe veſſels be in the reach of the aſſayer's eye. The moſt frequent ſize of the muffle is, however, four inches high, ſix or eight long, and four or ſix inches broad. The ſegments cut off at the baſes, for the leſſer holes, muſt be of ſuch a proportioned height that the leaſt veſſels put under may not be in the way of coals or aſhes falling into them.

MUFTY, or MUPHTI, the chief of the eccleſiaſtical order, or primate, of the muſſulman religion. The authority of the mufti is very great in the Ottoman empire; for even the ſultan himſelf, if he would preſerve any appearance of religion, cannot, without hearing his opinion, put any perſon to death, or ſo much as inflict any corporal puniſhment.

The election of the mufti is ſolely in the grand ſignior, who preſents him with a veſt of rich ſables, &c. If he is convicted of treaſon, or any great crime, he is put into a mortar, kept for that purpoſe in the Seven Towers at Conſtantinople, and pounded to death.

MUGGLETONIANS, a religious ſect, which aroſe in England, about the year 1657; ſo denominated from their leader Lodowick Muggleton, a journeyman taylor, who, with his aſſociate Reeves, ſet up for great prophets, pretending, as it is ſaid, to have an abſolute power of ſaving and damning whom they pleaſed; and giving out, that they were the two laſt witneſſes of God that ſhould appear before the end of the world.

MUGWORT, in botany, the ſame with the artemiſia. See ARTEMISIA.

MUID, a large meaſure, in uſe among the French, for things dry. The muid is no real veſſel uſed as a meaſure, but an eſtimation of ſeveral other meaſures, as the ſeptier, mine, minot, buſhel, &c.

MUID is alſo one of the nine caſks, or regular veſſels uſed in France, to put wine and other liquors in. The muid of wine is divided into two demi-muids, four quarter-muids, and eight half-quarter-muids, containing thirty-ſix ſeptiers.

MULATTO, a name given in the Indies to thoſe who are begotten by a negro man on an Indian woman, or an Indian man on a negro woman.

MULBERRY, *Morus*, in botany, a genus of plants, having no corolla; the ſtamina are four ſubulated erect filaments, longer than the cup; there is no pericarpium; the cup is very large, carnoſe, ſucculent, and baccated, containing a ſingle ovato-acute ſeed.

There are ſeveral ſpecies of this tree; but two only are generally cultivated, called the black and white mulberry.

The black mulberry grows naturally in Perſia, from whence it was firſt brought to the ſouthern parts of Europe; but is now become common in every part of Europe, where the winters are not very ſevere: for in the northern parts of Sweden, theſe trees will not live in the open air; and in ſeveral parts of Germany they are planted againſt walls, and treated in the ſame way as peach and other tender fruits are here.

Theſe trees are generally of both ſexes, having male flowers or katkins, on the ſame tree with the fruit; but it often happens that ſome of the trees which are raiſed from ſeeds, have only male flowers, and produce no fruit; ſo that thoſe who plant theſe trees for their fruit, ſhould never make choice of ſuch as have been propagated by ſeeds, unleſs they have ſeen them produce fruit in the nurſery. It is alſo the ſureſt way to mark ſuch trees as are fruitful in the nurſery, at the time when their fruit is upon them, becauſe thoſe trees which are propagated by layers, are ſometimes of the male ſort.

The old mulberry trees are not only more fruitful than the young, but their fruit are much larger and better flavoured; ſo that where there are any of theſe old trees, it is the beſt way to propagate from them, and to make choice of thoſe branches which are moſt fruitful. The uſual method of propagating theſe trees, is by laying down their branches, which will take root in one year, and are then ſeparated from the old trees; but as the moſt fruitful branches are often ſo far from the ground as not to be layed, unleſs by raiſing of boxes or baſkets of earth upon ſupports for this purpoſe, ſo the better way is to propagate them by cuttings, which, if rightly choſen and ſkilfully managed, will take root very well; and in this method there will be no difficulty in having them from trees at a diſtance, and from the moſt fruitful branches. Theſe cuttings ſhould be the ſhoots of the former year, with one joint of two years wood to their bottom; the cuttings ſhould not be ſhortened, but planted their full length, leaving two or three buds above ground. The beſt ſeaſon for planting them is in March, after the danger of hard froſt is over; they ſhould be planted in light rich earth, preſſing the ground pretty cloſe about them; and if they are covered with glaſſes, it will forward their putting out roots; but where there is no ſuch conveniency, the ground about them ſhould be covered with moſs to prevent its drying; and where this is carefully done, the cuttings will require but little water, and will

ſucceed much better than with having much wet. If the cuttings ſucceed well and make good ſhoots, they may be tranſplanted the following ſpring into a nurſery, where they ſhould be regularly trained to ſtems, by fixing down ſtakes to each, to which the principal ſhoots ſhould be faſtened; and moſt of the lateral branches ſhould be cloſely pruned off, leaving only two or three of the weakeſt to detain the ſap, for the augmentation of the ſtem; for when they are quite diveſted of the ſide ſhoots, the ſap is mounted to the top, ſo that the heads of the trees grow too faſt for the ſtems, and become too weighty for their ſupport. In about four years growth in the nurſery, they will be fit to tranſplant where they are to remain; for theſe trees are tranſplanted with greater ſafety while young, than when they are of a large ſize.

The white mulberry is commonly cultivated for its leaves to feed ſilk-worms, in France, Italy, &c. though the Perſians always make uſe of the common black mulberry for that purpoſe; and it is ſaid that the worms fed with thoſe of the black produce much better ſilk than thoſe fed with the white; but it is to be obſerved, that the leaves of the black ſort ſhould never be given to the worms, after they have eaten for ſome time of the white, leſt the worms ſhould burſt, which is often the caſe when they are thus treated.

The trees which are deſigned to feed ſilk worms, ſhould never be ſuffered to grow tall, but rather kept in a ſort of hedge; and inſtead of pulling off the leaves ſingly, they ſhould be ſheared off, together with their young branches, which is much ſooner done, and not ſo injurious to the tree.

This white ſort may be propagated either from the ſeeds or layers, as the black mulberry, and is equally hardy; but the moſt expeditious method of raiſing theſe trees in quantity, is from the ſeeds, which may be procured in plenty from the ſouth of France and Italy. The beſt way to ſow theſe ſeeds in England, is to make a moderate hot bed, which ſhould be arched over with hoops, and covered with mats; upon this bed the ſeeds ſhould be ſown in the middle of March, and covered over with light earth about a quarter of an inch deep: in very dry weather the bed muſt be frequently watered, and in the heat of the day ſhaded with mats, and alſo covered in the nights when they are cold. With this management the plants will come up in five or ſix weeks, and as they are tender when they firſt appear, ſo they muſt be guarded againſt froſty mornings, which often happens in May. During the ſummer they muſt be kept clean from weeds, which is all the culture they require: but there muſt be care taken of them the firſt winter, eſpecially to cover them in autumn, when the firſt froſts come, which will kill the tender plants to the ground, if they are not protected; the following March theſe plants ſhould be tranſplanted into the nurſery, to get ſtrength, where they may remain two or three years, and then ſhould be removed where they are to continue.

This mild dulco-acid fruit is ſometimes uſed medicinally, as a refrigerant, antiſeptic, relaxant, attenuant, and aperient. Boerhaave looks upon the continued uſe of mulberries as one of the principal remedies in caſes of obſtruction and viſcidity, and in putrid diſorders; and Hoffmann gives inſtances of ſome obſtinate diſeaſes being cured by them: this fruit apparently promotes the alvine and urinary excretions; and in ſome fevers, where watery liquors run off almoſt unchanged, the urine is impregnated with the colour of the juice of the berries. To perſons of a bilious temperament and rigid fibres, and where the habit is diſpoſed, naturally or from extrinſic cauſes, to an inflammatory or putreſcent ſtate, their moderate, and even plentiful uſe, is ſalubrious: by thoſe of a cold inactive diſpoſition, where the veſſels are lax, the circulation languid, and the digeſtion weak, this fruit ſhould be taken very ſparingly.

MULCT, a fine of money laid upon a man, who has committed ſome fault or miſdemeanor.

MULE, in zoology, a mongrel kind of quadruped, uſually generated between an aſs and a mare, and ſometimes between a horſe and a ſhe-aſs. The mule is a ſort of a monſter, of a middle nature between its parents, and therefore incapable of propagating its ſpecies; ſo careful is nature to avoid filling the world with monſters. Mules are chiefly uſed in countries where there are rocky and ſtony roads, as about the Alps, Pyrenees, &c. Great numbers of them are kept in theſe places; they are uſually black, ſtrong, well-limbed, and large, being moſtly bred out of the fine Spaniſh mares: the mules are ſometimes fifteen or ſixteen hands high. No creatures are ſo proper for carrying large burdens, and none ſo ſure-footed. They are much ſtronger for draught than our horſes, and are often as thick-ſet as our dray-horſes; and they will travel ſeveral months together, with ſix or eight hundred weight upon their backs: they are much hardier and ſtronger than horſes, and will live and work twice the age of a horſe; and thoſe mules which are light are fitter for riding than horſes, as to the walk and trot; but they are apt to gallop rough.

MULIER, in law, ſignifies the lawful iſſue born in wedlock, though begotten before.

MULLER, or MULLAR, denotes a ſtone flat and even at the bottom, but round a-top, uſed for grinding of matters on a marble. The apothecaries uſe mullers to prepare ſome of their teſtaceous powders, and painters for their colours, either dry or in oil.

Muller is alſo an inſtrument uſed by the glaſs-grinders; being a piece of wood, to one end whereof is cemented the glaſs to be ground. It is ordinarily about ſix inches long, turned round.

MULLET, *Mugil*, in ichthyology, a genus of the acanthopterygious fiſhes, the head of which is of a depreſſed form in the anterior part, and the body oblong and compreſſed. On each ſide of the head, below the noſtrils, there ſtands a little bone, which is ſerrated on its lower part; the eyes are not covered with a ſkin; and there are teeth on the tongue and palate, but none in the jaws or fauces; the branchioſtege membrane on each ſide contains ſix oſſicles; theſe are of a crooked figure, and the upper one, which is the broadeſt, is covered by the coverings of the gills in ſuch a manner, that only five appear.

MULLET, or MOLLET, in heraldry, a bearing in form of a flat, or rather of the rowel of a ſpur, which it originally repreſented.

MULSUM, MULSE, a liquor made of wine and honey, or even of wine and water.

MULTANGULAR, a figure, or body, which has many angles.

MULTILATERAL, in geometry, is applied to thoſe figures which have more than four ſides or angles, more uſually called polygons. See POLYGON.

MULTINOMIAL, or MULTINOMIAL ROOTS, in mathematics, ſuch roots as are compoſed of many names, parts, or members; as $a+b+d+c$, &c. See the article ROOT.

MULTIPLE, *Multiplex*, in arithmetic, a number which comprehends ſome other ſeveral times; thus 6 is a multiple of 2, and 12 is a multiple of 6, 4, and 3, comprehending the firſt twice, the ſecond thrice, &c.

MULTIPLE RATIO, or PROPORTION, is that which is between multiples. If the leſſer term of the ratio be an aliquot part of the greater, the ratio of the greater to the leſs is called multiple; and that of the leſs to the greater ſubmultiple. A ſubmultiple number is that contained in the multiple; thus, the numbers 1, 2, and 3, are ſubmultiples of 9. Duple, triple, &c. ratios, as alſo ſubduples, ſubtriples, &c. are ſo many ſpecies of multiple and ſubmultiple ratios. See RATIO.

MULTIPLICAND, in arithmetic, one of the factors in the rule of multiplication; being that number which is given to be multiplied by another, which is called the multiplicator, or multiplier.

MULTIPLICATION, in arithmetic, the art of multiplying one number by another, to find the product, or it is a compendious method of performing the operation of addition.

Thus the multiplication of 4 by 5 makes 20, that is, four times five amount to 20.

In multiplication the firſt factor, i. e. the number to be multiplied, or the multiplicand, is placed over that whereby it is to be multiplied, and the product under both.

A

An example or two will make the proceſs of multiplication eaſy.—Suppoſe 269 were to be multiplied by 8.—

Multiplicand	— —	269
Multiplier	— —	8
Product	— —	2152

The factors being thus diſpoſed, and a line drawn underneath (as in the example), I begin with the multiplicator thus: 8 times 9 make 72, ſet down 2, and carry 7 tens, as in addition; then 8 times 6 make 48, and 7 I carried, 55; ſet down 5, and carry five: laſtly, 8 times 2 make 16, and with 5 I carried, 21; which I put down: ſo coming to number the ſeveral figures placed in order, 2, 1, 5, 2, I find the product to be 2152.

If the multiplicator conſiſts of more than one figure, the whole multiplicand is to be added to itſelf; firſt, as often as the right hand figure of the multiplicator ſhews, then as often as the next figure of the multiplicator ſhews, and ſo on.—Thus 421×23 is equal to 421×3, together with 421×20. The product ariſing from each figure of the multiplicator, multiplied into the whole multiplicand, is to be placed by itſelf in ſuch a manner, that the firſt or right hand figure thereof may ſtand under that figure of the multiplicator from which the ſaid product ariſes. For inſtance;

Multiplicand — —	421
Multiplicator — — —	23
Particular product of 421×3 —	1263
Particular product of 421×20	842
The total product — —	9683

This diſpoſition of the right-hand figure of each product follows from the firſt general rule; the right-hand figure of each product being always of the ſame denomination with that figure of the multiplicator from which it ariſes.

Thus, in the example, the figure 2 in the product 842 is of the denomination of tens, as well as the figure 2 in the multiplicator. For 1×20, (that is, the 2 of the 23) $= 20$, or 2 put in the place of tens, or ſecond place.

Hence, if either of the factors have one or more cyphers on the right-hand, the multiplication may be performed without regarding the cyphers, till the product of the other figures be found, to which they are to be then affixed on the right. And if the multiplicator have cyphers intermixed, they need not be regarded at all.—Inſtances of each follow:

12 | 0	358 | 6000	24 | 00 3 | 0	8013 5006
120	2148000	72000	48078
			4006500
			40113078

Thus much is ſufficient for an idea of multiplication, where the multiplicator conſiſts wholly of integers; in the praxis whereof, it is ſuppoſed the learner is appriſed of the product of any of the nine digits multiplied by one another, eaſily learned from the common table, or otherwiſe.

There are alſo ſome abbreviations of this art.—Thus to multiply a number by 5, you need only add a cypher to it, and then halve it.—To multiply by 9, add a cypher to the given multiplicand, and ſubtract the multiplicand therefrom, the remainder muſt certainly be nine times the number which was given to be multiplied.—To multiply by 15, firſt multiply it by 10, which is done by annexing a cypher to it, to which add the product by 5, the ſum will be the required product.

Expedients for the more eaſy and expeditious multiplying large ſums are ſliding rules, and Nepier's bones; the want of which may be ſupplied by tabulating the multiplicand.

Where the multiplicator is not compoſed wholly of integers, as it frequently happens in buſineſs, where pounds are accompanied with ſhillings and pence; yards with feet and inches; the method of procedure, if you multiply by a ſingle digit, is the ſame as in ſimple numbers, only carrying from one denomination to another, as the nature of each ſpecie requires. E. gr. to multiply 123 *l.* 14 *s.* 9 *d.* 3 *q.* by 5; ſay, $5 \times 3q = 15q$; that is, 3 *d.* 3 *q.* write down the 3 *q.* and proceed, ſaying, $5 \times 9 = 45 d.$ that is, 3 *s.* 9 *d.* ſet down the 9 *d.* and proceed in the ſame manner through the reſt.

If you multiply by two or more digits, the methods of procedure are as follow:—Suppoſe I have bought 37 ells of cloth at 13 *l.* 16 *s.* 6 *d.* per ell, and would know the amount of the whole. I firſt multiply 37 ells by the 13 *l.* in the common method of multiplication by integers, leaving the two products without adding them up; then multiply the ſame 37 ells by 16 *s.* leaving, in the like manner, the two products without adding them. Laſtly, I multiply the ſame 37 by the 6 *d.* the product whereof is 222 *d.* which, divided by 12, gives 18 *s.* 6 *d.* and this added to the products of the 16 *s.* the ſum will be 610 *s.* 6 *d.* the amount of 37 ells at 16 *s.* 6 *d.* the ell. Laſtly, the 610 *s.* 6 *d.* are reduced into pounds, by dividing them by 20: upon adding the whole, the amount of 37 ells at 13 *l.* 16 *s.* 6 *d.* per ell will be found as in the following:

37 ells.	37 ells.	37 ells
At 13 pounds.	At 16 ſhillings.	At 6 pence.
111	222	222
37	37	
30.10.6	18.6	
Product 511.10.6	610.6	

Or thus: ſuppoſe the ſame queſtion; reduce the 13 *l.* 16 *s.* into ſhillings, the amount will be 276 *s.* reduce 276 *s.* into pence, adding 6, the amount will be be 3318 *d.* Multiply the 37 ells by 3318, the amount will be 122766 *d.* which divided by 12, and the quotient 10230 *s.* 6 *d.* reduced into pounds by cutting off the laſt figure on the right hand, and taking half of thoſe on the left, yields 511 *l.* 10 *s.* 6 *d.* the price of the 37 ells, as before. Though by theſe two methods any multiplication of this kind may be effected, yet the operations being long, we ſhall add a third much ſhorter.—Suppoſe the ſame queſtion: Multiply the price by the factors of the multiplicator, if reſolvable into factors; if not, by thoſe that come neareſt it; adding the price for the odd one, of multiplying it by what the factors want of the multiplier. So the work will ſtand thus; 37 ells at 16 *s.* 6 *d.*: $6 \times 6 = 36 \times 1 = 37$.

Therefore	— —	6	
		82	19 0
		497	14 0
		13	16 6
		511	10 6

The price of the 37 ells.

But the moſt commodious is the fourth method, which is performed by aliquot and aliquant parts—where you are to obſerve by the way, that aliquot parts of any thing are thoſe contained ſeveral times therein, and which divide without any remainder; and that aliquant parts are other parts of the ſame thing compoſed of ſeveral aliquot parts.

To multiply by aliquot parts, is, in effect, only to divide a number by 3, 4, &c. which is done by taking a 3^d, 4^{th}, 5^{th}, &c. from the number to be multiplied. Example.—To multiply, v. g. by 6 *s.* 8 *d.* Suppoſe I have 347 ells of ribband at 6 *s.* 8 *d.* per ell.

Multiplicand — —	347 ells.	
Multiplicator — —	6 *s.* 8 *d.*	
Product — — —	115 *l.* 13 *s.* 4 *d.*	

The queſtion being ſtated, take the multiplicator, which according to the table of aliquot parts, is the third; and ſay, the third of three is 1, ſet down 1; the third of 4 is 1, ſet down 1, remains 1, that is 1 ten, which added to 7 makes 17; then the third of 17 is 5; remain 2 units, i. e. two thirds, or 13 *s.* 4 *d.* which place after the pounds. Upon numbering the figures, 1, 1, and 5, integers, and 13 *s.* 4 *d.* the aliquot part remaining, I find the ſum 115 *l.* 13 *s.* 4 *d.*

For multiplication by aliquant parts: ſuppoſe I would multiply by the aliquant part 19 *s.* I firſt take for 10 *s.* half the multiplicand; then for 5, which is the fourth, and laſtly, for 4, which is the fifth. The products of the three aliquot parts that compoſe the aliquant part being added together, the ſum will be the total product of the multiplication, as in the following example; which may

may ſerve as a model for multiplication by any aliquant part that may occur.

Multiplicand	—	356 ells.
Multiplier	—	19 *s.*
		178 *l.* for 10 *s.*
		89 *l.* for 5 *s.*
		71 *l.* 4 *s.* for 4 *s.*
Product	—	338 *l.* 4 *s.*

For the Proof of MULTIPLICATION.—The operation is right when the product, divided by the multiplier, quotes the multiplicand; or divided by the multiplicand, quotes the multiplier. A readier way, though not abſolutely to be depended on, is thus: Add up the figures of the factors, caſting out the nines; and ſetting down the remainders of each, theſe multiplied together, and out of their product caſt away the nines, and ſet down the remainder; if this remainder agree with the remainder of the product, after the nines are caſt out, the work is right. This method of proving multiplication by caſting out the nines, depends upon a peculiar property of the number 9, which no other digit has, viz. that the remainder will be exactly the ſame, whether we divide any number whatſoever by 9, or firſt add together the digits compoſing that number, and then divide the ſum by 9. This premiſed, let F and f repreſent any propoſed factors or numbers that are to be multiplied together; then will $F \times f$ be the product: let alſo m and n repreſent the reſpective remainders after having divided each of thoſe factors by 9, or, which is the ſame thing, after having caſt out the nines: then it is evident that $F-m$, $f-n$, and $\overline{F-m} \times \overline{f-n}$ being reſpectively divided by nine, will exactly terminate without any remainder; but $\overline{F-m} \times \overline{f-n}$ is equal to $F \times f - Fm - fn + mn$, therefore Ff being divided by 9, muſt leave the ſame remainder as mn divided by 9; or the ſum of the digits in the product mn muſt, when divided by 9, leave the ſame remainder as the ſum of the digits in the product Ff would when divided by 9.

Croſs MULTIPLICATION, otherwiſe called duodecimal arithmetic, is an expeditious method of multiplying feet and inches by feet and inches. This is much uſed in meaſuring, &c.—The method is thus:

Suppoſe 5 feet 3 inches to be multiplied by 2 feet 4 inches: ſay,

	F.	I.
2 times 5 feet is 10 feet, and 2 times 3 is 6 inches:	5	3
again, 4 times 5 is 20 inches, or 1 foot 8 inches;	2	4
and 4 times 3 is 12 parts, or 1 inch: the whole	10	6
ſum makes 12 feet 3 inches. In this manner	1	8
you may manage yards, feet, inches, and parts,		1
&c.	12	3

MULTIPLICATION *of Algebra.*—In multiplication the general rule for the ſigns is, that when the ſigns of the factors are alike (i. e both + or both —) the ſign of the product is +; but when the ſigns of the factors are unlike, the ſign of the product is —.

Caſe 1. When any poſitive quantity, $+a$, is multiplied by any poſitive number, $+n$, the meaning is, that $+a$ is to be taken as many times as there are units in n; and the product is evidently na.

Caſe 2. When $-a$ is multiplied by n, then $-a$ is to be taken as often as there are units in n; and the product muſt be $-na$.

Caſe 3. Multiplication by a poſitive number implies a repeated addition: but multiplication by a negative implies a repeated ſubtraction. And, when $+a$ is to be multiplied by $-n$, the meaning is that $+a$ is to be ſubtracted as often as there are units in n; therefore the product is negative, being $-na$.

Caſe 4. When $-a$ is to be multiplied by $-n$, then $-a$ is to be ſubtracted as often as there are units in n; but to ſubtract $-a$ is equivalent to adding $+a$, conſequently the product is $+na$. The ſecond and fourth caſes may be illuſtrated in the following manner:

It is evident that $+a-a=0$; therefore if we multiply $+a-a$ by n, the product muſt vaniſh or be 0, becauſe the factor $a-a$ is 0. The firſt term of the product is $+na$ (by caſe 1.) Therefore, the ſecond term of the product muſt be $-na$, which deſtroys $+na$; ſo that the whole product muſt be $+na-na=0$. Therefore, $-a$ multiplied by $+n$ gives $-na$.

In the like manner, if we multiply $+a-a$ by $-n$, the firſt term of the product being $-na$, the latter term of the product muſt be $+na$, becauſe the two together muſt deſtroy each other, or their amount be 0, ſince one of the factors (viz. $a-a$) is 0. Therefore, $-a$ multiplied by $-n$ muſt give $+na$.

If the quantities to be multiplied are ſimple, find the ſign of the product by the laſt rule; after it place the product of the co-efficients, and ſet down all the letters after one another as before.

EXAMPLES.

Mult.	$+a$	$-2a$	$+6x$
By	$+a$	$+4b$	$-5a$
Product	$+ab$	$-8ab$	$-30ax$
Mult.	$-8x$	$+3ab$	
By	$-4a$	$-5ac$	
Product	$+32ax$	$-15aabc$.	

To multiply compound quantities, you muſt multiply every part of the multiplicand by all the parts of the multiplier taken one after another, and then collect all the products into one ſum: the ſum ſhall be the product required.

Mult.	$a+b$	$2a-3b$
By	$a+b$	$4a+5b$
Prod.	$aa+ab$	$8aa-12ab$
	$+ab+bb$	$+10ab-15bb$
Sum	$aa+2ab+bb$	$8aa-2ab-15bb$

Mult.	$2a-4b$	$xx-ax$
By	$2a+4b$	$x+a$
Prod.	$4aa-8ab$	$xxx-axx$
	$+8ab-16bb$	$+axx-aax$
Sum	$4aa..0.-16bb$	$xxx..0..-aax$

Mult. $aa+ab+bb$
By $a-b$
Prod. $aaa+aab+abb$
$-aab-abb-bbb$
Sum $aaa..0...0.....-bbb$

Products that ariſe from the multiplication of 2, 3, or more quantities, as abc, are ſaid to be of 2, 3, or more dimenſions; and thoſe quantities are called factors or roots.

If all the factors are equal, then theſe products are called powers; as aa or aaa are powers of a. Powers are expreſſed ſometimes by placing, above the root to the right hand, a figure expreſſing the number of factors that produce them, thus:

a	1ſt		a
aa	2d		a^2
aaa	3d	power of the root a,	a^3
$aaaa$	4th	and is generally expreſſed thus:	a^4
$aaaaa$	5th		a^5

Theſe figures which expreſs the number of factors that produce powers are called their indices or exponents; thus 2 is the index of a^2. And powers of the ſame root are multiplied by adding their exponents thus: $a^2 \times a^3 = a^5$. $a^4 \times a^3 = a^7$. $a^3 \times a = a^4$.

Sometimes it is uſeful not actually to multiply compound quantities, but to ſet them down upon the ſign of multiplication ($\times$) between them, drawing a line over each of the compound factors. Thus $\overline{a+b} \times \overline{a-b}$ expreſſes the product of $a+b$ multiplied by $a-b$.

MULTIPLICATION *of Surds.* When the quantities are pure ſurds of the ſame kind, multiply them together, and to their product prefix their radical ſign. Thus $\sqrt{b} \times \sqrt{a} = \sqrt{ba}$, and $\sqrt{\overline{ba+da}} \times \sqrt{ca} = \sqrt{\overline{bcaa+dcaa}}$.

If the ſurd quantities of the ſame kind are joined to rational quantities, then multiply the rational into the rational, and the ſurd into the ſurd, and join their products together. Thus $d\sqrt{bc} \times 3b\sqrt{a} = 3db\sqrt{bca}$, and $5cd\sqrt{\overline{ba+da}} \times 3a\sqrt{ca} = 15cda\sqrt{\overline{bcaa+dcaa}}$.

MUL-

MULTIPLICATOR, or MULTIPLIER, in arithmetic, a number multiplying another called the multiplicand.

MULTIPLYING GLASS, in optics, one wherein objects appear increased in number.

It is otherwise called a polyhedron, being ground into several planes, that make angles with each other; thro' which the rays of light, iſſuing from the ſame point, undergo different refractions, ſo as to enter the eye from every ſurface in a different direction.

MULTISIQUOUS PLANTS, thoſe which have after each flower many diſtinct, long, ſlender, ſiliquæ, or pods, in which their ſeed is contained: ſuch are bear's foot, columbine, houſe-leek, navel-wort, orpine, &c.

MULTITUDE, an aſſemblage or collection of a great number of diſtinct perſons or things: thus we ſay, a multitude of men, of horſes, of trees, &c.

MUM, a kind of malt-liquor, much drank in Germany; and chiefly brought from Brunſwic, which is the place of moſt note for making it. The proceſs of brewing mum, as recorded in the town-houſe of that city, is as follows: Take ſixty-three gallons of water that has been boiled till one-third part is conſumed, and brew it with ſeven buſhels of wheaten-malt, one buſhel of oat-malt, and one buſhel of ground beans; when it is tunned, the hogſhead muſt not be filled too full at firſt; as ſoon as it begins to work, put into it three pounds of the inner rind of fir; one pound of the tops of fir and beech; three handfuls of carduus benedictus; a handful or two of the flowers of roſa ſolis; add burnet, betony, marjoram, avens, penny-royal, and wild thyme, of each a handful and a half; of elder-flowers, two handfuls or more; ſeeds of cardamum bruiſed, thirty-ounces; barberries bruiſed, one ounce; when the liquor has worked a while, put the herbs and ſeeds into the veſſel; and, after they are added, let it work over as little as poſſible; then fill it up: laſtly, when it is ſtopped, put into the hogſhead ten new-laid eggs unbroken; ſtop it up cloſe, and drink it at two years end. Our Engliſh brewers, inſtead of the inner rind of fir, uſe cardamum, ginger, and ſaſſafras; and alſo add elecampane, madder, and red ſanders.

MUMMY, a body embalmed or dried, in the manner uſed by the ancient Egyptians: or the compoſition with which it is embalmed. There are two kinds of bodies denominated mummies: the firſt are only carcaſes dried by the heat of the ſun, and by that means kept from putreſaction: theſe are frequently found in the ſands of Lybia. Some imagine, that theſe are the bodies of deceaſed people buried there on purpoſe to keep them intire without embalming; others think they are the carcaſſes of travellers, who have been overwhelmed by the clouds of ſand raiſed by the hurricanes frequent in thoſe deſarts. The ſecond kind of mummies are bodies taken out of the catacombs, near Cairo, in which the Egyptians depoſited their dead, after embalming.

MUMMY, among gardeners, a kind of wax uſed in grafting and planting the roots of trees, made in the following manner; take one pound of black pitch, and a quarter of a pound of turpentine; put them together into an earthen pot, and ſet them on fire in the open air, holding ſomething in your hand to cover and quench the mixture in time, which is to be alternately lighted and quenched till all the nitrous and volatile parts be evaporated. To this a little common wax is to be added; and the compoſition is then to be ſet by for uſe.

Dr. Agricola directs its being uſed in planting pieces of the roots of trees, in the following manner: melt it, and having let it cool a little, dip in the two ends of the pieces of root, one after another; then put them in water, and plant them in the earth, the ſmall end downward, ſo that the larger may appear a little way out of the earth, in order to have the benefit of the air; then preſs the earth hard down about them that they may not receive too much wet. This work he recommends to be performed in the months of September, October, and November.

MUNDIC, in natural hiſtory, a metallic mineral more commonly called marcaſite.

MUNDIFICATIVES, *Mundifiers*, *Mundificativa*, in phyſic, cleanſing or deterging medicines.

The word is derived from the Latin *mundus*, clean.

MUNICIPAL, in the Roman civil law, an epithet which ſignifies, inveſted with the rights and privileges of Roman citizens. Thus the municipal cities were thoſe whoſe inhabitants were capable of enjoying civil offices in the city of Rome.

MUNIMENTS, or MINIMENTS, the writings relating to a perſon's inheritance, by which he is enabled to defend his title to his eſtate: or, in a more general ſenſe, all manner of evidences, ſuch as charters, feoffments, releaſes, &c.

MUNIMENT HOUSE, a little ſtrong room in a cathedral, college, or univerſity, deſtined for keeping the ſeal, charters, &c. of ſuch cathedral, college, &c.

MUNIONS, in architecture, are the ſhort upright poſts or bars which divide the ſeveral lights in a window frame.

MUNITION, the proviſions with which a place is furniſhed in order for defence; or that which follows a camp for its ſubſiſtence. See the article AMMUNITION.

MURAL, in general, any thing belonging to a wall, which the Latins call *murus*.

MURAL ARCH is a wall, or walled arch, placed exactly in the plane of the meridian, for fixing a large quadrant, ſextant, or other inſtrument, in order to obſerve the meridian altitudes of the heavenly bodies.

MURAL CROWN. See the article CROWN.

MURDER, or MURTHER, in law, is the wilful and felonious killing a perſon from premeditated malice; provided the party wounded, or otherwiſe hurt, die within a year and a day after the fact was committed.

MUREX, in natural hiſtory, a genus of univalve or ſimple ſhells, without any hinge, formed of a ſingle piece, and beſet with tubercles or ſpines; the mouth is large and oblong, and has an expanded lip, and the clavicle is rough.

MURRAIN, or GARGLE, a contagious diſeaſe among cattle.

The moſt remarkable murrain is that mentioned in the Philoſophical Tranſactions, which ſpread through Switzerland, Germany, into Poland, &c.

The contagion ſeemed to propagate itſelf in form of a blue miſt, which fell on the graſs where the cattle grazed, when whole herds, forbearing their food, almoſt died away in twenty-four hours. Upon diſſection were found large corrupted ſpleens, ſphacelous and corroded tongues, &c. And even the perſons who managed them were infected, and died like the beaſts.

Some imagined it had its riſe from noxious vapours thrown out of the earth, in three earthquakes perceived in the neighbourhood of the place where it began; though Dr. Slare thinks it rather owing to ſwarms of volatile inſects.

The antidote for the ſound, and medicine for the ſick, was equal parts of ſoot, gunpowder, brimſtone, and ſalt, with as much water as would waſh it down: a ſpoonful was the doſe.

MURREY, in heraldry, a kind of purple colour. See SANGUINE.

MUS, in zoology, a genus of quadrupeds, of the order of the agriæ, the characters of which are theſe: the fore-teeth are acute, and there are no canine teeth at all, the feet are divided, and the ears naked.

Of this genus there are a great many ſpecies, known by diſtinct Engliſh names; as the rat, mouſe, dor-mouſe, or ſorex, citille, agutis, guinea-pig, &c.

MUSA, the plantain tree, in botany, a genus of plants, the flower of which conſiſts of two petals; one of which is erect, and divided by five indentings at the edge; and the other is hollow, ſhorter, and nectariferous: the ſtamina are ſix, and the fruit is an oblong, triquetrous berry.

MUSCÆ VOLITANTES, certain dark ſpots, ſeen by many people on looking at the ſky, a candle, or other bright object; ſo called, from their reſembling flies.

MUSCADINE, a rich kind of wine, of the growth of Provence and Languedoc, in France.

MUSCLE, *Muſculus*, in anatomy, a part of the human body, deſtined to move ſome other part, and that in general by a voluntary motion, or ſuch as is dictated by the will; being compoſed principally of fleſh and tendinous fibres, which have alſo veſſels of all kinds, as arteries,

veins, nerves, and lymphatics; all which are ſurrounded by, or encloſed in, one common membrane.

The muſcular fibres are, according to the action they are intended for, of various directions; ſome ſtraight, others oblique, tranſverſe, annular, and ſpiral. Some conſiſt of one uniform ſeries of fibres, and on that account are called ſimple; others are compoſed of various, and often contrary courſes of fibres, and theſe being cloſely arranged together, the large one ſeems to be made up of a number of leſſer muſcles, and is therefore called compound; and the more of theſe cluſters of fibres, or ſmaller veſſels, enter into the compoſition of a larger one, the thicker and ſtronger it is.

A muſcle is divided, by anatomiſts, into the body, and the two extremities: the body *c* (plate XC. *fig.* 2.) is alſo called the venter or belly of the muſcle; and the two extremities, if white, are called tendons; whereof that marked *a* is the right, and *b* the left. Fig. 3. repreſents a ſimple muſcle opened, to ſhew the internal ſeries of fleſhy fibres; and *fig.* 5. exhibits a ſection of a regular compound muſcle, ſhewing the arrangement of fibres in each belly.

That extremity where the muſcle ariſes is called its head, caput; or its beginning, origin, or fixed point: and its other extremity, or end, is called its tail, moveable point, and often its tendon; and, finally, if this be broad and membranous, it is called an aponeuroſis.

In many of the muſcles, both the extremities are moveable: in theſe, that part which of the two is leaſt moveable, is always called the head, and the more moveable part the tail. This, however, cannot be done univerſally; ſince there are caſes in which that extremity of a muſcle, which was before the moveable point, becomes the fixed point; and *vice verſa*, as in the ſerrati antici, and ſome of the muſcles of the abdomen, not to mention any others.

Action of the MUSCLES. This conſiſts in the contraction of its belly, after whatever manner that is done: by this means its extremities approach toward each other; and by this means alſo the part in which the end of the muſcle is inſerted, moves as if it were drawn by a cord. Schelhammer is of opinion, that this contraction of the belly of the muſcle is effected by a corrugation of the fibres, in the ſame manner as we ſee an earthworm ſhorten and contract itſelf by corrugating its ſkin, &c. Morgagni, on the other hand, alledges, that, in order to underſtand the power of motion in a muſcle, we ought to attend to Wallis's experiment; by which it is evidently proved, that the ſmalleſt force imaginable of the air, driven thro' a cylindric tube into a bladder, will, by diſtending its width, and ſhortening its length, cauſe it to raiſe up, and ſuſtain a weight of ſixty or ſeventy pounds.

Others have demonſtrated, from hydroſtatical principles, that a very ſmall quantity of a fluid, directed thro' a ſmall cylindric tube, placed in a veſſel of a larger baſe, and already filled, will be able, in the ſame manner, to move and raiſe up a large weight; from whence they conclude, that the belly of a muſcle ſwells in the time of its contraction or action; and that this intumeſcence may, nay and muſt, have very great effects.

On the other hand, there are, among the lateſt and moſt celebrated writers, ſome who affirm that the belly of a muſcle does not ſwell or become diſtended at all in the time of its contraction. But it would be well, ſays Heiſter, if the aſſertors of this opinion would, while they forcibly draw up the under jaw to the upper, lay two or three of their fingers upon either the temporal or maſſeter muſcle; for in this caſe they would ſee the moſt evident of all conviction, that, while theſe muſcles act, their bellies are in reality diſtended, and rendered firmer. Or let them only, when the hand is placed in a proper ſituation, forcibly draw the thumb toward the firſt finger, and then they may both ſee and feel, that the muſcle between the thumb and the index ſwells, or is diſtended in its middle, as the action of drawing the thumb is performed. The reader who would enter more deeply into this diſquiſition, may conſult Borelli *de Motu Animalium*; Bernouilli *de Motu muſcul.* Berger's *Phyſiolog.* c. 22. Boerhaave's *Inſtitutes*, chap. of muſcular motion; and Mead's *Introduction to Cowper's Myographia*.

Among the muſcles, there are different ones that conſpire in the ſame action, and ſo perform the ſame motion as aſſociates: ſuch are the flexors or extenſors of the arm, and the like: hence theſe, and ſuch others as conſpire in the ſame manner to the ſame action, are called by authors focii and congeneres.

When, on the other hand, we regard the contrary actions of certain muſcles, as the extenſors of any part which act quite contrarily to the flexors, theſe are called antagoniſt muſcles; in this caſe both the kinds acting together, render the limbs rigid or immoveable: this action of the muſcles is called motus tonicus. It is alſo obſervable, that ſeveral of the muſcles, conſidered ſingly and ſeparately, perform other kinds of motions beſides thoſe aſcribed to them in regard to the whole part: thus the maſtoide muſcle, the rectus major capitis, &c. when they act on both ſides, bend the head forwards; but when only on one ſide, they draw the head obliquely downwards, and to one ſide. Hence, from the diverſity of the muſcles, which act either alone or conjunctly with their aſſociates, or with others, there ariſe ſeveral intermediate motions, quite different from the primary ones, and ſuch as have not hitherto been ſufficiently obſerved. This does not only happen in regard to the muſcles of the head, the flexors and extenſors, and the like, but to ſeveral others; and particularly to thoſe of the eyes, the lips, the jaws, the tongue, the neck, the abdomen, the arm, the carpus, &c. Theſe we are carefully to attend to, and explain to ourſelves, by what particular muſcles, acting diſtinctly, they are performed; otherwiſe we ſhall never be able to underſtand the various and wonderful motions of the parts. Winſlow, in his excellent obſervations on the actions of the muſcles, publiſhed in the Memoirs of the Paris-Academy, obſerves, among other curious things, that a great many of the motions of the muſcular parts are not owing to the ſuppoſed contraction, but to the relaxation of the muſcles on the oppoſite ſide.

MUSCLE, *Mytulus*, in natural hiſtory, a ſhell compoſed of two valves, of an oblong figure, and ſhutting cloſe all the way; the valves are both convex, and of a ſimilar ſhape: and the animal inhabiting it is called a tethys.

MUSCULAR, or MUSCULOUS, in anatomy, ſomething relating to, or partaking of the nature of a muſcle. See the article MUSCLE.

MUSEUM, a name which originally ſignified a part of the palace of Alexandria, which took up at leaſt one fourth of that city. This quarter was called the Muſeum, from its being ſet apart for the muſes and the ſtudy of the ſciences. Here were lodged and entertained the men of learning, who were divided into many companies or colleges, according to the ſciences of which they were the profeſſors; and to each of theſe houſes or colleges was allotted a handſome revenue. The foundation of this eſtabliſhment is attributed to Ptolemy Philadelphus, who here placed his library. Hence the word muſeum is now applied to any place ſet apart as a repoſitory for things that have an immediate relation to the arts.

MUSES, certain fabulous divinities amongſt the Pagans, ſuppoſed to preſide over the arts and ſciences: for this reaſon it is uſual for the poets, at the beginning of a poem, to invoke theſe goddeſſes to their aid. Some reckon the muſes to be no more than three, viz. Mneme, Aœde, and Melete; that is, memory, ſinging, and meditation: but the moſt antient authors, and particularly Homer and Heſiod, reckon nine; Clio, which means glory; Euterpe, pleaſing; Thalia, flouriſhing; Melpomene, attracting; Terpſichore, rejoicing the heart; Erato, the amiable; Polyhymnia, a multitude of ſongs; Urania, the heavenly; and Calliope, ſweetneſs of voice. To Clio, they attributed the invention of hiſtory; to Melpomene, tragedy; to Thalia, comedy; to Euterpe, the uſe of the flute; to Terpſichore, the harp; and to Erato, the lyre and lute; to Calliope, heroic verſe; to Urania, aſtrology; and to Polyhymnia, rhetoric.

The muſes are painted young, handſome, and modeſt; agreeably dreſſed, and crowned with flowers. Their buſineſs was to celebrate the victories of the gods, and to inſpire and aſſiſt the poets: hence the cuſtom of invoking their aid at the beginning of a poem. It muſt not, however, be imagined, that the antient poets themſelves

ſelves ever conſidered the deities thus invoked, as divine perſons from whom they expected any real help. Their addreſſes to the muſes are mere allegories, and manners of expreſſing themſelves poetically, as when they make gods of ſleep, of fame, of virtue; and other natural and moral things; under the name of muſe they prayed for the genius of poetry, and all the talents neceſſary for a happy execution of what they had undertaken.

MUSHROOM, *fungus*, in botany, a genus of imperfect plants, compoſed of a pedicle, crowned with a broad head, convex and ſmooth at the top; and hollow, foliated, lamellated, or fiſtulous on the under ſide.

Mr. Miller directs the following method of cultivating them. If you have no beds of your own that produce them, you ſhould look abroad in rich paſtures, during the months of Auguſt and September, till you find them; and then opening the ground about their roots, you will often find the earth full of ſmall white knobs, which are the off-ſets from the muſhrooms: theſe ſhould be carefully gathered, and preſerved dry with the earth about them. The muſhroom-beds ſhould be made of dung in which there is good ſtore of litter. Theſe beds ſhould be made on dry ground, and the dung be laid upon the ſurface about a foot thick, two feet and a half broad, and of a length in proportion to the quantity of muſhrooms deſired: it ſhould be covered about four inches deep with ſtrong earth; upon this lay more dung, about ten inches thick; then another layer of earth; ſtill drawing in the ſides of the bed, ſo as to form it like the ridge of an houſe, which may be done by three layers of dung and as many of earth. When the bed is finiſhed it ſhould be covered with litter, to keep out the wet and prevent its drying; in this ſituation it may remain eight or ten days, by which time it will be of a proper degree of warmth; the litter ſhould then be taken off, the ſides of the bed ſmoothed, and a covering of light rich earth ſhould be laid over the bed; upon this the ſmall roots or off-ſets of the muſhrooms ſhould be put, placing them two or three inches aſunder; then gently cover them about half an inch thick with the ſame light earth; and again put on the covering of litter. The great ſkill in managing theſe beds, is that of keeping them in a proper temperature of moiſture. By this means muſhrooms may be produced all the year; and when the beds are deſtroyed, the ſurface which contains the duſt and roots of the muſhrooms, ſhould be laid by in a dry place for a freſh ſupply, till the proper time of uſing it.

MUSIC is one of the ſeven ſciences, commonly called liberal, and comprehended alſo among the mathematical, as having for its object diſcrete quantity or number, but not conſidering it in the abſtract like arithmetic, but in relation to time and ſound, in order to make a delightful harmony: or, it is the art of diſpoſing and conducting ſounds conſidered as acute and grave; and proportioning them among themſelves, and ſeparating them by juſt intervals pleaſing to the ſenſe.

Mr. Malcolm defines it a ſcience that teaches how ſound, under certain meaſures of time and tune, may be produced; and ſo ordered and diſpoſed, as either in conſonance or ſucceſſion, or both, they may raiſe agreeable ſenſations.

MUSK, *Moſchus*, in the materia medica, an odoriferous, grumous ſubſtance, found in a little bag, ſituated near the umbilical region of an oriental quadruped, which is ſaid by ſome to bear the greateſt reſemblance to the goat, by others to the ſtag-kind. The beſt muſk is brought from Tonquin in China, an inferior ſort from Agria and Bengal, and a ſtill worſe ſort from Ruſſia.

Fine muſk comes over in round thin bladders, generally about the ſize of pigeon's eggs, covered with ſhort brown hairs well filled, and without any aperture, or any appearance of their having been opened. The muſk itſelf is dry, with a kind of unctuoſity; of a dark reddiſh brown, or ruſty blackiſh colour; in ſmall round grains, with very few hard black clots; perfectly free from any ſandy or other viſible foreign matter. Chewed, and rubbed with a knife on paper, it looks bright, yellowiſh, ſmooth, and free from grittineſs. Laid on a red-hot iron, it catches flame, and burns almoſt intirely away, leaving only an exceeding ſmall quantity of light greyiſh aſhes: if any earthy ſubſtances have mixed with the muſk, the quantity of the reſiduum will diſcover them.

This concrete has a bitteriſh ſubacrid taſte; and a fragrant ſmell, agreeable at a diſtance, but ſo ſtrong as to be diſagreeable when ſmelt too near, unleſs weakened by a large admixture of other ſubſtances. A ſmall quantity, macerated for a few days in rectified ſpirit of wine, imparts a deep colour, and a ſtrong impregnation to the ſpirit: this tincture of itſelf, diſcovers but little ſmell, the ſpirit covering or ſuppreſſing the ſmell; but on dilution it manifeſts the full fragrance of the muſk, a drop or two communicating to a quart of wine or watery liquors a rich muſky ſcent. The quantity of liquor which may thus be flavoured by a certain known proportion of muſk, appears to be the beſt criterion of the genuineneſs and goodneſs of this commodity; a commodity which is not only ſaid to vary in goodneſs according to the ſeaſon of its being taken from the animal, but which is oftentimes ſo artfully ſophiſticated, that the abuſes cannot be diſcovered by any external characters, or by any other known means than the degree of its ſpecific ſmell and taſte, which the above experiment affords the moſt commodious method of meaſuring. The rectified ſpirit takes up completely the active matter of the muſk; watery liquors extract it only in part. The ſhops endeavour to procure an union of its virtues with water by the intervention of ſugar: twelve grains of muſk and a dram of fine ſugar are thoroughly ground together, and ſix ounces by meaſure of damaſk roſe-water added by degrees: this intermedium, however, does not anſwer ſo effectually as could be wiſhed; the mixture, at firſt turbid, becoming clear on ſtanding for a little time, and depoſiting, along with the feculent matter, a great ſhare of the medicinal parts of the muſk: the moſt ſucceſsful medium for uniting muſk with water, appears to be mucilage of gum arabic. By diſtillation, water becomes ſtrongly impregnated with the ſcent of the muſk, and ſeems to elevate all its odoriferous matter; while rectified ſpirit, on the contrary, brings over little or nothing of it.

MUSK, a medicine of great eſteem in the Eaſtern countries, has lately come into uſe among us, alſo, in ſome nervous diſorders; though liable, by its ſtrong impreſſion on the organs of ſmell, to offend and diſorder hyſterical perſons and conſtitutions of great ſenſibility, yet, when taken internally, it is found to abate ſymptoms of that kind, which its ſmell produces, and to be one of the principal medicines of the antipaſmodic claſs. Dr. Wall informs us, that two perſons labouring under a ſubſultus tendinum, extreme anxiety, and want of ſleep, occaſioned by the bite of a mad dog, were perfectly relieved by two doſes of muſk of ſixteen grains each: that convulſive hiccoughs, attended with the worſt ſymptoms, were removed by a doſe or two of ten grains; that in ſome caſes, where this medicine could not, on account of ſtrong convulſions, be adminiſtered by the mouth, it proved of ſervice when injected as a clyſter: that he never met with any perſon, how averſe ſoever to perfumes, but could take it in the form of a bolus without inconvenience: that under the quantity of ſix grains, he never found much effect from it, but that when given to ten grains and upwards, it produces a mild diaphoreſis, without heating or giving any uneaſineſs, but on the contrary, abating pain and raiſing the ſpirits; and that after the ſweat has begun, a refreſhing ſleep generally ſucceeds. This medicine has been tried alſo in ſome maniacal caſes, in which it ſeemed to procure a temporary relief.

MUSKET, a fire arm borne on the ſhoulder, and uſed in war. The length of a muſket is fixed at three feet eight inches from the muzzle to the pan, and it carries a ball of ſixteen to the pound.

In fortification, the length of the line of defence is limited by the ordinary diſtance of a muſket-ſhot, which is about 120 fathoms; and the length of almoſt all military architecture is regulated by this rule.

MUSKET-BASKETS, in fortification. See the article BASKETS *of Earth*.

MUSKETOON, a kind of ſhort thick muſket, whoſe bore is the thirty-eighth part of its length: it carries five

ounces

ounces of iron, or ſeven and a half of lead, with an equal quantity of powder. This is the ſhorteſt ſort of blunderbuſſes. See BLUNDERBUSS.

MUSLIN, a fine thin ſort of cotton cloth, which bears a downy knap on its ſurface. There are ſeveral ſorts of muſlins brought from the Eaſt Indies, and more particularly from Bengal; ſuch as doreas, beteſſes, mulmuls, tanjeebs, &c.

MUSTER, in the marine, a ſummoning together the crew of any particular ſhip, and calling them ſeverally over by their names.

MUTE, *dumb*, in a general ſenſe, ſignifies a perſon that cannot ſpeak, or has not the uſe of ſpeech.

MUTE, in law, a perſon that ſtands dumb or ſpeechleſs, when he ought to anſwer, or to plead.

MUTE, in grammar, a letter which yields no ſound without the addition of a vowel. The ſimple conſonants are ordinarily diſtinguiſhed into mutes and liquids, or ſemivowels.

The mutes in the Greek alphabet are nine, three of which, viz. π, κ, τ, are termed tenues; three, β, γ, δ, termed mediæ; and three, φ, χ, θ, termed aſpirates.

The mutes of the Latin alphabet are alſo nine, viz. B, C, D, G, L, K, P, Q, T.

MUTILATION, the retrenching or cutting away any member of the body.

This word is alſo extended to ſtatues and buildings, where any part is wanting, or the projecture of any member, as a corniche or an impoſt, is broken off.

MUTULE, in architecture, a kind of ſquare modillion ſet under the corniche of the Doric order.

The only difference between the mutule and modillion conſiſts in this, that the former is uſed in ſpeaking of the Doric order, and the latter in the Corinthian.

MUZZLE *of a Gun or Mortar*, the extremity at which the powder and ball is put in; and hence, the muzzle-ring is the metalline circle, or moulding, that ſurrounds the mouth of the piece. See GUN.

MYLOGLOSSI, in anatomy, two muſcles of the tongue. See TONGUE.

They are ſo called, as ariſing from the roots of the dentes molares.

The word is formed of the Greek $\mu\upsilon\lambda\alpha\iota$, the grinders, and $\gamma\lambda\omega\sigma\sigma\alpha$, the tongue.

MYLOHYOIDÆI, in anatomy, are two muſcles of the os hyoides. See TONGUE.

MYOLOGY, *Myologia*, a treatiſe or deſcription of the muſcles. See MUSCLE.

The word is Greek, and formed of $\mu\upsilon\varsigma$, or $\mu\upsilon\omega$, a muſcle, and $\lambda o\gamma o\varsigma$, diſcourſe.

MYOPIA, or MYOPIAS, implies a ſhort-ſighted, or purblind perſon, who cannot ſee objects at a diſtance but confuſedly, and near ones diſtinctly, which is contradiſtinguiſhed from preſbyta. See the article PRESBYTA.

The word is Greek, and formed of $\mu\upsilon\omega$, to ſhut, and $\omega\psi$, the eye; becauſe people ſo affected generally half ſhut the eyes, when they look intenſely at an object.

This diſorder is owing to the too great convexity of the ball of the eye, and particularly of the cryſtaline humour; whereby the viſual rays concur before they reach the retina. For this reaſon, to ſee an object diſtinctly, they muſt either apply it cloſe to the eye, or uſe a concave glaſs.

MYOSOTIS, mouſe-ear, in botany, a genus of plants, with a monopetalous flower, ſemiquinquifid at the limb: the ſeeds are four, which are contained in the bottom of the cup.

MYOSURUS, mouſe-tail, in botany, a genus of plants, the flower of which conſiſts of five very ſmall petals; and its numerous ſeeds are diſpoſed in an imbricated order upon a receptacle.

MYRIAD, a term ſometimes uſed to denote ten thouſand.

MYRIOPHYLLUM, ſmall water milfoil, in botany, a genus of plants, without any flower petals; and the fruit is compoſed of four naked ſeeds.

MYRISTICA, the nutmeg-tree, a genus of trees, the characters of which are not fully aſcertained: it is ſaid to have no flower petals; and its fruit is a drupe, of a roundiſh figure, containing a ſingle ſeed, lightly ſulcated. See NUTMEG.

MYROBALANS, dried medicinal fruits, of the plum kind, brought from the Eaſt Indies.

Five ſorts have been diſtinguiſhed in the ſhops; but all of them have an unpleaſant, bitteriſh, very auſtere taſte; and ſtrike an inky blackneſs with ſolution of chalybeate vitriol. They are ſaid to have a gently purgative, as well as aſtringent and corroborating virtue; but in this country, they have long been entire ſtrangers to practice, and are now diſcarded by the colleges both of London and of Edinburgh, from their catalogue of officinals.

MYRRH, in the materia medica, a gummy reſinous concrete juice, of an oriental tree, of which we have no certain account. It comes over in glebes or drops, of various colours and magnitudes; the beſt ſort is ſomewhat tranſparent, friable, in ſome degree unctuous to the touch, of an uniform browniſh or reddiſh yellow colour, often ſtreaked internally with whitiſh ſemi-circular veins; of a moderately ſtrong, not diſagreeable, ſmell; and a lightly pungent, very bitter taſte, accompanied with an aromatic flavour, but not ſufficient to prevent its being nauſeous to the palate. There are ſometimes found among it hard ſhining pieces, of a pale yellowiſh colour, reſembling gum arabic, of no taſte or ſmell: ſometimes maſſes of bdellium, darker-coloured, more opake, internally ſofter than the myrrh, and differing from it both in ſmell and taſte: ſometimes an unctuous gummy reſin of a moderately ſtrong ſomewhat ungrateful ſmell, and a bitteriſh very durable taſte, obviouſly different both from thoſe of bdellium and myrrh: ſometimes likewiſe, as Cartheuſer obſerves, hard compact dark-coloured tears, of an offenſive ſmell, and a moſt ungrateful bitterneſs, ſo as, when kept for ſome time in the mouth, to provoke reaching. Great care is therefore requiſite in the choice of this drug.

This bitter aromatic gummy-reſin is a warm corroborant, deobſtruent, and antiſeptic. It is given from a few grains to a ſcruple and upwards, in uterine obſtructions, cachexies, putrid fevers, &c. and often employed alſo as an external antiſeptic and traumatic.

Myrrh diſſolves almoſt totally in boiling water, but as the liquor cools, a proportion of reſinous matter ſubſides. The ſtrained ſolution is of a dark yellowiſh colour, ſomewhat turbid, ſmells and taſtes ſtrongly of the myrrh, and retains both its taſte and a conſiderable ſhare of its ſcent, on being inſpiſſated with a gentle heat to the conſiſtence of an extract. By diſtillation with a boiling heat, the whole of its flavour ariſes, partly impregnating the diſtilled water, partly collected and concentrated in the form of an eſſential oil; which is in ſmell extremely fragrant, and rather more agreeable than the myrrh in ſubſtance, in taſte remarkably mild, ſo ponderous as to ſink in the aqueous fluid, whereas the oils of moſt, perhaps of all the other gummy-reſins ſwim: the quantity of oil, according to Hoffman's experiments, is about two drams from ſixteen ounces, and when the myrrh is of a very good kind, near three drams.

Rectified ſpirit diſſolves leſs of this concrete than water, but extracts more perfectly that part in which its bitterneſs, flavour, and virtues reſide: the reſinous matter, which water leaves undiſſolved, is very bitter; but the gummy matter, which ſpirit leaves undiſſolved, is inſipid, the ſpirituous ſolution containing all the active parts of the myrrh. Tinctures of myrrh, made by digeſting three ounces of the concrete in a quart of rectified or proof ſpirit, are kept in the ſhops, and given ſometimes internally from fifteen drops to a tea-ſpoonful, but oftener uſed among us externally for cleanſing ulcers and promoting the exfoliation of carious bones; both tinctures are of a reddiſh yellow colour. In diſtillation, rectified ſpirit brings over little or nothing of the flavour of the myrrh; the extract, obtained by inſpiſſating the tincture, is a fragrant, bitter, very tenacious reſin, amounting to one third or more of the weight of the myrrh employed.

MYRTIFORM, in anatomy, an appellation given to ſeveral parts, from their reſembling myrtle-berries: thus we meet with the myrtiform caruncles, and the myrtiform muſcle

muſcle of the noſe, which ariſes near the inciſorius of the upper-lip, and is inſerted into the alæ of the noſe. See CARUNCLE.

MYRTLE, in botany, an ever-green ſhrub, with oblong leaves, pointed at both ends; in the bloſſoms of which ſpring ſolitary white pentapetalous flowers, followed by black oblong umbilicated berries, full of white crooked ſeeds. It is a native of the ſouthern parts of Europe, from whence the ſhops have been uſually ſupplied with the berries, called myrtilli, which rarely come to perfection in our climate; nor does the ſhrub bear our ſevere winters without ſhelter.

The berries of the myrtle, recommended in alvine and uterine fluxes and other diſorders from relaxation and debility, appear to be among the mild reſtringents or corroborants: they have a roughiſh not unpleaſant taſte, accompanied with a degree of ſweetiſhneſs and aromatic flavour. The leaves have likewiſe a manifeſt aſtringency, and yield, when rubbed, a pretty ſtrong aromatic ſmell agreeable to moſt people.

There are ſeveral ſpecies of this plant, however, preſerved in our gardens; they are all eaſily propagated from cuttings. The beſt ſeaſon for this is July, and the ſtraighteſt and youngeſt vigorous ſhoots are to be choſen. Theſe ſhould be cut off about eight inches long, and the leaves of the lower part ſtripped off to about two inches high, and that part of the ſtalk twiſted which is to be placed in the ground; they are to be planted in pots of light rich earth, at about two inches diſtance from each other, obſerving to cloſe the earth very well about them, and give them a gentle watering. They are then to be removed into a moderate hot-bed, and ſhaded and watered once in two or three days, till they have taken root. In about a month's time they will be rooted, and will begin to ſhoot, and muſt then be inured, by degrees, to the air; and in Auguſt they ſhould be removed into the open air, but placed in a warm ſituation, and ſheltered from the winds; they ſhould ſtand here till October, and then be removed into a green-houſe, where they ſhould be placed ſo as to have as much air as poſſible. In the March following they ſhould be removed into ſeparate pots of rich earth, and in May ſet out to the open air in a warm and well defended place. They will require in the ſummer frequent waterings, and the dead leaves ſhould be carefully picked off. As they advance in growth, they are to be ſhifted at times into pots of a larger ſize; and this ſhould be done either in April or in Auguſt; and towards the end of October, they ſhould always be removed into the green-houſe.

MYSTERY, ſomething ſecret or concealed, impoſſible or difficult to comprehend. All religions, true or falſe, have their myſteries. The pagan religion was remarkably full of them. Ovid reckons it a great crime to divulge the myſtic rites of Ceres and Juno. The eleuſinia, or ſacred rites of Ceres, ſolemnized at Eleuſis, were called, by way of eminence, the myſteries; and ſo ſuperſtitiouſly careful were they to conceal theſe ſacred rites, that if any perſon divulged any part of them, he was thought to have called down ſome divine judgment on his head, and it was accounted unſafe to abide under the ſame roof with him; and Horace declares, that he would not put to ſea in the ſame ſhip with one who revealed the myſteries of Ceres. The pagan myſteries, it is true, were generally myſteries of iniquity, and concealed only becauſe their being publiſhed would have rendered their religion ridiculous and odious. Thus the ſacred writings often ſpeak of the infamous myſteries of the pagan deities, in which the moſt ſhameful crimes were committed under the ſpecious veil of religion.

The whole religion of the Egyptians was myſterious from the beginning to the end, and both their doctrine and worſhip wrapped up in ſymbols and hieroglyphics.

The religion of the Jews is ſuppoſed to be full of myſteries. The whole nation, according to St. Auguſtin, was a myſtery, as it repreſented or was a type of the people of Chriſt, and the Chriſtian religion. Whatever was commanded or forbidden them was figurative, and their ſacrifices, prieſthood, &c. included myſteries. The prophecies concerning Jeſus Chriſt in the Jewiſh books, are likewiſe figurative and myſterious.

The Chriſtian religion has alſo its myſteries; but in the Scripture language the word myſtery is uſed with ſome latitude, and denotes whatever is not to be known without a divine revelation, and all the ſecret things which God has diſcovered by his miniſters the prophets, by Jeſus Chriſt and his apoſtles. The myſteries of the Chriſtian church are, the incarnation of the word, the hypoſtatical union of the divine and human nature, the miraculous birth, death, and reſurrection of the Son of God, the doctrine of the trinity, &c. See the article INCARNATION, &c.

St. Paul often ſpeaks of the myſteries of the Chriſtian religion; as the myſtery of the goſpel, the myſtery of the croſs of Chriſt, the myſtery which was kept ſecret ſince the world began; and he calls the preachers of the goſpel, the ſtewards of the myſteries of God.

MYSTICAL, ſomething myſterious or allegorical.

MYSTICS, a religious ſect, diſtinguiſhed by their profeſſing a pure, ſublime, and perfect devotion, with an entire diſintereſted love of God, free from all ſelfiſh conſiderations, and by their aſpiring to a ſtate of paſſive contemplation.

MYTHOLOGY, *μυθολογια*, the hiſtory of the fabulous gods and heroes of antiquity, with the explanations of the myſteries or allegories couched therein. Lord Bacon thinks that a great deal of concealed inſtruction and allegory was originally intended in moſt part of the ancient mythology: he obſerves, that ſome fables diſcover a great and evident ſimilitude, relation, and connection with the thing they ſignify, as well in the ſtructure of the fable, as in the meaning of the names, whereby the perſons or actors are characterized.

The ſame writer thinks it may paſs for a farther indication of a concealed and ſecret meaning, that ſome of theſe fables are ſo abſurd and idle in their narration, as to ſhew an allegory even afar off: but the argument of moſt weight upon this ſubject he takes to be this, that many of theſe fables appear by no means to have been invented by the perſons who relate them: he looks on them not as the product of the age, nor invention of the poets, but as ſacred relics, as he terms them, gentle whiſpers, and the breath of better times, that from the tradition of more ancient nations, came at length into the flutes and trumpets of the Greeks. He concludes, that the knowledge of the early ages was either great or happy; great if they by deſign made this uſe of trope and figure; or happy, if, whilſt they had other views, they afforded matter and occaſion to ſuch noble contemplations.

MYURUS, in medicine, an epithet for a ſort of ſinking pulſe, when the ſecond ſtroke is leſs than the firſt; the third than the ſecond, and ſo on. Of this, there are two kinds; the firſt, when the pulſe ſinks ſo as never to ariſe; the other, when it returns again, and riſes in ſome degree. Both are eſteemed a bad preſage.

N.

NAH

N, A liquid conſonant, and the thirteenth letter of the Greek, Latin, Engliſh, &c. alphabets. It is formed from the old Greek, and that from the old Hebrew nun. Its ſound is formed by a ſtrong expreſſion of the voice through the mouth and noſtrils, being at the ſame time intercepted by applying the tongue to the fore palate, and the lips or mouth open. It ſuffers no conſonant immediately after it in the beginning of words or ſyllables; nor any before it but *g*, *k*, and *ſ*, as *gnaw*, *knave*, *ſnow*, &c.

As a numeral, N ſtands for 900; and with a daſh over it, thus $\bar{N}$, for 9000.

N. L. in the ancient law, ſtood for *non liquet*, meaning that the cauſe was not clear enough for ſentence.

N. or N°. in commerce, medicine, &c. is an abbreviation of *numero*, or number.

NAAM, in law, the detaching or diſtraining a perſon's moveable goods: as where a man takes another man's beaſt for doing damage in his ground, or where it is done in conſequence of another man's act, as when it is agreed, that in default of payment of ſome contract, it ſhall be lawful to diſtrain on lands charged therewith.

NABOB, a viceroy, or governor of one of the provinces of the mogul's empire, in India. See the article INDIA.

NABONASSAR, or *Æra of* NABONASSAR, a method of computing time from the commencement of Nabonaſſar's reign. See EPOCHA.

The epocha of Nabonaſſar is of the greater importance, as Ptolemy and other aſtronomers account their years from it.

NADAB, the ſovereign pontiff, or high prieſt of the Perſians, whoſe dignity is the ſame as that of the muſti among the Turks; with this difference only, that the nadab may diveſt himſelf of his eccleſiaſtical office, and paſs to civil employments, which the mufti is not allowed to do.

NADIR, in aſtronomy, that point of the heavens which is diametrically oppoſite to the zenith, or point directly over our heads.

The zenith and nadir are the two poles of the horizon. See HORIZON and POLE.

Sun's NADIR, in aſtronomy, is the axis of the cone formed by the earth's ſhadow: it is thus called, becauſe being produced, it gives a point in the ecliptic diametrically oppoſite to the ſun.

NAHUM, or *the Prophecy of* NAHUM, a canonical book of the Old Teſtament.

Nahum, the ſeventh of the twelve leſſer prophets, was a native of Elkoſhai, a little village of Galilee. The ſubject of his prophecy is the deſtruction of Nineveh, which he deſcribes in the moſt lively and pathetic manner; his ſtyle is bold and figurative, and can hardly be exceeded by the moſt perfect maſters of oratory. This prophecy was verified at the ſiege of that city by Aſtyages, in the year of the world 3378, 622 years before Chriſt.

The time of Nahum's death is unknown; the Greek menologies, and the Latin martyrologies, place his feſtival on the firſt of December.

NAI

NAIADS, in mythology, the nymphs of the fountains. See NYMPH.

NAIANT, in heraldry, a term uſed in blazoning fiſhes, when borne in an horizontal poſture, as if ſwimming.

NAIL, *Unguis*, in the animal body, a kind of horny ſubſtance growing over the ends of the fingers and toes of men, &c. much of the ſame nature with horn or the hoofs of beaſts.

The nails are looked upon by ſome as productions of the cutaneous papillæ, and by others as a continuation of the epidermis.

By maceration the epidermis may be ſeparated entire from the hands and feet; and, in this experiment, the nails part from the papillæ, and go along with the epidermis; and yet their ſubſtance and ſtructure appear to be very different from that of the epidermis.

The ſubſtance of the nails conſiſts of ſeveral planes of longitudinal fibres, ending at the extremity of each finger, being nearly of an equal thickneſs, but different lengths.

The graduated roots of all the fibres of which theſe planes conſiſt, are hollowed for the reception of the ſame number of very ſmall oblique papillæ, which are continuations of the true ſkin.

There are three parts generally diſtinguiſhed in the nails, namely, the root, body, and extremity. The root is white, and like a creſcent, and the greateſt part of it hid under the ſemi-lunar fold. The body of the nail is naturally arched, tranſparent, and of the colour of the cutaneous papillæ that lie under it. The extremity of the nail does not adhere to any thing, and grows, as often as it is cut.

The principal uſe of the nails is to ſtrengthen the ends of the fingers and toes, and to hinder them from being inverted towards the convex ſide of the hand or foot, when we handle or preſs upon any thing hard; ſo that they ſerve rather for buttreſſes than ſhields. *Winſlow.*

The Romans had their nails cut by artiſts, who made an employment of it.

The Chineſe doctors pique themſelves on the exceſſive length of their nails; ſome of them, according to Le Compte, being near as long as their fingers.

NAIL is alſo a meaſure of length, containing the ſixteenth part of a yard.

NAILS, in building, &c. ſmall ſpikes of iron, braſs, &c. which being drove into wood, ſerve to bind ſeveral pieces together, or to faſten ſomething upon them. The ſeveral ſorts of nails are very numerous; as 1. Back and bottom nails; which are made with flat ſhanks to hold faſt, and not open the wood. 2. Clamp-nails for faſtening the clamps in building, &c. 3. Claſp-nails, whoſe heads claſping and ſticking into the wood, render the work ſmooth, ſo as to admit a plane over it. 4. Clench-nails, uſed by boat and barge builders, and proper for any boarded buildings that are to be taken down; becauſe they will drive without ſplitting the wood, and draw without breaking; of theſe there are many ſorts. 5. Clout-nails, uſed for nailing on clouts to axle trees. 6. Deck-

Deck-nails, for faſtening of decks in ſhips, doubling of ſhipping, and floors laid with planks. 7. Dog-nails, for faſtening of hinges on doors, &c. 8. Flat-points, much uſed in ſhipping, and are proper where there is occaſion to draw and hold faſt, and no conveniency of clenching. 9. Jobent nails, for nailing thin plates of iron to wood, as ſmall hinges on cup-board-doors, &c. 10. Lead-nails, for nailing lead, leather, and canvas to hard wood. 11. Port-nails, for nailing hinges to the ports of ſhips. 12. Pound-nails, which are four-ſquare, and are much uſed in Eſſex, Norfolk, and Suffolk, and ſcarce any where elſe, except for paleing. 13. Ribbing-nails, principally uſed in ſhip-building, for faſtening the ribs of ſhips in their places. 14. Roſe-nails, which are drawn four-ſquare in the ſhank, and commonly in a round tool, as all common two-penny nails are; in ſome countries all the larger ſort of nails are made of this ſhape. 15. Rother-nails, which have a full head, and are chiefly uſed in faſtening rother-irons to ſhips. 16. Round-head nails, for faſtening on hinges, or for any other uſe where a neat head is required; theſe are of ſeveral ſorts. 17. Scupper-nails, which have a broad head, and are uſed for faſtening leather and canvas to wood. 18. Sharp-nails; theſe have ſharp-points and flat ſhanks, and are much uſed, eſpecially in the Weſt-Indies, for nailing ſoft wood. 19. Sheathing-nails, for faſtening ſheathing-boards to ſhips. 20. Square-nails, which are uſed for hard wood, and nailing up wall-fruit. 21 Tacks, the ſmalleſt of which ſerve to faſten paper to wood; the middling for wool-cards, &c. and the larger for upholſterers and pumps.

Nails are ſaid to be toughened when too brittle, by heating them in a fire-ſhovel, and putting ſome tallow or greaſe among them.

Nails are ſold at ſix ſcore to the hundred: in lathing, 500 are uſually allowed to a bundle of five feet laths, and 600 to a bundle of four feet laths: in flooring, 200 are ſufficient for a ſquare of flooring.

NAISSANT, in heraldry, is applied to any animal iſſuing out of the midſt of ſome ordinary, and ſhewing only his head, ſhoulders, fore-feet and legs, with the tip of his tail; the reſt of his body being hid in the ſhield, or ſome charge upon it; in which it differs from iſſuant, which denotes a living creature ariſing out of the bottom of any ordinary or charge.

NAKED, in architecture, is the ſurface or plane from whence the projectures ariſe, or which ſerves as a ground to the projectures. Thus, we ſay the foliages of a capital ought to anſwer to the naked of a column, and that a pilaſter ought to exceed the naked of the wall by ſo many inches.

NAKED FIRE, in chemiſtry, is an open fire; or one where a veſſel is immediately expoſed to the fire.

NAKOUS, a muſical inſtrument, conſiſting of two braſs-plates, which are ſuſpended by ſtrings, and ſtruck together ſo as to beat time: they are uſed in the Coptic churches in Egypt, and in the Mahometan proceſſions.

NAME, *Nomen*, denotes a word whereby men have agreed to expreſs ſome idea; or which ſerves to ſignify a thing or ſubject ſpoken of. This the grammarians uſually call a noun, though their noun is not of quite ſo great an extent as our name. See the article NOUN.

Names are either proper or appellative. Proper names are thoſe which repreſent ſome individual thing or perſon, ſo as to diſtinguiſh it from all other things of the ſame ſpecies, as Ariſtotle, which repreſents a certain philoſopher. Proper names are either called Chriſtian, as that given us at baptiſm, or ſurnames; the firſt impoſed for the diſtinction of perſons, anſwering to the Roman prænomen; the ſecond for the diſtinction of families, anſwering to the nomen of the Romans, and the patronymicum of the Greeks. See PATRONYMIC, &c.

Appellative, or general names, are thoſe which ſignify common ideas, or which are common to ſeveral individuals of the ſame ſpecies, as a horſe, animal, &c.

NAPE, a name uſed for the hind part of the neck, ſuppoſed to be on account of the ſhort hair growing there, in reſemblance of the nap of a cloth.

NAPHTHA, in natural hiſtory, a fluid mineral body, of a thin conſiſtence, bright and pellucid, of a ſtrong ſmell, very readily inflammable, and when pure, burning away without leaving any reſiduum.

The naphtha is found in conſiderable quantities floating on the water of certain ſprings, principally breaking out at the ſides of hills in Perſia, Tartary, and ſome parts of the empire of China, where if a lighted candle be held near the ſurface, it takes fire and overſpreads the ſurface of the water for a great extent, with a ſtrong white flame, and emits a very diſagreeable ſmell. The genuine naphtha is very rare in Europe; it is not known to be any where naturally produced here, and what we ſee of it is generally ſophiſticated. Diſtilled by the retort, it yields an oil ſomewhat thinner than it was originally, and of a weaker ſmell. The ſubſtance remaining at the bottom of the retort, has much the reſemblance of amber; and Dr. Hill thinks it highly probable, that the origin of all the amber in the world is from the ſame ſort of principle; nay he tells us that he has ſucceeded ſo far in an attempt to make amber by this fluid and an acid drawn from the crude pyrites, that he has produced a friable ſomewhat pellucid matter, having all the properties of amber except its hardneſs and clearneſs, and yielding a true ſalt and oil of amber on diſtillation. See AMBER.

The medicinal virtues of the naphtha are the ſame with the common petroleum, but in a more remiſs degree. It is uſed externally on many occaſions in Perſia; and is taken inwardly, a few drops for a doſe, in colics. The principal uſe made of it, however, is burning in lamps; for which purpoſe it is very proper.

NAPLES, the capital of the kingdom of Naples: ſituated in eaſt long. 15°, north lat. 41°.

The kingdom of Naples is one of the Sicilies; it is the ſouth-eaſt part of Italy, and is ſituated between 14 and 19° eaſt long. and between 38 and 43° north lat. being bounded by the gulph of Venice on the north-eaſt, by the Mediterranean ſea on the ſouth-eaſt, by Sicily and the Tuſcan ſea on the ſouth-weſt, and by the pope's territories on the north-weſt; and divided from the iſlands of Sicily only by the narrow ſtreight or pharo of Meſſina.

NARCISSUS, the daffodil, in botany, a genus of plants, the corolla of which conſiſts of a nectarium formed of one leaf of a cylindric or funnel ſhape, coloured at the top and wide, curled and plicated at the mouth, and of ſix oval acuminated plane petals affixed externally to the tube of the nectarium above its baſe: the fruit is a roundiſh obtuſely trigonal capſule, formed of three valves, and containing three cells, in which are a number of round appendiculated ſeeds, with a columnar receptacle.

The root of this plant is emetic, vulnerary, and detergent.

NARCOTICS, in medicine, opiates, or medicines which excite ſleep.

The word is Greek, ναρκωτικὸς, and derived from ναρκόω, to ſtupify, or benumb.

Narcotics act on the nervous membranes of the ſtomach and inteſtines, principally by means of a vaporous and fetid ſulphur. For, as the ſtomach and inteſtines firſt and immediately feel the force and efficacy of remedies, they are ſo much the more liable to ſuffer from the influence of medicines, which are of a ſtronger and more penetrating nature than ordinary. Opium or any other narcotic, after it is taken, and begins to be diſſolved by the internal heat and moiſture, diffuſes its noxious vapours, which being received into the pores of the nervous membranes, their fluid, on which their tone and motion depend, loſes its nature: hence, the ſenſation and alſo the periſtaltic motion of the inteſtines become more languid: for if a ſtrong ſmell, as in the caſe of hyſterics, received up the noſtrils, ſuch for inſtance as proceeds from burnt feathers or aſſa-fætida, has ſo ſudden an effect in compoſing the turbulent and diſorderly motions in the nervous and membranous ſyſtem; and on the contrary, if a ſweet ſmelling vapour has the force of immediately diſturbing the whole frame of the muſcles by violent ſpaſms; why may not the foul and noiſome exhalations of narcotics, by contaminating a fluid of conſummate activity, as well injure or put a ſtop to its motion? But thoſe things which act on the nerves, are moſt ſpeedy in their effects, becauſe their influence is immediately diffuſed over the whole nervous ſyſtem.

Narcotics have alſo a mighty influence on the membranes of the brain, whereby greatly diminiſhing the ſpring and ſyſtole of the arteries, which are furniſhed with very thin membranes, they cauſe a ſtagnation of the blood therein,

therein, with diſtentions of the veſſels of the head, by which means they induce a torpor, drowſineſs, delirioulneſs, with frightful and troubleſome dreams. Though much miſchief and danger may be the natural effects of narcotics, ſo that they may be eſteemed not far removed from the nature of poiſons, phyſicians, however, both ancient and modern, have at all times experienced great benefit from hypnotic anodynes, eſpecially in violent pains and fluxes; for what greater benefit can we receive than to be delivered from intolerable pains? Beſides, ſuch is the nature of pain, that, if it be of any long continuance, it either weakens the powers of the mind and body to ſuch a degree, as to render a diſeaſe, otherwiſe favourable, eventually mortal, or elſe brings death of itſelf.

In diſorders of the ſtomach and inteſtines all things which induce a ſtupor, are very cautiouſly or never at all to be exhibited, becauſe no kind of medicines is ſo pernicious and injurious to the tone and motions of the nervous parts.

To preſerve health and prevent diſeaſes, nothing is ſo effectual, as to retain the tone, ſtrength, and motion of what they call the primæ viæ, or firſt paſſages, becauſe that moſt ſalutary excretion which is performed by ſtool, and diſcharges the ſordes, which are the recrements remaining after digeſtion, or are collected from all parts of the body, depends chiefly thereon. Where this evacuation is wholly ſuppreſſed, or performed after a ſlow and remiſs manner, a deluge of viſcous humours is ſoon collected, and becomes the cauſe as well as the fomenter of diſeaſes. Now there is nothing which ſo effectually diminiſhes the periſtaltic motion of the inteſtines, and ſuppreſſes inteſtinal excretion, as ſudatives and anodynes.

It is very dangerous to adminiſter opiates and anodynes where the ſtomach and inteſtines are inclining to an inflammation and ſphacelus, or where an extraordinary impurity of the humours diſpoſes them to a corruption.

NARDUS Celtica, Celtic nard, in botany, a ſmall ſpecies of valerian, with uncut, oblong, obtuſe, ſomewhat oval leaves. It is a native of the Alps, from whence the ſhops have been generally ſupplied with the dried roots, conſiſting of a number of blackiſh fibres, with the lower parts of the ſtalks adhering; which laſt are covered with thin yellow ſcales, the remains of the withered leaves.

This root has been recommended as a ſtomachic, carminative, and diuretic; at preſent it is ſcarcely otherwiſe made uſe of, in this country, than as an ingredient in mithridate and theriaca, though its ſenſible qualities promiſe ſome conſiderable medicinal powers. It has a moderately ſtrong ſmell, and a warm bitteriſh ſubacrid taſte, ſomewhat reſembling thoſe of common wild valerian: an extract made from it by rectified ſpirit has a ſtrong penetrating taſte, and retains in good meaſure the particular flavour, as well as the bitterneſs and pungency of the root.

Nardus Indica, Indian nard, or ſpikenard, in botany, the buſhy top of the root, or the remains of the withered ſtalks and ribs of the leaves of an Indian graſſy-leaved plant, of which we have no particular deſcription. The nard, as brought to us, is a congeries of ſmall tough reddiſh brown fibres, cohering cloſe together, but not interwoven, ſo as to form a bunch or ſpike about the ſize of a finger; ſometimes two or three bunches iſſue from one head, and ſometimes bits of leaves and ſtalks in ſubſtance are found among them.

The Indian nard, now kept in the ſhops chiefly as an ingredient in mithridate and theriaca, was formerly employed in the ſame intentions as the Celtic, and is ſaid to be uſed among the Orientals as a ſpice. It is moderately warm and pungent, accompanied with a flavour not diſagreeable.

NARRATION, in oratory and hiſtory, a recital or rehearſal of a fact as it happened, or when it is ſuppoſed to have happened.

Narration, in poetry, is uſed for the action, or event, that makes the ſubject of an epic poem.

NARWAL, in ichthyology, the unicorn fiſh, ſo called from a long wreathed tooth; though it be really a tooth fixed in the gomphoſis of the upper-jaw, altogether in the manner of other teeth: hence ſome have called it monodon, which is certainly a more proper name than that of the unicorn-fiſh.

The narwal is a fiſh of the whale kind, often growing to twenty-five feet in length, but is more commonly found from ſixteen to twenty.

NASIAS, in anatomy, a thin bone making the upper part of the noſe.

NATES, in anatomy, a term expreſſing thoſe two fleſhy exterior parts of the body, vulgarly called the buttocks.

Nates Cerebri, two circular protuberances of the brain, ſituated on the backſide of the medulla oblongata, near the cerebellum.

NATION, a collective term, uſed for a conſiderable people inhabiting a certain extent of land, confined within fixed limits, and under the ſame government.

NATIVE, a perſon conſidered as born in a certain place which was the proper reſidence of his parents, and where he received his education.

Native, or Nativus, in our ancient law books, ſignifies a perſon born in a ſtate of villainage, in contradiſtinction to a bondſman, or one who became a villain by his own act and deed.

NATIVITY, or Natal-Day, the day of a perſon's birth.

The word nativity is chiefly uſed in ſpeaking of the ſaints, as the nativity of St. John the Baptiſt, &c. But when we ſay the Nativity, it is underſtood of that of Jeſus Chriſt, or the feaſt of Chriſtmas. See the article Christmas.

Nativity, in aſtrology, the ſituation of the heavens, and particularly of the twelve houſes, at the moment of a perſon's birth.

NATRON, or Mineral Fixed Alkaline Salt. This ſalt is contained in great abundance in the waters of the ocean, and makes the baſis of the neutral ſalt ſo plentifully extracted from them for alimentary uſes. It is likewiſe diſcoverable in ſundry mineral ſprings, even of thoſe which do not participate of ſea-ſalt; and in ſome of the Eaſtern countries it is ſaid to be found in conſiderable quantities on the ſurface of the earth, ſometimes pure, but more commonly blended with various heterogeneous matters, from which it is extracted by means of water. The alkali, called ſoda, prepared by incinerating the maritime plant kali, or glaſs-wort, contains a ſalt of the ſame kind.

The mineral alkali agrees in its general qualities with the common lixivial ſalts of vegetables. The differences which have been obſerved are, that it is milder and leſs acrid in taſte: that when diſſolved in water, it concretes, on evaporation, into a cake, which appears a congeries of ſmall cryſtals: that when expoſed to the air, though it grows moiſt on the ſurface, it does not run into a liquid form: that the neutral ſalt reſulting from its coalition with the vitriolic acid, is very eaſily diſſoluble in water and fuſible in the fire: that with the nitrous acid it forms cubical cryſtals; and with the marine, perfect ſea ſalt. Its medicinal differences from the common lixivial ſalts, in pure ſtate, are not well known; but in combination with acids, they are apparent.

NATURAL, in general, ſomething that relates to nature. Natural children are thoſe born out of lawful wedlock.

The natural functions are thoſe actions whereby the aliments are changed and aſſimilated ſo as to become a part of the body.

Natural History, a deſcription of the productions of the earth, air, water, &c. See Earth, &c.

The natural hiſtory of any one place is a very extenſive ſubject, which, according to Mr. Boyle, may be conveniently reduced to four heads; viz. the things that regard the heavens, the air, the waters, and the earth.

Of the firſt claſs, are the longitudes and latitudes of places, the lengths of the longeſt and ſhorteſt days and nights; the climates, parallels, &c. what fixed ſtars are ſeen, and what are not ſeen there.

About the air may be obſerved, its temperature, as to the firſt four qualities, and the meaſure of them; its weight, clearneſs, and refractive power; its ſubtility or coarſeneſs; its abounding with or wanting an eſurient ſalt; its variations according to the ſeaſons of the year and the times of the day; what duration the ſeveral kinds of weather uſually have; what meteors it is moſt or leaſt ap

apt to breed; and in what order they are generated, and how long they generally laſt; what winds it is moſt ſubject to; whether any of them be ſtated or ordinary; what diſeaſes are ſaid to be epidemical, or depending on the ſtate and condition of the air; what other diſeaſes it is ſubject to, wherein the air may be ſuppoſed to have ſome ſhare; what is the uſual ſalubrity of it, and what ſort of conſtitutions it agrees with, what it does not. See the article AIR.

About the waters, it may be proper to obſerve the ſea, its depth, tides, currents, ſaltneſs, and other qualities: next the rivers will come under conſideration, their depth, length, courſe, inundation, and the goodneſs or badneſs of their waters, with their gravity, and other peculiar qualities; after theſe, the lakes, ſprings, ponds, &c. are to be conſidered, eſpecially the mineral waters, their kinds, qualities and virtues, and the manner of trying them: the inhabitants of the waters may follow here; and the particular kinds of fiſh that are found there, whether of the ſea or rivers, are to be mentioned, with an account of their ſtores, bigneſs, goodneſs, ſeaſons of perfection, haunts, peculiarities of any kind relating to them, and the manner of taking them, eſpecially when there is any thing ſingular in it.

The things relating to the earth, are laſt to be examined: theſe are, firſt the earth itſelf, then its inhabitants, and its various productions, whether external or internal. In the earth itſelf may be obſerved, its dimenſions, ſituation eaſt, weſt, north and ſouth; its figure; its plains and valleys, and their extent; its hills and mountains, and the height of the talleſt, both in reference to the neighbouring valleys and plains, and to the level of the ſea; as alſo whether the mountains lie ſcattered, or are diſpoſed in ridges; and if of the latter kind, whether they run eaſt, weſt, north, or ſouth. What promontories alſo, and what fiery or ſmoaking hills it has, if any: whether the country be coherent, or much broken into iſlands: what the magnetical declination is in ſeveral places, and the variation of that declination in the ſame place, and if thoſe be conſiderable; what may be conjectured as the occaſions of them, whether the vicinity of iron-mines, of ſubterranean fires, or what elſe. What the nature of the ſoil is, whether clayey, ſandy, or of good mould; and what vegetables, plants, and trees, beſt agree with it and ſucceed in it, what worſt. By what particular contrivances the inhabitants improve the advantages, or remedy the diſadvantages of the ſoil; and what hidden qualities the ſoil may have. The inhabitants of the earth are then to be conſidered, both natives, and ſtrangers that have been long ſettled there; and in particular, their ſtature, colour, features, ſtrength, agility, or defects of theſe; and their complexions, hair, beauty, and the like; their diet, inclinations and cuſtoms, ſo far as they are not owing to education; the fruitfulneſs and barrenneſs of the women; their hard or eaſy labours; the diſeaſes they are moſt ſubject to, and any remarkable ſymptoms attending them.

As to the external productions of the earth, the enquiries are to be theſe: what graſſes, grains and fruit it beſt produces: the herbs, flowers, and timber-trees; and the coppices, groves, foreſts and woods the country has or wants: what peculiarities are obſervable in any of them; what ſoils they moſt like or diſlike, and with what culture they thrive beſt. Then what animals the country has or wants, both as to wild beaſts and birds of prey, and as to poultry and cattle of all ſorts; and particularly, if they have any animals that are not common, or any thing particular in thoſe they have. After thoſe, the ſubterranean ſtores are to be examined; what minerals the earth affords, and what it wants; then what quarries of ſtone, and in what manner they lie: what clays and earths are found there; as clays, marles, fuller's earths, earths for tobacco-pipes, earths for potter's wares, medicinal earths; what other mineral productions it yields, whether coals, ſalt-mines, or ſalt-ſprings, alum, vitriol, ſulphur, &c. What metals the country yields, with a deſcription of the mines of them; their depths, numbers, ſituations, ſigns, waters, damps, quantities of ores, goodneſs of the ores, and the ways in uſe for the reducing them to metals.

NATURAL INCLINATIONS are the tendencies of our minds towards things ſeemingly good.

NATURAL PHILOSOPHY, that which conſiders the powers and properties of natural bodies, and their mutual actions on one another.

The buſineſs of natural philoſophy, ſays Boerhaave, is to communicate a ſolid and accurate knowledge of all the bodies in being, and all the affections thereof. Nor can this ſcience be acquired otherwiſe than by obſerving, by means of our ſenſes, all the objects which the Author of nature has made cognizable thereto: hence, the firſt and principal part of this ſcience is to collect all the manifeſt and ſenſible appearances of things, and reduce them into a body of natural hiſtory. Now there are two ways of making ſuch obſervations; the firſt, when we view things nearly as they happen to turn up, without any deſign or intervention of our own; in which way no great improvements can be expected in the art, becauſe chance having here the direction, only exhibits occaſional or extemporary properties: the other method is, when, after a thorough acquaintance with bodies, we apply them to other bodies equally known, diligently attending to the reſult, and obſerving whether any thing new ariſes. See EXPERIMENTAL PHILOSOPHY.

NATURAL, in muſic, is a term variouſly uſed: thus natural muſic is the ſame with vocal, in oppoſition to artificial muſic, or that performed on inſtruments. A ſong is alſo called natural, when its notes move eaſily and gracefully, the voice or inſtrument being nowiſe forced or ſtrained. Natural harmony is that produced by the natural and eſſential chord of the mode.

A natural note is uſed to contradict thoſe flats and ſharps that are ſet at the beginning of a ſtave; and in ſuch caſe, it muſt be taken exactly as in the gamut. For the character of this note, ſee the article CHARACTER.

NATURALIST, a perſon well verſed in the ſtudy of nature, and the knowledge of natural bodies, eſpecially in what relates to animals, vegetables, metals, minerals, and ſtones.

NATURALIZATION, in law, the act of naturalizing an alien, or placing him in the condition of a natural born ſubject.

NATURALS, *Res Naturales*, among phyſicians, whatever naturally belongs to an animal, in oppoſition to non-naturals. See the article NON-NATURALS.

NATURE, *Natura*, according to Mr. Boyle, has eight different ſignifications; it being uſed, 1. For the Author of nature, whom the ſchoolmen call *Natura Naturans*, being the ſame with God. 2. By the nature of a thing we ſometimes mean its eſſence; that is, the attributes which make it what it is, whether the thing be corporeal or not; as when we attempt to define the nature of a fluid, of a triangle, &c. 3. Sometimes we confound that which a man has by nature, with what accrues to him by birth; as when we ſay, that ſuch a man is noble by nature. 4. Sometimes we take nature for an internal principle of motion; as when we ſay, that a ſtone by nature falls to the earth. 5. Sometimes we underſtand by nature the eſtabliſhed courſe of things. 6. Sometimes we take nature for an aggregate of powers belonging to a body, eſpecially a living one; in which ſenſe phyſicians ſay, that nature is ſtrong, weak, or ſpent; or that, in ſuch and ſuch diſeaſes, nature left to herſelf will perform the cure. 7. Sometimes we uſe the term nature for the univerſe, or whole ſyſtem of the corporeal works of God; as when it is ſaid of a phœnix, or chimera, that there is no ſuch thing in nature. 8. Sometimes too, and that moſt commonly, we expreſs by the word nature a kind of ſemi-deity, or other ſtrange kind of being.

If, ſays the philoſopher, I were to propoſe a notion of nature, leſs ambiguous than thoſe already mentioned, and with regard to which many axioms, relating to that word, may be conveniently underſtood, I ſhould firſt diſtinguiſh between the univerſal and the particular nature of things. Univerſal nature I would define to be the aggregate of the bodies that make up the world, in its preſent ſtate, conſidered as a principle; by virtue whereof they act and ſuffer, according to the laws of motion preſcribed by the Author of all things. See BODY, INERTIA, MOTION, &c.

And this makes way for the other ſubordinate notion; ſince the particular nature of an individual conſiſts in the general nature, applied to a diſtinct portion of the univerſe; or, which is the ſame thing, it is a particular aſſemblage of the mechanical properties of matter, as figure, motion, &c.

Thoſe who deſire a more particular diſcuſſion of each of theſe opinions may conſult Boyle's Free Inquiry into the vulgar notion of nature.

NAVAL, relating to a ſhip; whence

NAVAL ARCHITECTURE, the art of deſigning the figure, forming the ſeveral limbs, and conſtructing the hull or lower-frame of a ſhip, diſtinct from the ſuper-ſtructure, which comprehends her machinery and furniture for ſailing, which laſt is explained under the articles MAST, SAILS, and RIGGING.

To whom the world is indebted for the invention of ſhips is, like all other things of equal antiquity, uncertain: if we liſten to the fables of the poets, we ſhall be extremely divided in our opinion amongſt the variety of competitors. Prometheus, Neptune, Janus, Atlas, Hercules, Jaſon, Danaus, Erythraeus, &c. appear with ſufficient authority to claim our aſſent: but Minerva, the auſpicious parent of arts and ſciences, ſeems to have a ſuperior title, and to her, probably with more propriety, it has been attributed by fame.

But ſome who reject theſe fabulous traditions, and pretend to greater certainty in their allegations, aſcribe it to the inhabitants of ſome places that border on the ſea, and ſeem appropriated by nature for harbouring ſhips, ſuch as the Phœnicians, Aeginenſians, &c. This difference of opinions appears naturally to have ariſen, on obſerving the various places where navigation was firſt practiſed, or from the different conſtruction and equipage of ſhips; ſome of which having been built by the abovementioned perſons, have entitled them to the whole invention.

A very ſmall portion of art or contrivance was ſeen in the firſt ſhips; they were neither ſtrong nor durable, but conſiſted only of a few planks laid together, without beauty or ornament, and juſt ſo compacted as to keep out the water. In ſome places they were only the hulks or ſtocks of trees hollowed, and then conſiſted only of one piece of timber; nor was wood alone applied to this uſe, but any other buoyant materials, as the Egyptian reed papyrus, or leather, of which the primitive ſhips were frequently compoſed; the bottom and ſides being extended on a frame of thin battens or ſcantlings, of flexible wood, or begirt with wickers, ſuch as we have frequently beheld amongſt the American ſavages ourſelves. In this manner they were often navigated upon the rivers of Ethiopia, Egypt, and Sabaean Arabia, even in later times. But in the firſt of them, we find no mention of any thing but leather or hides ſewed together. In a veſſel of this kind, Dardanus ſecured his retreat to the country afterwards called Troas, when he was compelled by a terrible deluge, to forſake his former habitation of Samothrace. According to Virgil, Charon's infernal boat was of the ſame compoſition.

But as the other arts extended their influence, naval architecture likewiſe began to emerge from the gloom of ignorance and barbariſm; and as the ſhips of thoſe ages were increaſed in bulk, and better proportioned for commerce, the appearance of thoſe floating citadels of unuſual form, full of living men, flying with ſeemingly expanded wings over the ſurface of the untravelled ocean, ſtruck the ignorant people with terror and aſtoniſhment: and hence, as we are told by Ariſtophanes, aroſe the fable of Perſeus flying to the Gorgons, who was actually carried thither in a ſhip! Hence, in all probability, the famous ſtory of Triptolemus riding on a winged dragon is deduced, only becauſe he ſailed from Athens, in the time of a great dearth, to a more plentiful country, to ſupply the neceſſities of his people. The fiction of the flying horſe Pegaſus may be joined with theſe, who, as ſeveral mythologiſts report, was nothing but a ſhip with ſails, and thence ſaid to be the offſpring of Neptune, the ſovereign of the ſea: nor does there appear any other foundation for the ſtories of griffons, or of ſhips transformed into birds and fiſhes, which we ſo often meet with in the ancient poets. So acceptable to the firſt ages of the world were inventions of this nature, that whoever made any improvements in navigation, or naval architecture, building new ſhips better fitted for ſtrength or ſwiftneſs than thoſe uſed before, or rendered the old more commodious by additional contrivances, or diſcovered countries unknown to former travellers, were thought worthy of the greateſt honours, and often aſſociated into the number of their deified heroes. Hence we have in aſtronomy the ſigns of Aries and Taurus, which were no other than two ſhips: the former tranſported Phryxus from Greece to Colchos, and the latter Europa from Phœnicia to Crete. Argo, Pegaſus, and Perſeus's whale, were likewiſe new ſhips of a different ſort from the former, which, being greatly admired by the barbarous and uninſtructed people of thoſe times, were tranſlated amongſt the ſtars, in commemoration of their inventors, and metamorphoſed into conſtellations by the poets of their own and of ſucceeding ages.

It will be neceſſary on this occaſion to ſay ſomething of the different parts uſed in fabricating the ſhips of the ancients, previous to an explanation of modern ſhip-building.

The ignorance of the principal parts of their ſhipping has occaſioned many miſtakes and much confuſion in thoſe who have converſed with authors of antiquity. Herein we ſhall chiefly follow Scheffer, who hath ſo copiouſly treated this ſubject, and with ſuch induſtry and learning, collected whatever is neceſſary to illuſtrate it, that very little room is left for enlargement by thoſe who incline to purſue this inveſtigation.

The chief parts then, of which ſhips formerly conſiſted, were three, viz. the belly, the prow, and the ſtern: theſe were again compoſed of other ſmaller parts, which ſhall briefly be deſcribed in their order.

1. In the belly or middle part of the ſhip there was τρόπις, *carina*, or the keel, which was compoſed of wood: it was placed at the bottom of the ſhip, being deſigned to cut and glide through the waves, and therefore was not broad, but narrow and ſharp; whence it may be perceived that not all ſhips, but only the μακραὶ, which ſhips of war were called, whoſe bellies were ſtraight, and of a ſmall circumference, were provided keels, the reſt having uſually flat-bottoms. Around the outſide of the keel were fixed pieces of wood to prevent it from being damaged, when the ſhip was firſt launched into the water, or afterwards ſtruck on any rocks; theſe were called χελεύσματα, in Latin *cunei*.

Next to the keel was φαλκὶς, the pump-well, or well-room, within which was contained the ἀντλία, or pump, through which water was conveyed out of the ſhip.

After this, there was δευτερὰ τρόπις, or the ſecond keel, ſomewhat reſembling what is now called the kelſon; it was placed beneath the pump, and called λεσβίον, χαλκήνη, κλειτοποιὸν: by ſome it is falſely ſuppoſed to be the ſame with φαλκὶς.

Above the pump was an hollow place, called by Herodotus κοιλη της νηὸς, by Pollux κυτος and γαστρὰ, becauſe large and capacious, after the form of a belly, by the Latins *teſtudo*. This was formed by crooked ribs, with which it was ſurrounded, which were pieces of wood riſing from the keel upwards, and called by Heſychius νομεὶς, and by others ἐγκοιλία, the belly of the ſhip being contained within them, in Latin *coſtæ*, and in Engliſh timbers: upon theſe were placed certain planks, which Ariſtophanes calls ἐντερωνείας, or ἐντερωνίδα.

Hence proceed we to the πλευραὶ, *latera*, or ſides of the ſhip, which encompaſſed all the former parts on both hands; theſe were compoſed of large rafters extended from prow to ſtern, and called ζωστῆρες, and ζωμιάματα, becauſe by them the whole fabric was begirt or ſurrounded.

In both theſe ſides the rowers had their places, called τοῖχοι, and ἑδώλια, in Latin *fori* and *tranſtra*, placed above one another: the loweſt was called θαλαμος, and thoſe that laboured therein θαλαμιοι; the middle ζυγὰ, and the men ζυγιοι; the uppermoſt θρανοι; whence the rowers were termed θρανῖται. In theſe apartments were ſpaces through which the rowers put their oars; theſe were ſometimes one continued vacuity from one end to the other, called τρῆρη, but more uſually diſtinct holes, each of which was deſigned for a ſingle oar; theſe were

were ſtiled τρηματα, τρυπηματα, as alſo οφθαλμοι, becauſe not unlike the eyes of living creatures: all of them were by a more general name termed εγκωτα, from containing the oars; but εγκωτιν ſeems to have been another thing, ſignifying the ſpaces between the banks of oars on each ſide, where the paſſengers appear to have been placed: on the top of all there was a paſſage or place to walk, called παραδος, and παραβρανος, as joining to the ξρανοι, or uppermoſt bank of oars.

2. Πρωρα, the prow or fore-deck, whence it is ſometimes called μετωπον, and commonly diſtinguiſhed by other metaphorical titles taken from human faces. In ſome ſhips there is mention of two prows, as alſo two ſterns; ſuch was Danaus's ſhip adorned by Minerva when he fled from Egypt. It was uſual to beautify the prow with gold and various ſorts of paint and colours: in the primitive times red was moſt in uſe, whence Homer's ſhips were commonly dignified with the titles of μιλτοπαρηοι, and φοινικοπαρηοι, or red-faced: the blue likewiſe or ſky-colour was frequently made uſe of, as bearing a near reſemblance to the colour of the ſea, whence we find ſhips called by Homer κυανοπρωροι, by Ariſtophanes κυανεμβολοι. Several other colours were alſo made uſe of; nor were they barely varniſhed over with them, but very often annealed by wax melted in the fire, ſo as neither the ſun, winds, nor water, were able to deface them. The art of doing this was called from the wax κηροζυραφια, from the fire εγκαυσικη, which is deſcribed by Vitruvius, and mentioned in Ovid.

Picta coloribus uſtis
Caeruleam matrem concava puppis habet.

The painted ſhip with melted wax anneal'd
Had Tethys for its deity.——

In theſe colours the various forms of gods, animals, plants, &c. were uſually drawn, which were likewiſe often added as ornaments to other parts of the ſhips, as plainly appears from the ancient monuments preſented to the world by Bayſius.

The ſides of the prow were termed πτερα, or wings, and παρια, according to Scheffer, or rather παρειαι; for ſince the prow is commonly compared to an human face, it will naturally follow that the ſides ſhould be called cheeks; theſe are now called bows by our mariners.

3. Πρυμνη, the hind-deck or poop, ſometimes called ουρα, the tail, becauſe the hindmoſt part of the ſhip: it was of a figure more inclining to round than the prow, the extremity of which was ſharp, that it might cut the waters; it was alſo built higher than the prow, and was the place where the pilot ſat to ſteer: the outer-bending part of it was called στεγεων, anſwering to our term, quarter.

They had various ornaments of ſculpture on the prow; as helmets, animals, triumphal wreaths, &c. The ſtern was more particularly adorned with wings, ſhields, &c. Sometimes a little maſt was erected whereon to hang ribbands of divers colours, which ſerved inſtead of a flag to diſtinguiſh the ſhip, and a weather-cock to ſignify the part from whence the wind blew. See COLOURS, FLAG, SIGNAL.

On the extremity of the prow was placed a round piece of wood, called the αμυχις, from its bending; and ſometimes οφθαλμος, the eye of the ſhip, becauſe fixed on the fore-deck; on this was inſcribed the name of the ſhip, which was uſually taken from the figure painted on the flag. Hence comes the frequent mention of ſhips called Pegaſi, Scyllæ, Bulls, Rams, Tigers, &c. which the poets took the liberty to repreſent as living creatures that tranſported their riders from one country to another.

The whole fabric being compleated, it was fortified with pitch, and ſometimes a mixture of roſin, to ſecure the wood from the waters; whence it comes that Homer's ſhips are every where mentioned with the epithet of μελαιναι, or black. The firſt that made uſe of pitch were the inhabitants of Phaeacia, ſince called Corſica: ſometimes wax was employed in the ſame uſe, whence Ovid,

Caerulea ceratas accipit unda rates.

The azure waves receive the waxy ſhips.

After all, the ſhip being bedecked with garlands and flowers, the mariners alſo adorned with crowns, ſhe was launched into the ſea with loud acclamations and other expreſſions of joy; and being purified by a prieſt with a lighted torch, an egg and brimſtone, or after ſome other manner, was conſecrated to the god whoſe image ſhe bore.

Originally all ſhips, for whatever uſe deſigned, appear to have been of the ſame form; but the various purpoſes of navigation ſoon occaſioned a conſiderable difference in their ſize, conſtruction and equipage, at which time they became chiefly characterized as veſſels of war, burthen, or paſſage.

The ſhips of war of the ancients were diſtinguiſhed from other kinds of veſſels, by various turrets and acceſſions of building, ſome to defend their own ſoldiers, and others to annoy the enemy; and from one another, in later ages, by ſeveral degrees or ranks of oars, the moſt uſual number of which was four or five, which appear not to have been arranged, as ſome imagine, on the ſame level in different parts of the ſhip; nor yet, as others have ſuppoſed, directly above one another's heads; but their ſeats being placed one behind another, aſcended gradually like ſtairs. Ptolomy Philopater, urged by a vain-glorious deſire of exceeding all the world beſides in naval architecture, is ſaid to have farther enlarged the number of banks to forty, and the ſhip being otherwiſe in equal proportion, this raiſed her to ſuch an enormous bulk, that ſhe appeared at a diſtance like a floating mountain or iſland, and, upon a nearer view, like a prodigious caſtle on the ocean: ſhe contained four thouſand rowers, four hundred ſailors employed in other ſervices, and near three thouſand ſoldiers. But this, and all ſuch monſtrous fabrics, ſerved only for ſhew and oſtentation, being rendered by their vaſt bulk unwieldy and unfit for ſervice. Athenaeus informs us, the common names they were known by, were Cyclades, or Aetna, i. e. iſlands, or mountains, to which they ſeemed nearly equal in bigneſs; conſiſting, as ſome report, of as many materials as would have compoſed fifty triremes, or ſhips of three banks. Thus much we thought neceſſary to ſay concerning the naval architecture of the ancients; for the ſeveral ornaments, furniture, and inſtruments of war, ſee Scheffer, or Potter's Antiq. b. ii. c. 14, 15, 16, &c. To this we ſhall add, a general ſketch of the art, as it has been improved by the moderns, and appears at this day. See NAVIGATION, SHIP.

With regard to modern naval architecture, we think it neceſſary to obſerve here, that it is ſo complicated, extenſive, and various, comprehending ſuch a diverſity of ſtructures, that to treat the ſubject at large with accuracy and preciſion would fill a large volume of itſelf, and therefore greatly exceed our bounds; and being thus neceſſitated to contract our deſcription, we ſhall reſt ſatisfied with giving our readers a general idea of the principles of the art, the neceſſary qualities of a ſhip, and a deſcription of the principal members that compoſe this noble machine, in which we ſhall decline as much as poſſible to diſtract their imagination by leading them into a labyrinth of technical terms, from which we can neither extricate them nor ourſelves.

Naval architecture then ought to be reduced to the examination of three different queſtions; 1. thoſe which determine the figure of a ſhip; 2. thoſe which contribute moſt to her ſolidity; 3. thoſe which beſt facilitate her plans; that is, 1. her figure or outward form ought to be ſuitable to the ſervice for which ſhe is deſigned; 2. the exact ſhape of all the pieces of timber neceſſary to compoſe ſuch a fabric ſhould be found; 3. convenient apartments ſhould be made for the artillery, ammunition, proviſions, and cargo; together with ſuitable accommodations for the officers and men.

In order to give the bottom a proper figure, all the qualities neceſſary to make her anſwer the ſervice for which ſhe is deſigned ſhould be conſidered.

A ſhip of war ſhould carry her lower tier of guns four or five feet out of the water. A ſhip for the merchant-ſervice ſhould ſtow her cargo well; and be ſo faſhioned as to go well, carry a good ſail, ſteer eaſily, and lie in a high ſea without ſtraining.

Some eminent geometricians have endeavoured to diſcover the form of a ſolid that will anſwer all theſe purpoſes beſt, or meet with the leaſt reſiſtance in dividing the

the fluid through which it is to paſs; but have not been able to reduce their theory to practice, on account of the various ſituations in which a ſhip is obliged to lie when under ſail. The artificers thus deſpairing to eſtabliſh this point by mathematical rules, have applied themſelves entirely to experience and obſervation, which may greatly ſupply the deficiency of art; but though they may diſcover that a ſhip has bad qualities, it may be difficult to determine where they lie, or whether they are in the hull or rigging; but if their obſervations be aided by mathematical principles, it will certainly conduce very much to attain the deſired end. See EVOLUTION, TRIM, SAILING.

But as many ſhips have been built, which ſeem to anſwer every purpoſe for which they were calculated, ſome builders have ſtudied chiefly to copy thoſe which are approved by the ſeamen; and this method they very improperly regard as the principal rule to be obſerved in building. Now as the bodies of ſhips are very different, there are of courſe variety of different models adopted as ſtandards. But admitting a poſſibility to diſcover ſuch a body as ſhould give entire ſatisfaction, and have every good quality requiſite for the ſervice propoſed, yet this could by no means be eſtabliſhed as a ſtandard for ſhips of a different ſize to be copied from, ſince although we may have a firſt rate of 100 guns, which has been found by experience to be a very good ſhip in every reſpect; yet we ſhould be much deceived to build a 20 gun-ſhip, in which all the parts bore a ſimilar proportion to one another, which they have in the firſt rate.

It has been remarked above, that a ſhip of war muſt carry her loweſt tier of cannon high enough above the water, otherwiſe a great ſhip which cannot open her lower battery, when ſailing with a freſh ſide wind, may be taken by a ſmall one that can make uſe of her cannon.

A ſhip ſhould be duly poiſed, ſo as not to dive or pitch heavily, but go ſmooth and eaſy through the water, riſing to the waves when they run high, and the ſhip has reduced her ſail to the ſtorm; otherwiſe they will break aboard and ſtrain the decks, or carry away the boats: the maſts are likewiſe in great danger from the ſame cauſe.

A ſhip ſhould ſail well when large and before the wind, but chiefly cloſe hauled, or with a ſide wind, and her ſails ſharp trimmed, and then not fall off to the leeward.

Now the great difficulty lies in uniting ſo many different qualities in one ſhip, which ſeems to be nearly impoſſible; the whole art therefore conſiſts in forming the body in ſuch a manner that none of theſe qualities ſhould be entirely deſtroyed, and in giving a preference to that which is chiefly required in the particular ſervice for which the veſſel is deſigned: we ſhall briefly ſhow the poſſibility of uniting them all in one ſhip, that each of them may be eaſily diſcerned: when it happens otherwiſe the fault muſt lie in the builder, who has not applied himſelf to ſtudy the fundamental rules and principles of his art.

To make a ſhip carry a good ſail. A flat floor-timber, and ſomewhat long, or the lower-futtock pretty round, a ſtraight upper-futtock, the top-timber to throw the breadth out aloft; at any rate to carry her main breadth as high as the lower-deck. Now if the rigging be well adapted to ſuch a body, and the upper-works lightened as much as poſſible, ſo that they all concur to lower the center of gravity, there will be no room to doubt of her carrying a good ſail.

To make a ſhip ſteer well, and anſwer the helm quickly. If the faſhion-pieces be well formed, the tuck, or ſpreading-parts under the ſtern carried pretty high, the midſhip-frame well-forward, a conſiderable difference in the draught of water abaft more than afore, a great rake forward and none abaft, a ſnug quarter-deck and fore-caſtle; all theſe will make a ſhip ſteer well. A ſhip which ſails well, will certainly ſteer well.

To make a ſhip carry her guns well out of the water. A long floor-timber, and not of great riſing; a very full midſhip-frame, and low tuck, with light upper-works.

To make a ſhip go ſmoothly through the water without pitching hard. A long keel, a long floor, not to riſe too high afore and abaft; but the area or ſpace continued in the fore-body, according to the reſpective weights they are to carry; all theſe are neceſſary to make a ſhip go ſmoothly through the water.

To make a ſhip keep a good wind, and drive little to the leeward. A good length by the keel; not too broad, but pretty deep in the hold, which will occaſion her to have a ſhort floor-timber, and a great riſing.

As ſuch a ſhip will meet with great reſiſtance in the water going over the broadſide, and little when going ahead, ſhe will not fall much to the leeward.

Now ſome builders imagine it is impoſſible to make a ſhip carry her guns well, bear a good ſail, and be a prime ſailer; becauſe it would require a very full bottom to gain the firſt two qualities, whereas a ſharp ſhip will anſwer better for the latter; but when it is conſidered that a full ſhip will carry a great deal more ſail than a ſharp one, a good artiſt may ſo form the body, as to have all theſe three good qualities, and alſo ſteer well. After what has been ſaid on this, it certainly cannot be thought impoſſible to unite all theſe different qualities in one ſhip: giving the water a proper curve, ought likewiſe to be conſidered, upon which the beauty and ſtatelineſs of a ſhip greatly depend; ſince it is this which makes a ſhip look airy and graceful in the water. There is no certain rule for laying them down; this is left entirely to the fancy and taſte of the artiſt, which, as we have more than once obſerved, is not often of the moſt delicate degree, or corrected by truth and judgment; witneſs the barbarous and unnatural mixture of Gothic and Chineſe ornaments, "clumſy heroes and fat-headed gods," on the ſame ſhip, the monſtrous iſſue of a ſavage conception and way-ward genius, as deformed and perverſe as their own cant-timbers.

As we cannot without greatly exceeding our limits treat particularly of all the pieces that compoſe a ſhip, we have here defined all the principal pieces, and laid down each piece ſeparately (plate XCI.), by which means the length of the ſcarfs are deſcribed, and the manner in which they are joined together.

Explanation of Plate XCI.

A. The keel, in four pieces, to be firmly bolted together and clinched.

I. The fore-foot, one end of which is ſcarfed to the fore-end of the keel, of which it is a part, and the other end makes a part of the ſtem, to which it is ſcarfed.

u u. Two pieces of dead-wood, one afore and the other abaft, fayed upon the keel.

C. C. The ſtem in two pieces to be ſcarfed together: it is the circular piece of timber where both the ſides of the ſhip unite forward.

E E. The apron, in two pieces, to be ſcarfed together, and fayed on the inſide of the ſtem, to ſupport the ſcarf of the ſtem: for which purpoſe the ſcarf of the apron muſt be clear from that of the ſtem.

o. The ſtemſon in two pieces, to ſupport the ſcarf of the apron.

o. The falſe poſt, which is fayed to the fore-part of the ſtern poſt. Faying is fitting two pieces of wood, ſo as that one may be joined to the back, or inſide of the other, ſo as to lie cloſe.

B. The ſtern-poſt: it is tenanted into the keel, to which it is faſtened with a knee; and is that ſtraight piece of timber at the after-end of the ſhip, into which both the ſides are united.

D. The back of the poſt, which is likewiſe tenanted into the keel, and ſecurely bolted to the ſtern-poſt; the deſign of it is to give ſufficient breadth to the poſt, which ſeldom can be procured of a ſufficient breadth in one piece.

F. The knee which faſtens the poſt to the keel.

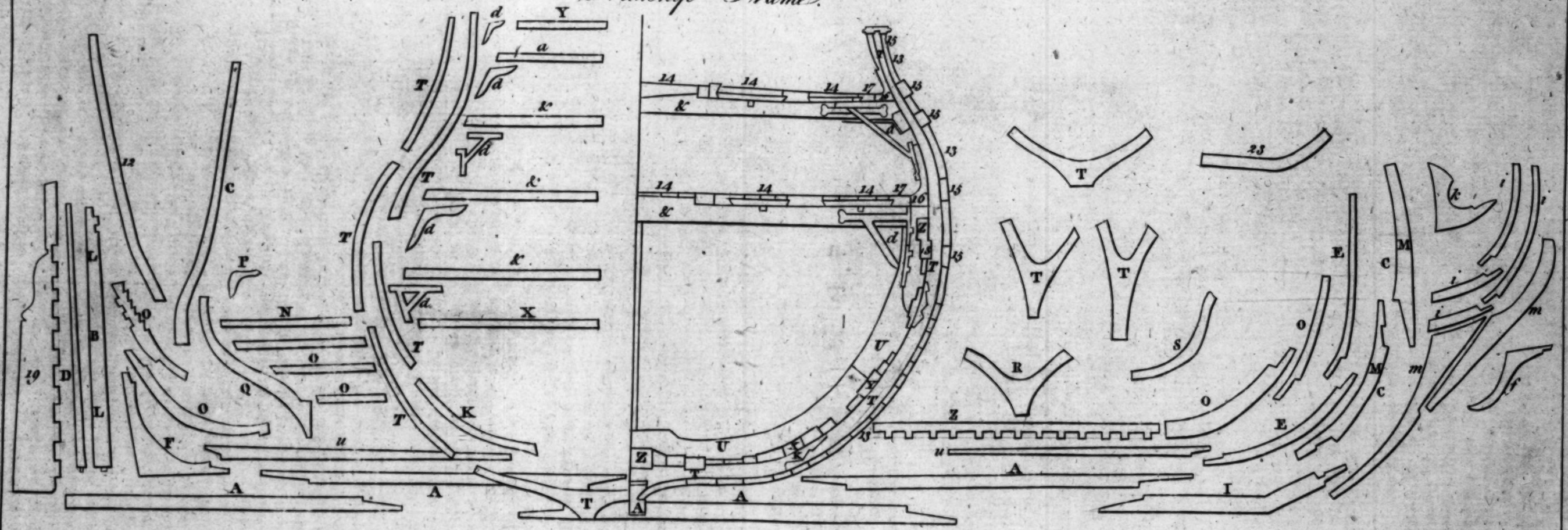
N. The wing-tranſom. It is fayed acroſs the ſtern-poſt, and bolted to the head of it: the faſhion-pieces are faſtened to the end of it; under this, and parallel to it, is the deck tranſom.

O O. Two tranſoms faſtened to the ſtern-poſt and faſhion-pieces, in the ſame manner as the wing-tranſom.

P. The tranſom-knee which faſteneth it to the ſhip's ſide.

Q. The faſhion-piece, of which there is one on each ſide: their heels are faſtened to the ſtern-poſt, at the height of the floor-ribbands, and their heads are faſtened to the wing-tranſom.

Midship Frame.



5 JA 59

T. A floor-timber: it is fayed acroſs the keel, to which it is faſtened by a bolt through the middle.

TTTTT. 2d, 3d, 4th futtocks and top-timbers. Theſe ſhew the proper length and ſcarf of the timbers, in what is called the midſhip-frame, which is a plane comprehended between the two ſides, at their extreme breadth, and the keel to which it is perpendicular; ſo that if a ſhip were cut through perpendicular to her length, and at her greateſt breadth, the exterior and interior part of both ſides from the upper-parts or edges, called the gunnels, down to the keel, would exhibit the midſhip-frame. The futtocks are to be joined, to complete a frame of timbers.

U U. Riders: theſe are fayed on the inſide of the ſhip acroſs the keel, and ſtand in the ſame manner as the timbers, and conſiſt of floor and futtock riders.

Z. The kelſon: this is made of two or three large pieces of timber ſcarfed together in the ſame manner as the keel. It is placed over the middle of the floor timbers, and ſcored about an inch and a half down upon each of them.

R, S. Breaſt-hooks: theſe are fayed on the inſide acroſs to the ſtem, and to the bow on each ſide of it, to which they are faſtened with proper bolts. There are generally four or five in the form of an R in the hold, one in the form of S, into which the lower-deck planks are rabbetted; there is one right under the hawſe-holes, and another under the ſecond deck.

X, Y, Z. Are thick planks which are fayed to the inſide, and ſtretch fore and aft, or from one end of the ſhip to the other, to ſupport the ſcarfing of the timbers.

Z. Are thick planks in the inſide called clamps, which ſuſtain the end of the beams.

15, 15, 15, 15, 15. Are the wales: they are planks broader and thicker than the reſt, which are faſtened to the outſide of the ſhip on a line with the decks: with regard to the planks reaching from the wale upwards to the top of the ſide, and downwards to the keel, the reader is referred to the ſection of one half of the midſhip-frame, as laid down in the plate.

d, d, d, d, d, d, d. Are knees. Theſe are crooked pieces of timber conſiſting of two arms, which form an angle ſometimes acute and ſometimes obtuſe or rectangular: their uſe is to faſten any two pieces together; as the beams to the ſhip's ſide, &c.

19. The rudder: this is joined to the ſtern-poſt by the rudder-irons, upon which it turns round in the googings, which are faſtened upon the ſtern-poſt for that purpoſe. There is a mortiſe cut through the head of it, into which a long bar is fitted, called the tiller, by which the rudder is turned from one ſide to the other, and both parts together, are called the helm.

23. The cat-heads. Theſe are two large ſquare pieces of timber, one on each ſide of the bowſprit: they project from the bow over the ſide, in order to keep the anchor clear of the ſhip, which is drawn up by a rope called the cat-fall, which paſſes through certain pullies, called ſheaves, in the outer-end of the cat-head: their inner-ends are faſtened upon the fore-caſtle.

m, m, i, i, i. Are the ſeveral pieces which compoſe the knee of the head, called by ſeamen the cut-water; the lower part *m* is fayed to the ſtem, the heel of it is ſcarfed to the head of the fore-foot; it is faſtened to the bows by two knees, called cheeks, and to the ſtem by a knee called a ſtandard, in the form of a K.

a, X, Y. Are beams, or large pieces of timber which ſupport the planks of each deck. See the article BEAMS. The reader will readily diſcover that the two ſides of the midſhip-frame in the middle of the plate are ſo diſpoſed, that all the pieces on one ſide may be ſeen before they are joined, and on the other after they are fixed in their proper places.

In ſhips of war the general dimenſions are eſtabliſhed by the authority of thoſe appointed by the government for that purpoſe. In the merchants ſervice, the extreme breadth, length of the keel, depth in the hold, and height in the waſte, and between decks; and ſometimes the height and breadth of the wing-tranſom, are agreed on by contract: and from theſe dimenſions the builder is to form a draught ſuitable to the trade for which ſhe is deſigned.

The firſt thing to be done, in order to lay down the deſign of a ſhip of war, is to determine the length, which ſhould be either on the lower-gun deck, or at the load-water-line: water-lines are deſcribed lengthways on a ſhip's bottom by the ſurface of the water in which ſhe ſwims; that which determines how much ſhe is under water when laden, is called the load-water-line, which is commonly at, or a little below her extreme length: there muſt be great care that ſufficient room be left between the ports.

The next thing is to eſtabliſh the breadth by the midſhip-beam; although ſome builders are divided in their opinion, about proportioning this to the length, yet moſt of them conform to dimenſions of ſhips of the ſame rate. After theſe two dimenſions are determined, the depth of the hold muſt be fixed, which in moſt ſhips is half the breadth; but the form of the body ſhould be conſidered; for a flat floor will require leſs hold than a ſharp one. The diſtances between the decks muſt alſo be determined.

We may then proceed to fix the length of the keel, which will oblige us to eſtabliſh the rake of the ſtem and ſtern-poſt: rake is the difference between a ſhip's length at the keel and upper-deck: or the line on which ſhe gradually projects farther out with the ſtem and ſtern as the fabric riſes. The height of the ſtem and wing-tranſom muſt alſo be fixed.

After theſe dimenſions are ſettled, the timbers may be conſidered which form the ſides of the ſhip. A frame of timbers, which appears to be one continued timber, is compoſed of one floor-timber, two or three futtocks, and a top-timber on each ſide: all theſe being united and ſecured by croſs-bars, form a circular incloſure; that which incloſes the greateſt ſpace is called the midſhip-frame: the curve of this frame is inverted at the lower part, ſo that the floor-timber will be ſomewhat hollow in the middle, whereby the ends will form a very obtuſe angle; but this angle decreaſes, the farther the frames are removed from the midſhips, in ſuch a manner, that the foremoſt and aftmoſt will become very ſharp, and form a very acute angle. Floor-timbers of this kind are called crutches.

Builders differ much in determining the ſtation of the midſhip-frame, ſome placing it before, and others at the middle of the ſhip. Thoſe who place it before alledge, that if a ſhip is full forward, ſhe will meet with no reſiſtance after ſhe has once opened a column of water, and that the water ſo diſplaced will eaſily unite abaft, and by that means force the ſhip forward, and have more power on the rudder, the farther it is from the center of gravity; and beſides this, comes neareſt the form of fiſhes, which ſhould ſeem to be the moſt advantageous for dividing fluids.

When the riſing of the midſhip floor-timber is agreed on, we may then proceed to decide the riſing line of the floor abaft on the ſtern-poſt, and afore on the ſtem.

The height of the lower-deck is the next thing to be conſidered: it is determined in midſhips by the depth of the hold; and ſome builders make it no higher than the ſtem, but they raiſe it more than it is in the midſhips, by as much as the load-water-mark abaft exceeds that afore. As to the height between decks, it is altogether arbitrary, and muſt be determined by the rate of the ſhip, and the ſervice ſhe is deſigned for.

We come now to conſider the upper-work, or all that is above water, called the dead work; and here the ſhip muſt be narrower; ſo that all the weight, lying above the load-water-line, will thereby be brought nearer the middle of the ſhip; by which means ſhe will ſtrain leſs by working the guns, &c. But though theſe advantages are gained by narrowing a ſhip above water, great care muſt be taken not to narrow her too much, for there muſt be ſufficient room upon the upper deck for the guns to recoil. The ſecurity of the maſts ſhould likewiſe be remembered, which requires ſufficient breadth to ſpread the ſhrouds, although this may be in ſome meaſure ſupplied by enlarging the breadth of the channels which ſpread them.

With regard to naval architecture, if we except ſome ancient artificers poſſeſſed of a natural genius, and a few of the moderns who have been inſtructed in the principles of geometry, and have laboured hard to make a progreſs

in ſhip-building, we may venture to aſſert that the greateſt number ſatisfy themſelves with copying ſhips that are eſteemed good ſailers; and a tenacious imitation of theſe ſervile mechanical methods, which are too common, have, to the great reproach of the art, produced all theſe pretended rules of proportion; for the various models they have hitherto uſed, prove beyond diſpute that they have not yet found a proper ſtandard: the only reaſon why they have tried ſo many different methods, is becauſe they could not find the beſt; yet every builder confines theſe mechanical rules of deſcribing the midſhip-frame, and forming the reſt of the timbers, to his own fancy, concealing it from the inferior artificers, who may be poſſeſſed of a genius and taſte greatly ſuperior to his own; but we would inform theſe gentlemen, that this is ever regarded by the polite world as a certain characteriſtic of a narrow and vulgar education, a ſordid and illiberal diſpoſition, and a perverſe and crooked taſte!

Whoever heard, that a great architect endeavoured to conceal the proportions of the different orders of architecture? Do we not ſee every where ſyſtems of that noble art publiſhed, plans, elevations, and ſections, preſented to the general obſervation of mankind for their approbation or cenſure? But poſſibly, we are afraid that publication of ſhip-building may be dangerous in a political light, by making our enemies maſters of the ſecret. This can never be the caſe, ſince we know that our ſeventy-gun ſhips and frigates, generally eſteemed the moſt uſeful ſhips in the navy, have been all the late war entirely copied from the models of the French, who have never ſtudied to conceal them. But although the methods of deſcribing the midſhip-frame, and forming the reſt of the timbers, be known to moſt of our younger artificers, yet we have but few good maſter-builders; this requires a greater portion of genius, than the mere mechanical methods. They ſhould, at leaſt, have a ſufficient acquaintance with mathematics, phyſics, mechanics, and the nature of ſolids and fluids, to be able to diſcover what figure would procure ſome good quality, without hazarding the putting a bad one in its place.

We refer ſuch readers as wiſh to be more fully or particularly informed of ſhip-building to M. Du Hamel's curious and uſeful Elements of Naval Architecture, to which we acknowledge ourſelves greatly indebted for the above deſcription. Mr. Mungo Murray has alſo publiſhed a book on this ſubject, called a Treatiſe on Ship-Building, &c. which muſt be of great ſervice to the younger artificers of this profeſſion, as it contains variety of very accurate drawings of ſhips. An abridgment of M. Du Hamel's book referred to above, is alſo tranſlated, and annexed to Murray's Treatiſe.

NAVAL-ARMAMENT, the ſame with fleet of ſhips of war, which ſee.

NAVAL-CAMP, in antiquity, a fortification, conſiſting of a ditch and parapet on the land-ſide, or a wall built in the form of a ſemi-circle, and extended from one point of the ſea to another. This was ſometimes defended with towers, and beautified with gates, thro' which they iſſued forth to attack their enemies. Homer hath left us a remarkable deſcription of the Grecian fortifications of this ſort, in the Trojan war, beginning at v. 436. Iliad η. of which we ſhall preſent our readers with Mr. Pope's tranſlation.

> Then to ſecure the camp and naval powers,
> They rais'd embattled walls with lofty tow'rs:
> From ſpace to ſpace were ample gates around,
> For paſſing chariots, and a trench profound,
> Of large extent; and deep in earth below
> Strong piles infix'd ſtood adverſe to the foe.

Towards the ſea, or within it, they fixed great pales of wood, like thoſe in their artificial harbours; before theſe the veſſels of burthen were placed in ſuch order, as that they might be inſtead of a wall, and give protection to thoſe within; in which manner Nicias is reported by Thucydides to have encamped himſelf: but this ſeems only to have been practiſed when the enemy was thought ſuperior in ſtrength, and raiſed great apprehenſions of danger in them. When their fortifications were thought ſtrong enough to defend them from the aſſaults of enemies, it was frequent to drag their ſhips to ſhore, which the Greeks called ἑλκειν, the Romans *ſubducere*. Around the ſhips the ſoldiers diſpoſed their tents, as appears every where in Homer; but this ſeems only to have been practiſed in winter, when their enemy's fleet was laid up and could not aſſault them, or in long ſieges, and when they lay in no danger from their enemies by ſea, as in the Trojan war, where the defenders of Troy never once attempted to encounter the Grecians in a ſea-fight.

The adjacent places were uſually filled with inns, and ſtews, well ſtocked with females, that proſtituted themſelves to the mariners, merchants, and artificers of all ſorts, who flocked thither in great numbers; this however appears to be only in times of peace. *Potter's Antiquities of Greece.*

NAVAL-CROWN, *Corona Navalis*, in Roman antiquity. See the article CROWN.

NAVAL ENGAGEMENT implies in general either a ſea-fight between ſingle ſhips or fleets of men of war, or gallies, &c.

Before we enter into a deſcription of our modern naval engagements, it may perhaps be thought neceſſary to ſay ſomething of the manner in which the ancient ſhips of war entered into action, as alſo to give ſome account of their principal inſtruments of war, which gun-powder has rendered uſeleſs, and which time has almoſt buried in oblivion.

Εμβολον, *roſtrum*, was a beak of wood, fortified wih braſs, whence it is called χαλκωμα νεων, in Diodorus; and ſhips have ſometimes the epithet of χαλκεμβολοι: one or more of theſe was always faſtened to the prow, to annoy the enemy's ſhips, and the whole prow was ſometimes covered with braſs to guard it from rocks and aſſaults. The perſon who firſt uſed theſe beaks is ſaid to have been one Piſaeus, an Italian; for it will not be allowed that the primitive Grecians had any knowledge of them, ſince no ſuch thing is mentioned in Homer, which could ſcarcely have happened had they been invented at the time of the Trojan war. Theſe beaks were at firſt long and high, but afterwards it was found more convenient to have them ſhort and firm, and placed ſo low as to pierce the enemy's ſhip under water.

Καταστρωματα Σανιδωματα, an elevation of wood, raiſed on the deck on purpoſe for the ſoldiers, that they might level their miſſive weapons with greater force and certainty againſt their enemies. In the primitive ages, particularly about the time of the Trojan war, we are told by Thucydides, that the ſoldiers uſed to fight upon the foremoſt and hindermoſt decks; and therefore, whenever we find Homer ſpeak of ικρια νηος, which his ſcholiaſts interpret hatches, we are only to underſtand him of theſe eminences.

There were alſo commonly hides, or ſuch like materials hung on both ſides of the ſhip, as well to hinder the waves from falling into it, as to receive the darts caſt from the adverſe ſhips, that under theſe, as walls on both ſides, the ſoldiers might without danger annoy their enemies.

Δελφιν, a certain machine, which being uſually a part of theſe ſhips, cannot be omitted in this place: it was a vaſt and maſſy piece of lead or iron, caſt in the form of a dolphin, and hung with cords and pullies to the ſail-yards or maſt, whence being thrown with great violence into the adverſe ſhips, either penetrated them, and ſo opened a paſſage for the riſing floods, or by its weight and force ſunk them to the bottom of the ſea.

Δορατα ναυμαχα, ſpears of an unuſual length, ſometimes exceeding twenty cubits, whence they are called in Livy *haſtæ longæ*, and by Homer, in his 15th Iliad, ξυστα ναυμαχα, and μακρα, where Ajax in reſiſting Hector,

> A pond'rous mace with ſtuds of iron crown'd,
> Full twenty cubits long he ſwings around.
>
> POPE.

Δρεπανον, called by Appian δρεπανιδιον, by Diodorus δρεπανηφορον χειριον, was an engine of iron, crooked like a ſickle, and fixed to the top of a long pole, wherewith they cut aſunder the cords of the ſail-yards, and thereby

by letting the ſails fall down, diſabled the light ſhips. Not unlike this was another inſtrument, armed at the end with a broad iron head, edged on both ſides, wherewith they cut the cords that tie the rudder to the ſhip.

Κερκιδες were machines to caſt ſtones into the enemy's ſhips.

We find another engine mentioned by Vegetius, which hung upon the main-maſt, and reſembled a battering-ram; for it conſiſted of a long beam, and head of iron, and was with great violence puſhed againſt the ſides of adverſe ſhips.

Χειρ σιδηρα, in Latin, *manus ferrea*, was a grappling-iron, which they caſt out of an engine into the enemy's ſhip. It is ſaid to have been firſt uſed in Greece by Pericles the Athenian; at Rome by Duilius. Different from theſe were the αρπαγες, *Harpagines*, ſaid to be invented by Anacharſis the Scythian philoſopher; which, as Scheffer collects out of Athenaeus, were hooks of iron hanging on the top of a pole, which being ſecured with chains to the maſts, or ſome other lofty part of the ſhip, and then caſt with great force into the enemy's veſſel, caught it up into the air. The means uſed to defeat thoſe engines, was to cover their ſhips with hides, which caſt off, or blunted the ſtroke of the iron.

The ancient Greeks, in preparing for an engagement at ſea, made it their firſt buſineſs to diſburthen their ſhips of war of all proviſions, and other lumber not neceſſary in the action, leſt by too heavy a load they ſhould be rendered unwieldy, and unfit for ſervice, being neither able with force and vigour to aſſail their enemies, nor by lightly tacking about to avoid their onſets. This done, when the enemy appeared in view, they took down their ſails, lowered their maſts, and ſecured whatever might expoſe them to the winds, chuſing rather to be governed by oars, which they could manage at their pleaſure.

As to their order of battle, that was varied as time, place, and other circumſtances required; being ſometimes formed like an half-moon, and called σολος μηνοειδης, the horns jutting out towards the enemy, and containing the ableſt men and ſhips; ſometimes, on the contrary, having its belly neareſt the enemy, and its horns turned backwards, whence it was termed κυρτη παραταξις: nor was it unuſual to range them in the form of a circle, which they called κυκλον τιθεναι; or, to mention no more, in the figure of the letter V, with the horns extended in a direct line, and meeting at the end; which order was named εμβολη παραταξις; in Latin, *foreeps*; and was uſually encountered by the enemies ranged into the ſame order inverted, whereby they reſembled the figure of a wedge or beak, whence it was called *cuneus* or *roſtrum*; this enabled them to penetrate into the body of the adverſe battle.

Before they joined battle, both parties invoked the gods to their aſſiſtance by prayers and ſacrifices; and the admirals going from ſhip to ſhip in ſome of the lighter veſſels, exhorted their ſoldiers in a ſet oration, to behave themſelves like men: then, all things being in readineſs, the ſignal was given by hanging out of the admiral's galley a gilded ſhield, as we read in Plutarch; or a red garment or banner, which was termed αιρειν σημεια. During the elevation of this the fight continued, and by its depreſſion, or inclination towards the right or leſt, the reſt of the ſhips were directed in what manner to attack their enemies, or retreat from them. To this was added the ſound of trumpets, which was begun in the admiral's galley, and continued round the whole navy. It was likewiſe uſual for the ſoldiers, before the fight, to ſing a pæan, or hymn, to Mars; and after the fight, another to Apollo.

The fight was uſually begun by the admiral-galley, as we find done at the battle of Salamis, and another time by Attalus's ſhip: it was carried on in two different manners, for not only the ſhips engaged one another, and by their beaks and prows, and ſometimes their ſterns, endeavoured to daſh in pieces, or overſet and ſink their oppoſers, but the ſoldiers alſo annoyed their enemies with darts and ſlings; and upon their nearer approach, with ſwords and ſpears. Thus Lucan:

Ut primum roſtris crepuerunt obvia roſtra,
In puppim rediere rates, emiſſaque tela
Æra texerunt vacuumque cadentia pontum.

The ſhips firſt meeting ſhew their fierceſt rage,
And furiouſly with claſhing beaks engage;
Theſe turn about, and then the javelins fly,
And ſhow'rs of arrows darken all the ſky;
The ſea is cover'd o'er.——

We find by the ſame author, that after this firſt onſet, their ſhips approached ſo near each other as to be linked together with chains or grappling-irons, and then they fought with ſword in hand. Sometimes for want of irons they ſo fixed their oars, as thereby to hinder their enemies from retreating; ſo we read in Lucan:

Seque tenent remis, toto ſtetit æquore bellum.

The ſhips they hold with oars, and all around
The face of horrid war appears.——

This ſort of combat was not unlike a ſiege, where the ſtronger party, prevailing over their enemies, entered their veſſels by laying bridges between them, and having killed, or taken priſoners, all they found in arms, ſeized and dragged away their ſhips.

When a town was beſieged by ſea, they uſed to environ its walls and harbour with ſhips, ranged in order from one ſide of the ſhore to the other, and ſo cloſely joined together by chains and bridges, on which armed men were placed, that, without breaking their order, there could be no paſſage from the town to the ſea; this leaguer Diodorus calls ζευγμα. The better to prevent any attempts of the beſieged, Demetrius is ſaid to have invented a ſort of boom armed with ſpikes of iron, which ſwam upon the waters; this he placed at the mouth of the harbour of Rhodes, when he beſieged that city. Sometimes they blocked up the harbour, or made a paſſage to the town by raiſing a vaſt mole before it, as we read of Alexander in the ſiege of Tyre; or by ſinking ſhips filled with ſtones and ſand, as we find practiſed by the Romans.

The attacks were uſually carried on by men ſtanding upon bridges between the ſhips, and thence with darts and ſtones forcing the beſieged from their walls: thus Alexander, in the ſiege of Tyre, ſo ordered his gallies, that two of them being joined at the heads, and the ſterns ſomewhat diſtant, boards and planks were laid over in the faſhion of bridges, for ſoldiers to ſtand upon, who were in this manner rowed cloſe to the wall, where, without any danger, they threw darts at their enemies, being ſheltered behind the fore-decks of their own gallies. Here, alſo, that they might throw their miſſive weapons with greater advantage, and batter the walls with their rams and other engines, they erected towers ſo high as to command the city walls, from which having repelled the defenders, they by this means had opportunity to deſcend by ladders.

The beſieged were not at a loſs for ways of defeating theſe ſtratagems; the ſhips linked together they pulled aſunder with iron-hooks, the paſſage to the town they blocked up in the ſame manner the enemies had done that of the harbour, or otherways; if they could not hinder their approach, they failed not to gall them with darts, ſtones, fire-balls, melted pitch or metals, and many other things; and, laſtly, to trouble you no farther, it was frequent for thoſe in the town to deſtroy the veſſels and works of the beſiegers by fire-ſhips, as we find done by the Tyrians, who, taking a large veſſel, put a great quantity of ballaſt into the ſtern, covered the head with pitch, tar, and brimſtone, then by the help of ſails and oars brought her cloſe to the Macedonian fortreſs, where having ſet the combuſtible matter on fire, they retreated into boats prepared for that purpoſe; the fire immediately ſeized the towers of the fortification, and by the help of torches and fire-brands caſt by thoſe in the boats, the work itſelf took fire, and that vaſt pile, on which ſo much time and labour had been beſtowed, was in a few moments quite demoliſhed. The uſe of fire-ſhips we likewiſe meet with amongſt the Rhodians in Diodorus the Sicilian.

We have obſerved above that the ancients ranged their ſhips or gallies ſo as to preſent them in front to their enemy; becauſe the machines they then made uſe of, were fixed

fixed in the heads or prows of their veſſels: the ſame reaſon now prevails with regard to the gallies, which are drawn up in the form of a creſcent, or half-moon, whoſe ends or horns are oppoſed to the enemy; in the middle of which is the admiral, from whence he the more diſtinctly obſerves the motions of his fleet throughout. The two fleets being thus drawn up, approach each other to a convenient diſtance, when the battle beginning at the ends of the half-moon, extends inſenſibly till the whole fleet is engaged, and each partakes of the danger and glory of the action. See lower compartment of plate XCII.

In an engagement of ſhips of war, the fleets are drawn up in two parallel lines upon a wind. The ſhips keep cloſe to the wind on the line they are formed in, and are commonly at a cable's length diſtance one from the other; the fire-ſhips, tranſports, tenders, &c. keeping at half a league diſtance on the oppoſite ſide of the enemy. Thus in the upper compartment of plate XCII. the fleets A B and C D, that are engaged, are ranged under an eaſy ſail, cloſe to the wind; and the fire-ſhips E E, of the fleet A B, are to windward; the fire-ſhips F F, are to the leeward of their fleet C D. This form was obſerved, for the firſt time, in the famous battle of the Texel, where the duke of York defeated the Dutch, on the 13th of June, 1665. See the article SQUADRON and LINE.

It is probably the moſt expedient method, as proved by experience, to keep a conſtant cannonade on the enemy, by firing in platoons, which will have a much greater effect, and diſtreſs them more, than the common received notion of broad-ſide and broad-ſide with ſome intervals between, which is generally the caſe in moſt actions; in order to which, it will be moſt prudent to divide the guns into five fires, in the following manner, viz. half the guns abaft below, then half the guns abaft aloft, ſo the other half below forward; and, laſtly, the quarter-deck guns, and thoſe on the fore-caſtle: ſo that, by the time your firſt platoon is fired, you will be able to keep up a conſtant fire on your enemy, which method is preferable, as was obſerved before, to broad-ſide and broad-ſide, where chance has often a greater ſhare in the execution than judgment; notwithſtanding, this laſt method is ſometimes neceſſary, as time and circumſtances may offer. It is likewiſe neceſſary to point your guns ſo as to make a breach in your enemy's ſhip.

The chief judgment of an admiral, is to form his line in a proper diſpoſition and ſtrength from the van throughout to the rear; in doing which, particular care muſt be had to make the center ſtrong, for if that is forced, or broke through, the battle is looked upon as loſt. Here it is to be obſerved, that, in a ſea-action, the center is made the ſtrongeſt, whereas in a land-fight it is the weakeſt; and the wings of an army are ſtrongeſt, leſt the enemy, by forcing a wing, ſhould have the advantage of flanking, and conſequently putting the line in diſorder: for the ſame reaſon alſo, the van and rear of a fleet is not put into confuſion, becauſe care is taken to make them proportionably ſtrong to reſiſt the enemy: therefore the weakeſt part of the line will be in the quarters, ſupported each way from the center throughout.

The ſignal being made for battle, each diviſion, every captain crouds into his proper ſtation without loſs of time: they endeavour to approach each other till within point-blank gun ſhot, which is near enough for a line of battle; for if you ſhould be too near, your line will naturally fall into a curve, notwithſtanding all your endeavours to the contrary; beſides, you cannot ſo well obſerve your own line: the enemy may intercept your ſight, eſpecially if the line be long, which may cauſe a miſtake in the ſignals. It would be better for the contending admirals in chief, that each had a view of his own line, as well as of that of the enemy, in order to make proper ſignals, and, if any diſtreſs happen, to be the better able to relieve, or if any advantage, to improve upon it.

The battle being begun, the fate of war decides the day. In a word, the ſucceſs of all depends upon placing your ſhot well, and preſerving a proper diſpoſition in the line. There is one maxim, by which we ſhould always be guided, that is, that bravery and reſolution are abſolutely neceſſary in the firſt ſort of engagement, viz. between ſingle ſhips; and conduct and bravery in the ſecond ſort, viz. that between two ſquadrons.

Conduct and preſence of mind are chiefly requiſite in a line of battle; for the admiral cannot be ſuppoſed to want bravery and reſolution. It is then he muſt ſummon up all his knowledge and experience, to judge of the ſtrength of his line; when and how to keep it as complete as poſſible, by ordering ſhips from the corps-de-reſerve, or by changing ſhips from one part of the line to the other; or by detaching from one part of the wings, which may not be ſo much preſſed, to that which is. Here he muſt alſo conſider the poſition of his enemy; his eyes muſt be on him, as well as on his own line, from the van to the rear; and all ſhould ſtrictly mind the admiral's motions, ſignals, &c. Boats will, in all probability, be continually paſſing from the ſhips to their flag-officers, if any thing extraordinary ſhould happen, to acquaint them of it; and from the admirals or commanding officers of each diviſion to the admiral in chief, giving an account of the ſtate and condition of each diviſion, which will be a great ſatisfaction to him, as he will then be better able to judge how to aſſiſt where moſt wanted when occaſion requires, or how to improve upon any advantage gained.

The battle drawing to a concluſion, it is eaſy to judge what the conqueror will do to improve his victory; as neceſſary a part of an officer as any in the action, as it requires great judgment and readineſs of thought; and the other, in making his retreat, ſhould let ſlip no opportunity to ſave as many of his fleet as he poſſibly can. His eye muſt be quick, and his judgment and preſence of mind as ready as at the firſt onſet of the battle. He has no other reſource leſt but in his eſcape, and this comfortable alleviation of his defeat, that a glorious retreat may gain him as much honour as the victory did to the conqueror. See the article RETREAT.

NAVAL FURNITURE. See ANCHORS, CABLES, CANNON, RIGGING, SAILS, &c.

NAVAL OFFICER. See the articles CAPTAIN, LIEUTENANT, MASTER, BOATSWAIN, GUNNER, and OFFICERS.

NAVE, in architecture, the body of a church, where the people are diſpoſed, reaching from the balluſter, or rail of the choir, to the chief door.

Some derive the word nave from ναὸς, a temple; and others from *navis*, a ſhip, by reaſon the vault or roof of a church bears ſome reſemblance to a ſhip.

NAVEL, *Umbilicus*, in anatomy. See the article UMBILICUS.

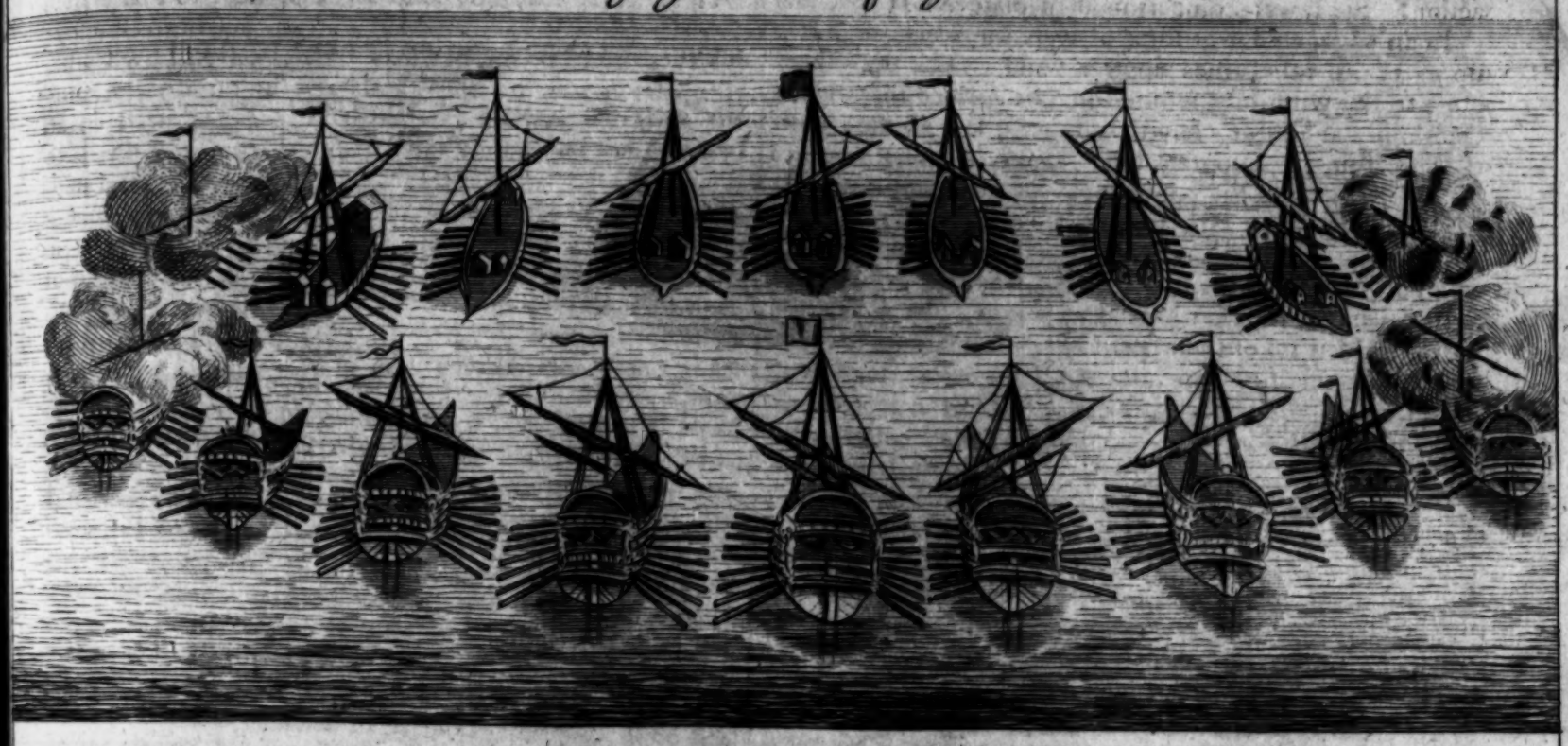
NAVEL-WORT, cotyledon, in botany. See the article COTYLEDON.

NAVEW, *Napus*, in botany, a plant of the turnip kind, with oblong roots growing ſlenderer from the top to the extremity. Two ſorts of it, ranked among the articles of the materia medica, are ſuppoſed by Linnæus to be only varieties, and are therefore joined into one ſpecies, under the name of braſſica radice cauleſcente fuſiformi. They are both biennial.

NAVEW, *Napus Sativa*, garden or ſweet navew, or French turnip; cultivated for the culinary uſe of its roots, which are warmer and more grateful than thoſe of the common turnip, and are ſaid to afford likewiſe, in their decoctions, a liquor beneficial in diſorders of the breaſt. The ſeeds, in figure roundiſh and in colour reddiſh, are the part principally directed for medicinal purpoſes: they have a moderately pungent taſte, ſomewhat approaching to that of muſtard ſeed, of the virtues of which they appear to partake: with muſtard ſeed they agree alſo in their pharmaceutic properties, their pungent matter being taken up completely by water and only partially by rectified ſpirit, and being diſſipated in the inſpiſſation of the watery infuſion, only an unpleaſant bitteriſhneſs remaining in the extract. As the navew ſeeds nearly ſimilar in kind to thoſe of muſtard, are apparently much inferior in degree, the college of Edinburgh has diſcarded them, and that of London retains them only as an ingredient in theriaca.

NAVEW, *Napus Silveſtris*, wild navew or rape, growing on dry banks and among corn, with leaves ſomewhat different from thoſe of the former, being more like thoſe

Engagement of Gallies.



Engagement of Ships of War.

5 JA 59

thoſe of cabbages than of turnips; the root ſmaller, and of a ſtronger unpleaſant taſte; and the ſeeds alſo rather more pungent, on which account they are preferred by the faculty of Paris. The ſeeds of both kinds yield upon expreſſion a large quantity of oil: the oil called rape-oil is extracted from the ſeeds of the wild ſort, which is cultivated in abundance, for that uſe, in ſome parts of England. The cake, remaining after the expreſſion of the oil, retains, like that of muſtard, the acrimony of the ſeeds. See the article RAPE-SEED.

NAVICULARE Os, in anatomy, a bone of the foot, lying between the aſtragalus and oſſa cuneiformia, and ſo called from its reſemblance to a boat.

It has a glenoid cavity, for its articulation with the head of the aſtragalus; and its anterior faces are received into the ſinuſes of the oſſa cuneiformia.

NAVIGATION, the theory and art of conducting a ſhip by ſea, from one port to another, or of diſpoſing and actuating her machinery, by the force of the wind, ſo as to begin and continue her motion at ſea.

Moſt of thoſe uſeful arts and admirable inventions which are the very ſupport of mankind, and ſupply them with all the neceſſaries and conveniences of life, have at firſt been the production of ſome lucky chance, or from ſlight and contemptible beginnings have been, by long experience, cautious obſervations, and various improvements, matured and brought to perfection. Inſtances of this kind are every where frequent and obvious, but none can be produced more remarkable than in the art of navigation, which, although now arrived to a pitch of perfection beyond moſt other arts, by thoſe ſucceſsful additions it has received from almoſt every age of the world, was in the beginning ſo mean and imperfect, that the pleaſure or advantage of thoſe who firſt applied themſelves to it, was very ſmall and inconſiderable.

Thoſe who adventured to commit themſelves to the liquid element, made their firſt eſſays in ſhallow waters, cautious of truſting themſelves at any conſiderable diſtance from the ſhore; but being emboldened by repeated trials, proceeded farther by degrees, till at length they took courage and launched forth into the main ocean. To this purpoſe Claudian ſays,

Inventa ſecuit primus qui nave profundum,
Et rudibus remis ſolicitavit aquas;
Tranquillis primum trepidus ſe credidit undis,
Littora ſecuro tramite ſumma legens;
Mox longos tentare ſinus, et linquere terras,
Et leni coepit pandere vela Noto:
Aſt ubi paulatim praeceps audacia crevit,
Cordaque languentem dedicere metum,
Jam vagus irrupit pelago, coelumque ſecutus,
Aegeas hyemes Ionaſque domat.

Which we may thus tranſlate:

Who launch'd the firſt bold veſſel on the deep,
And bade his aukward oars the waters ſweep;
Cautious, adventur'd on the margin-wave
At firſt; afraid the diſtant ſurge to brave:
Advancing farther, to the powerful gale,
High on the maſt he ſpread the ſwelling ſail.
Till by degrees he wander'd from the ſhore,
Unconſcious of thoſe fears he felt before;
And guided by ſome ſtar's auſpicious ray,
His bark undaunted cleav'd the watery way,
Along the Aegean and Ionian ſeas.

The officers appointed to ſuperintend the navigation of thoſe ſhips, were firſt,

Αρχικυβερνητας, the chief pilot, or pilot-general, who was entruſted with the care and management of all marine affairs, to provide commodious harbours, to direct the courſe of the fleet, and order all things concerning it, except thoſe which related to war. Second,

Κυβερνητης, the maſter or pilot, who had care of the ſhip, and government of the ſeamen therein, and ſat at the ſtern to ſteer. All things were managed according to his direction; it was therefore neceſſary that he ſhould have obtained a perfect knowledge of the art of navigation, which was called κυβερνητικη τεχνη, and chiefly conſiſted in theſe three things: Firſt, In the right management of the rudder, ſails, and all the engines uſed in navigation: Secondly, In the knowledge of the winds and celeſtial bodies, their motions and influences: Thirdly, In the knowledge of commodious harbours, of rocks, quick-ſands, and other occurrences of the ſea. How much this employment is ſimilar to the duty of the officer who manages the navigation in our ſhips of war, the reader will find in the article MASTER.

As to the heavenly bodies, they were obſerved by ſailors on a two-fold account, being of uſe to them in prognoſticating the ſeaſons, and as guides to ſhape their courſe. The principal of thoſe uſed in foretelling, were Arcturus, the Dog-ſtar, Arae, Orion, Hyades, Hoedi, Caſtor and Pollux, Helena, &c. It was likewiſe cuſtomary to take notice of various omens offered by ſea-fowls, fiſhes, and divers other things, as the murmuring of the floods, the ſhaking and buzzing noiſe of trees in the neighbouring woods, the daſhing of the billows againſt the ſhore, and many more, in which all good pilots were nicely ſkilled. As to the direction in their voyage, the firſt practitioners in the art of navigation, being unacquainted with the reſt of the celeſtial motions, ſteered all the day by the courſe of the ſun; at night betaking themſelves to ſome ſafe harbour, or reſting on the ſhore, and not daring to venture to ſea till their guide was riſen, to diſcover their way: that this was their conſtant cuſtom, may be obſerved from the ancient deſcriptions of thoſe times. See Virg Aen. 3. v. 508, *Sol ruit interea, et montes umbrantur opaci*, &c.

Afterwards the Phœnicians, called by ſome the firſt inventors of navigation, diſcovered the motions of ſome other ſtars, as may be obſerved by Pliny and Propertius. The Phœnicians we find to have been directed by Cynoſura, or the leſſer bear-ſtar, which was firſt obſerved, as ſome are of opinion, by Thales, the Mileſian, who was originally a Phoenician, when the mariners of Greece, as well as other nations, ſteered by the greater bear: for the firſt obſervation of this, they were obliged to Nauplius, if we may believe Theon, or according to the report of Flaccus to Tiphys, the pilot of the famous ſhip Argo. But of theſe two we are told by Theon, the former was the ſecurer guide, and therefore was followed by the Phoenicians, who, for ſkill in marine affairs, outſtript not only all the reſt of the world, but even the Grecians themſelves.

That the oars might ſtrike the water, and proceed in a regular and conſtant motion, keeping due time with each other, they had Τερπαυλης, a muſician, who, by the harmony of his voice and inſtrument, not only directed the rowers in their motions to ſtrike uniformly, but raiſed their ſpirits when weary with labour and ready to faint, as we read in Statius, Thebaid, v. 342.

Acclinis malo mediis interſonat Orpheus
Remigiis tantoſque jubet neſcire labores.

Againſt the maſt the tuneful Orpheus ſtands,
Plays to the weary rowers, and commands
The thought of toil away——

There were alſo people employed to ſet the ſhip along, and ſound the depths of the water with long poles, eſpecially in the night. This practice is very frequent amongſt the Poles at this time.

After they had invoked the protection of their gods by ſolemn prayers and ſacrifices, which, as they offered to other deities, ſo more eſpecially to thoſe who had any concern or command in the ſea; to the winds and tempeſts, the whole train of marine gods and goddeſſes, but above all to Neptune, they ſpread ſail and put to ſea. Nor was it enough for themſelves alone to petition the gods for ſafety and ſucceſs, but all the multitudes that thronged on theſe occaſions to the ſhore, earneſtly recommended them to the divine protection, and joined their fervent prayers for their deliverance from all the dangers they were going to encounter. Since the great improvement of navigation, theſe practices have, however, been intirely laid aſide by the moderns.

This done, we are told by the Scholiaſt upon Apollonius, that it was uſual to let fly a dove, which no doubt was looked on as an omen of ſafe return, becauſe that bird is not eaſily forced to relinquiſh its habitation, but when driven away delights to return. Then they put to ſea, the ſignal being given by a ſhout, by ſound of trumpet, and ſeveral other ways. In the night it was uſually given by torches lighted in the admiral-galley.

The ſhips were uſually ranged in this order; in the front went the lighter veſſels; after theſe followed the men of war, led on by the admiral, which was commonly diſtinguiſhed from the reſt by the richneſs of her ornaments: laſt of all, the veſſels of burthen came up. If the winds were high, or the ſea dangerous, they were extended at length, ſailing one by one; but at other times they went three or more in a breaſt. See the article NAVAL.

Tyre, the capital of the Phoenicians, whoſe commerce, riches, and power, are repreſented in ſuch lofty terms, both in ſacred and prophane authors, being furniſhed with excellent wood for ſhip-building, was very ſoon miſtreſs of a numerous fleet, with which the inhabitants conſtantly embarking on new expeditions, and ſettling new trades, they ſoon arrived at an incredible pitch of opulency and populouſneſs; inſomuch as to be in a condition to ſend out colonies, the principal of which was that of Carthage; which keeping up the Phoenician ſpirit of commerce, in time not only equalled Tyre itſelf, but vaſtly ſurpaſſed it, ſending its merchant-fleets through Hercules's pillars, now the ſtreights of Gibraltar, along the weſtern coaſts of Africa and Europe, and, if we may believe ſome authors, to America itſelf; the diſcovery whereof, ſo many ages afterwards, has been ſo glorious to the Spaniards.

After the deſtruction of Tyre, by Alexander the Great, its navigation and commerce were transferred to Alexandria, a new city, admirably ſituated for thoſe purpoſes, and propoſed for the capital of the empire of Aſia, which Alexander then meditated. And thus aroſe the navigation of the Egyptians, afterwards ſo cultivated by the Ptolomies, that Tyre and Carthage, which laſt, after having a long time diſputed empire with the Romans, was at length ſubdued, were quite forgot.

Egypt being reduced itſelf into a Roman province, after the battle of Actium, its trade and navigation fell into the hands of Auguſtus, in whoſe time Alexandria was only inferior to Rome; and the magazines of the capital of the world were wholly ſupplied with merchandize from the capital of Egypt.

At length Alexandria itſelf underwent the fate of Tyre and Carthage; and the fall of Rome and its empire drew along with it not only that of learning and the polite arts, but that of navigation; the Barbarians, into whoſe hands it fell, contenting themſelves with the ſpoils of the induſtry of their predeceſſors.

Navigation thus travelled, together with the polite arts, to the eaſtward; but it does not appear which of the European nations, after the ſettlement of their new maſters, firſt betook themſelves to navigation and commerce. Some think it began with the French, though the Italians ſeem to have the juſteſt title to it, and are accordingly looked on as the reſtorers thereof, as well as the other arts and ſciences, which had been baniſhed together, when the empire was torn aſunder: but at preſent the Britiſh navy holds an undiſputed empire over the main.

NAVIGATION, among the moderns, comprehends either the art of ſeamanſhip, or of conducting a ſhip by the laws of geometry, upon the wide and trackleſs ocean, or both.

By ſeamanſhip we would be underſtood to comprehend a perfect knowledge, as well of all the various machinery and furniture of a ſhip, as experience and ſkill to diſpoſe thoſe machines ſo judiciouſly, that by a mutual aſſiſtance of each other, they may begin and continue the motion of this complicated frame, according to the different deſigns which may be required, or the various exigencies to which it may be reduced. It likewiſe includes the art of renewing or keeping in repair the inſtruments and engines employed in all the purpoſes of navigation.

That part of navigation which regards the piloting or guiding a ſhip along the coaſt, can only be acquired by experience, as it chiefly comprehends a knowledge of the reigning winds, the ſetting of the tides, the different depths of water, and the various ſorts of ground diſcovered in different depths, as ſhells of many colours, ſand great and ſmall, clay, ooze, ſhingle, gravel, ſtones, &c. &c. by which the place of the ſhip may be known many times in the darkeſt night, and conſequently her diſtance from ſome known place on the coaſt. The bearings of the neareſt cape, head-land, promontory, or iſland, is always ſet by the compaſs, and the diſtance allowed by computation, which experience and attention often make the ſeamen very perfect in. See the article COASTING.

That part of navigation by which we underſtand the direction of a ſhip's courſe at ſea, and out of ſight of land, is formed on the principles of plain trigonometry; her progreſs is conſequently meaſured by geometrical rules, and determined by the ſides and angles of a right angled plain triangle, in which the hypothenuſe is converted into diſtance, the perpendicular into difference of latitude, the baſe into departure, and the angles into the courſe and its complement. See COURSE, DEPARTURE, DIFFERENCE of LATITUDE, and DISTANCE.

The courſe of the ſhip is known to be determined by the compaſs, and as the mate at the helm directs the ſhip's motion by this inſtrument, it is conſequently the firſt thing given in the triangles. The diſtance is next meaſured by the log-line and a half or quarter minute glaſs. See COMPASS and LOG-LINE.

Thus having the courſe and diſtance given, we diſcover the difference of latitude and departure, by the following analogy.

As radius,
To the diſtance;
So is the ſine of the courſe,
To the departure.

As radius,
To the diſtance;
So is the co-ſine of the courſe,
To the difference of latitude.

Thus having found the miles of departure, which muſt neceſſarily mean eaſting or weſting from the laſt meridian, we convert it into miles of longitude by Mercator, and reduce the northing or ſouthing alſo into miles of difference of latitude; which operation being performed at every alteration of the courſe on a change of wind, or other accident, the whole northings, ſouthings, eaſtings, and weſtings, ſailed in 24 hours, are diſpoſed in four columns, and the leſſer numbers ſubſtracted from the greater, leave the number of miles of difference of latitude north or ſouth, and of departure eaſt or weſt. The courſe and diſtance reſulting from theſe traverſes for the 24 hours, is then diſcovered by the following proportion.

As the difference of latitude,
To radius;
So is the departure,
To the tangent of the courſe,

As the ſine of the courſe,
To the departure;
So is radius,
To the diſtance.

But if the artiſt in the run of 24 hours has occaſion to believe from circumſtances, that the angle of the courſe is nearer truth than the ſide of the diſtance, and has proved the accuracy of his difference of latitude by a celeſtial obſervation, he will naturally chooſe to find his diſtance and departure by the courſe and the difference of latitude, and will then ſay,

As the co-ſine of the courſe,
Is to the difference of latitude;

So

So is radius,
To the diſtance.

And,

As radius,
To the diſtance;
So is the ſine of the courſe,
To the departure.

On the contrary, if the navigator has more reaſon to rely on the certainty of the diſtance than of the courſe, and has his difference of latitude confirmed by a ſolar obſervation, he is then furniſhed with two ſides of a right angled plain triangle, to diſcover the angle of the courſe and the third ſide; it will then be:

As the diſtance,
To radius;
So is the difference of latitude,
To the ſine complement of the courſe.

Which ſubſtracted from 90° gives the angle of the courſe: and then,

As radius,
To the diſtance;
So is the ſine of the courſe,
To the departure.

But if a ſhip has ſailed between the meridian and parallel, that is, any where on an angle between the four cardinal points, and is pretty exact in her courſe, as alſo in the miles of eaſting or weſting ſhe has made, called her departure, although the diſtance ſhe has run is not accurately determined, nor is her difference of latitude aſcertained; then will the two latter, *viz.* the diſtance and difference of latitude be diſcovered, by having the courſe and the departure given, as thus:

As the ſine of the courſe,
To the departure;
So is radius,
To the diſtance.

As the tangent of the courſe,
To the departure;
So is radius,
To the difference of latitude.

Laſtly, if a ſhip has ſailed a known diſtance, till the line of her departure is likewiſe aſcertained, and it be required to find the courſe ſhe has ſteered, and the difference of latitude ſhe has made, then muſt the departure and diſtance be given to find the courſe and difference of latitude.

As the diſtance,
To radius;
So is the departure,
To the ſine of the courſe.

As the tangent of the courſe,
To the departure;
So is radius,
To the difference of latitude.

Thus have we gone through the ſix caſes of that part of navigation, which is commonly called plain ſailing, and exactly ſimilar to the method of working Mercator's or Wright's, which ſuppoſes the degrees of latitude to be protracted in the ſame ratio, as the degrees of longitude are diminiſhed in their approaches towards the poles of the earth. See MERIDIONAL and MERCATOR.

This extenſion of the degrees of latitude, and conſequently of the difference of latitude between any two places, is called the meridional difference of latitude, and is found by taking the meridional parts of any two places from a table calculated for all parallels, and ſubtracting the leſſer from the greater number, if they are both ſituated north or ſouth of the equator. If one of them lies north, and the other ſouth, then is their meridional difference of latitude found by adding their meridional parts; and having this meridional difference given, together with their difference of longitude, we diſcover the courſe and diſtance as in plain ſailing.

As the meridional difference of latitude,
To the difference of longitude;
So is radius,
To the tangent of the courſe.

As the co-ſine or ſine-complement of the courſe,
To the real difference of latitude;
So is radius,
To the diſtance.

Caſe II. The courſe and diſtance ſailed being given, to find the difference of latitude and difference of longitude.

Firſt, for finding the difference of latitude by rectangular trigonometry, we have this proportion, *viz.* as radius is to the diſtance, ſo is the co-ſine of the courſe to the proper difference of latitude: and hence, it will be eaſy to find the meridional difference of latitude; and to find the difference of longitude, the proportion is, as the radius to the meridional difference of latitude, ſo is the tangent of the courſe to the minutes of difference of longitude.

Caſe III. Both latitudes, *viz.* that ſailing from and coming to, being given; to find the diſtance ſailed, and the difference of longitude.

Firſt, for the difference of longitude, the proportion will be; as radius is to the enlarged or meridional difference of latitude, ſo is the tangent of the courſe to the minutes of difference of longitude.

Then for the direct diſtance, the proportion is; as radius to the proper difference of latitude, ſo is the ſecant of the courſe to the direct diſtance.

Caſe IV. Both latitudes and diſtance ſailed being given, to find the direct courſe and difference of longitude.

Firſt, for finding the angle of the courſe, the proportion is; as the proper difference of latitude is to radius, ſo is the diſtance ſailed to the ſecant of the courſe: then, for the difference of longitude, it will be; as radius to the meridional difference of latitude, ſo is the tangent of the courſe to the minutes of difference of longitude.

Caſe V. One latitude, courſe, and difference of longitude being given: to find the other latitude, and diſtance ſailed.

Firſt, ſay; as the tangent of the courſe is to radius, ſo is the minutes of difference of longitude to the enlarged difference of latitude; whence the minutes of difference of latitude may be found: then to find the direct diſtance, ſay; as radius is to the proper difference of latitude, ſo is the ſecant of the courſe to the direct diſtance.

Caſe VI. One latitude, courſe, and departure being given; to find the other latitude, diſtance ſailed, and difference of longitude.

Firſt, for the diſtance, the proportion is; as the ſine of the courſe is to the departure, ſo is radius to the direct diſtance: then, for finding the proper difference of latitude, we have this analogy, *viz.* as the tangent of the courſe is to the departure, ſo is radius to the proper difference of latitude: next, to find the difference of longitude, ſay; as radius is to the meridional difference of latitude, ſo is the tangent of the courſe to the minutes of difference of longitude.

Caſe VII. Both latitudes and departure being given, to find the courſe, diſtance, and difference of longitude.

Firſt, for the difference of longitude, the proportion is; as the proper difference of latitude is to the departure, ſo is the enlarged difference of latitude to the minutes of difference of longitude: next, for the courſe, it will be; as the proper difference of latitude is to the departure, ſo is radius to the tangent of the courſe: and laſtly, to find the diſtance, we have this analogy; as the ſine of the courſe is to the departure, ſo is radius to the direct diſtance.

Caſe VIII. One latitude, diſtance ſailed, and departure being given; to find the other latitude, difference of longitude, and courſe.

Firſt,

First, for the courſe, ſay; as the diſtance is to radius, ſo is the departure to the fine of the courſe: next, for the difference of latitude, the proportion will be; as radius to the diſtance, ſo is the co-ſine of the courſe to the difference of latitude; whence the meridional difference of latitude may be found: laſtly, to find the difference of longitude, ſay, as the proper difference of latitude is to the departure, ſo is the enlarged or meridional difference of latitude to the minutes of difference of longitude.

In working the different problems of plain, or Mercator's ſailing, there is one univerſal axiom, to which we may refer for ſtating the proportion according to art.

Axiom. In all caſes of plain ſailing, if either of the legs (the difference of latitude or the departure) be made the radius of a circle, the other leg will be a tangent to its oppoſite angle; and the hypothenuſe, or diſtance, will be a ſecant to that ſame angle: but if the diſtance be made radius of a circle, then will the legs be ſines to their oppoſite angles. A general rule to find a ſide, the proportion muſt begin with an angle; but to find an angle, begin with a ſide.

NAVIS, *Argo navis*, or the ſhip Argo, in aſtronomy. See ARGO.

NAUSEA, in medicine, a reaching, or propenſity and endeavour to vomit, ariſing from a loathing of food, excited by ſome viſcous humour that irritates the ſtomach.

In this diſorder the patient is ſo far from deſiring aliment, that he rather loaths it. It either proceeds from a fault in the ſtomach, or elſe is derived from other diſeaſes, or is a ſymptom thereof, particularly acute inflammations, aſthma, dropſy, hypochondriac paſſion, &c. or when the humours are corrupted, and the ſpirits ſuppreſſed, in malignant diſeaſes. Vomiting in this caſe is proper, or purging when that is forbid. To theſe ſhould be joined ſtrengtheners of the ſtomach, and chiefly ſtomachic balſams, made of oil and nutmegs, and diſtilled oils, and ſtomachic plaſters. Hoffman ſays, that there is nothing better than mint, its ſpirituous water, and diſtilled oil; likewiſe maſtic and its ſpirit, or balſam of Peru diſtilled with ſalt of tartar. In acute fevers, eſpecially the malignant, epidemic, and ſpotted, there is generally a nauſea and reaching to vomit, for which reaſon emetics are good: likewiſe in the dyſentery, eſpecially when it is epidemic in a camp, emetics are not only uſeful but neceſſary, with a ſlender diet.

NAUTICAL PLANISPHERE, a deſcription of the terreſtrial globe upon a plane, for the uſe of mariners, more uſually called chart. See CHART.

NAUTILUS, in natural hiſtory, a ſimple ſhell, having no hinge, formed of one continued piece, rolled as it were into a ſpiral form, and having its cavity divided into a great number of cells by tranſverſe partitions, each of which has a perforation, and is continuous to the others, by means of a ſyphunculus carried the whole length of the ſhell. The animal inhabiting this ſhell is a ſepia.

Of the nautili, ſome are thick and ſtrong; others thin, light, and brittle; ſome are aurated, others are not ſo; and ſome are ſmooth on the external ſurface, and others furrowed.

NAVY, the fleet or ſhipping of a prince or ſtate. See FLEET.

NAZARENES, in church hiſtory, a name originally given to all Chriſtians in general, on account that Jeſus Chriſt was of the city of Nazareth; but afterwards reſtrained to a ſet of heretics, whoſe religion conſiſted of a ſtrange jumble of Judaiſm and Chriſtianity; obſerving at the ſame time the Moſaic law, and the ſeveral rites of the Chriſtian religion.

NAZARITES, among the Jews, perſons who either of themſelves, or by their parents, were dedicated to the obſervation of nazariteſhip. They were of two ſorts; namely, ſuch as were bound to this obſervance for only a ſhort time, as a week or month; or thoſe who were bound to it all their lives. All that we find peculiar to the latter's way of life, is, that they were to abſtain from wine and all intoxicating liquors, and never to ſhave or cut off the hair of their heads. The firſt ſort of Nazarites were moreover to avoid all defilement; and if they chanced to contract any pollution before the term was expired, they were obliged to begin afreſh. Women as well as men might bind themſelves to this vow.

NEALING, or rather ANNEALING, a term uſed for the preparing of ſeveral matters, by heating or baking them in an oven, or the like.

NEALING *of glaſs*. See GLASS.

NEALING *of ſteel*. See STEEL, TEMPERING, &c.

NEAT, or NET-WEIGHT, the weight of a commodity alone, clear of the caſk, bag, caſe, or even filth. See WEIGHT.

NEBEL, in Jewiſh antiquity, the ſame with the pſaltery. See PSALTERY.

NEBULOUS, CLOUDY, in aſtronomy, a term applied to certain of the fixed ſtars, which ſhew a dim hazy light, being leſs than thoſe of the ſixth magnitude, and therefore ſcarce viſible to the naked eye.

NEBULY, or NEBULE'E, in heraldry, is when a coat is charged with ſeveral little figures in form of words, running within one another, or when the outline of a bordure, ordinary, &c. is indented or waved.

NECESSARY, in a philoſophical ſenſe, that which cannot but be, or cannot be otherwiſe. See the next article.

NECESSITY, whatever is done by a neceſſary cauſe, or a power that is irreſiſtible, in which ſenſe it ſtands oppoſed to freedom. See FREEDOM.

NECK, *collum*, in anatomy, is that ſlender part ſituated between the head and the trunk of the body.

The neck conſiſts of the following parts: 1. the common integuments: 2. ſeven vertebræ: 3. a number of muſcles which ſerve to move the head, the neck, the larynx, the pharynx, and the os hyoides: 4. a number of very large arteries, as the carotids, internal and external, and the vertebral ones: 5. of large veins, as the jugular, internal and external, and the vertebral ones: 6. of large nerves, of the parvagum, the intercoſtals, the recurrent, the diaphragmatics, and the vertebral: 7. a part of the ſpinal marrow: 8. the aſpera arteria, or trachea, particularly the larynx, in which is an eminence called the pomum adami: 9. the pharynx, with a part of the oeſophagus: 10. the thyroide, with ſome other ſmaller glands. See the articles LARYNX, PHARYNX, JUGULAR, &c.

Luxation of the NECK. If life remain after ſuch an accident, the patient is to be immediately laid flat on the ground or floor; then the ſurgeon, laying hold of his head, is to extend it ſtrongly, gently moving it from ſide to ſide, till he finds that the neck is reſtored to its natural poſture. Mr. Petit mentions another method, by means of ſlings; but Heiſter gives the preference to the former method, both as being more ſimple, and becauſe the patient can be relieved much ſooner.

NECROSIS, in medicine, a term ſometimes uſed for a mortification, or ſphacelus. See SPHACELUS.

NECTAR, νεκταρ, among ancient poets, the drink of the fabulous deities of the heathens, in contradiſtinction from their ſolid food, which was called ambroſia. See AMBROSIA.

This word is alſo uſed by ſome of the ancients to expreſs honey.

NECTARINE, a fruit differing nothing from the common peach, of which it is a ſpecies, than in having a ſmoother rind and a firmer pulp.

NEEDLE, *acus*, a very common little inſtrument or utenſil, made of ſteel, pointed at one end, and pierced at the other, uſed in ſewing, embroidery, tapeſtry, &c.

Needles make a very conſiderable article in commerce, though there is ſcarce any commodity cheaper, the conſumption of them being almoſt incredible. The ſizes are from N° 1. the largeſt, to N° 25. the ſmalleſt. In the manufacture of needles, German and Hungarian ſteel are of moſt repute. In the making them, the firſt thing is to paſs the ſteel through a coal-fire, and, under a hammer, to bring it out of its ſquare figure into a cylindrical one. This done, it is drawn through a large hole of a wire-drawing-iron, and returned into the fire, and drawn through a ſecond hole of the iron, ſmaller than the firſt, and thus ſucceſſively, from hole to hole, till it has acquired the degree of fineneſs required for that ſpecies of needles, obſerving every time it

it is to be drawn that it be greaſed over with lard, to render it more manageable. The ſteel thus reduced to a fine wire, is cut in pieces of the length of the needles intended. Theſe pieces are flattened at one end on the anvil, in order to form the head and eye: they are then put into the fire to ſoften them farther, and thence taken out and pierced at each extreme of the flat part on the anvil, by force of a puncheon of well-tempered ſteel, and laid on a leaden block to bring out, with another puncheon, the little piece of ſteel remaining in the eye. The corners are then filed off the ſquare of the heads, and a little cavity filed on each ſide of the flat of the head: this done the point is formed with a file, and the whole filed over; they are then laid to heat red hot on a long, flat, narrow iron, crooked at one end, in a charcoal fire, and when taken out hence, are thrown into a baſon of cold water to harden. On this operation a good deal depends; too much heat burns them, and too little leaves them ſoft; the medium is learned by experience. When they are thus hardened, they are laid in an iron-ſhovel on a fire, more or leſs briſk in proportion to the thickneſs of the needles; taking care to move them from time to time. This ſerves to temper them, and take off their brittleneſs: great care here too muſt be taken of the degree of heat. They are then ſtraightened one after another with the hammer, the coldneſs of the water uſed in hardening them having twiſted the greateſt part of them. The next proceſs is the poliſhing them. To do this they take twelve or fifteen thouſand needles, and range them in little heaps againſt each other, on a piece of new buckram, ſprinkled with emery-duſt. The needles thus diſpoſed, emery-duſt is thrown over them, which is again ſprinkled with oil of olives; at laſt the whole is made up into a roll, well bound at both ends. This roll is then laid on a poliſhing-table, and over it a thick plank loaden with ſtones, which two men work backwards and forwards a day and a half, or two days, ſucceſſively; by which means the roll thus continually agitated by the weight and motion of the plank over it, the needles withinſide being rubbed againſt each other with oil and emery, are inſenſibly poliſhed. After poliſhing they are taken out, and the filth waſhed off them with hot-water and ſoap: they are then wiped in hot bran, a little moiſtened, placed with the needles in a round box, ſuſpended in the air by a cord, which is kept ſtirring till the bran and needles be dry. The needles thus wiped in two or three different brans, are taken out and put in wooden veſſels, to have the good ſeparated from thoſe whoſe points or eyes have been broken either in poliſhing or wiping: the points are then all turned the ſame way, and ſmoothed with an emery-ſtone turned with a wheel. This operation finiſhes them, and there remains nothing but to make them into packets of 250 each.

Magnetical NEEDLE, in navigation, a needle touched with a loadſtone, and ſuſtained on a pivot or center, on which playing at liberty, it directs itſelf to certain points in or under the horizon; whence the magnetical needle is of two kinds, viz. horizontal and inclinatory. See MAGNET.

NEGATION, in logic, an act of the mind, affirming one thing to be different from another; as, that the ſoul is not matter.

NEGATIVE, in general, ſomething that implies a negation: thus we ſay, negative quantities, negative ſigns, negative powers, &c. See QUANTITY, SIGN, POWER, &c.

Our words and ideas, ſays Dr. Watts, are ſo unhappily linked together, that we can never know which are poſitive, which negative ideas, by the words that expreſs them; for ſome poſitive terms denote a negative idea, as dead: and there are both poſitive and negative terms invented to ſignify the ſame and contrary ideas, as unhappy and miſerable.

To this may alſo be added, that ſome words, which are negative in the original language, ſeem poſitive in Engliſh, as *abyſs*. The way therefore to know whether any idea be negative or not, is to conſider whether it primarily implies the abſence of any poſitive being, or mode of being; if ſo, then it is a negative idea, otherwiſe a poſitive one.

According to logicians, the only way to prove a negative, is by converting it into an affirmative.

NEGATIVE *Pregnant*, a negative that implies or brings forth an affirmative; as where a perſon is impleaded to have done a certain thing on ſuch a day, &c. and denies the thing generally, without alleging any thing farther, it is a negative pregnant plea, becauſe ſuch pleading may nevertheleſs imply that he did it in ſome ſort.

NEGROES, properly the inhabitants of Nigritia, in Africa; alſo called blacks and moors; but this name is now given to all the blacks.

The origin of the negroes, and the cauſe of this remarkable difference from the reſt of the human ſpecies, has much perplexed the naturaliſts: Mr. Boyle has obſerved, that it cannot be produced by the heat of the climate; for though the heat of the ſun may darken the colour of the ſkin, yet experience does not ſhew that it is ſufficient to produce a true blackneſs, like that of the negroes.

In Africa itſelf, many nations of Æthiopia are not black, nor were there any blacks originally in the Weſt-Indies. In many parts of Aſia, under the ſame parallel with the African region, inhabited by blacks, the people are but tawney. He adds, that there are negroes in Africa beyond the ſouthern tropic, and that a river ſometimes parts nations, one of which is black, and the other only tawny. Dr. Barriere alledges, that the gall of negroes is black, and being mixed with their blood, is depoſited between their ſkin and ſcarf-ſkin. However, Dr. Mitchell, of Virginia, in the Philoſophical Tranſactions, N° 476, has endeavoured by many learned arguments to prove, that the influence of the ſun in hot countries, and the manner of life of their inhabitants, are the remote cauſes of the colour of negroes, Indians, &c. and indeed it would be a ſtrong confirmation of his doctrine, if we could ſee any people, originally white, become black and woolly by tranſplantation, or *vice verſa*.

NEHEMIAH, a canonical book of the Old Teſtament, ſo called from the name of its author. Nehemiah was born at Babylon, during the captivity, and ſucceeded Ezra in the government of Judah and Jeruſalem. He was a Jew, and was promoted to the office of cup-bearer to Artaxerxes Longimanus, king of Perſia; when the opportunities he had of being daily in the king's preſence, together with the favour of Eſther the queen, procured him the favour of being authorized to repair and fortify the city of Jeruſalem, in the ſame manner as it was before its deſtruction by the Babylonians. On his going to Jeruſalem, he finiſhed the rebuilding of the walls in fifty-two days, and dedicated the gates of the city with great ſolemnity. He then reformed ſome abuſes which had crept in among his countrymen, particularly the extortion of the uſurers, by which the poor were ſo oppreſſed as to be forced to ſell their lands and children for ſupport. After which he returned to Perſia, and came back again with a new commiſſion, by virtue of which he regulated every thing relating both to the ſtate and religion of the Jews. The hiſtory of theſe tranſactions is the ſubject of this book.

NEIF, *nativa*, in law-books, denotes a ſhe villain. See VILLAIN.

NEMÆAN *Games* were ſo called from Nemæa, a village between the cities of Cleone and Phlius, where they were celebrated every third year. The exerciſes were chariot-races, and all the parts of the pentathlum. Theſe games were inſtituted in memory of Opheltes, or Archemorus, the ſon of Euphetes and Creuſa, and nurſed by Hypſipyle; who leaving him in a meadow, while ſhe went to ſhew the beſiegers of Thebes a fountain, at her return found him dead, and a ſerpent twined about his neck: whence the fountain, before called Langia, was named Archemorus; and the captains, to comfort Hypſipyle, inſtituted theſe games. Others aſcribe their inſtitution to Hercules, after his victory over the Nemæan lion.

NEMINE CONTRADICENTE, *none contradicting it*, a term chiefly uſed in parliament when any thing is carried without oppoſition.

NENIA, or NÆNIA, in ancient poetry, a mournful

kind of ſong, filled with the praiſes of ſome deceaſed perſon, and ſung during the celebration of the funeral.

NEOMENIA, or NOUMENIA, a feſtival of the ancient Greeks, at the beginning of every lunar month, which was, as the name imports, obſerved upon the day of the new moon, in honour of all the gods, but eſpecially Apollo, who was called Neomenios.

The Jews had alſo their Neomenia, or feaſt of the new moon, on which peculiar ſacrifices were appointed, and on this day they had a ſort of family entertainment and rejoicing. The moſt celebrated Neomenia of all others, was that at the beginning of the civil year, or firſt day of the month Tiſri, on which no ſervile labour was performed: they then offered particular burnt-ſacrifices, and ſounded the trumpets of the temple. The modern Jews keep the Neomenia only as a feaſt of devotion, which any one may obſerve or not, as he pleaſes.

NEOPHYTES, new plants, a name given by the ancient Chriſtians, to thoſe heathens who had newly embraced the faith; ſuch perſons being conſidered as regenerated, or born anew by baptiſm. The term neophytes has been alſo uſed for new prieſts, or thoſe juſt admitted into orders, and ſometimes for the novices in monaſteries. It is ſtill applied to the converts made by the miſſionaries among the infidels.

NEOTTIA, bird's-neſt, in botany, a genus of plants, the flower of which conſiſts of five ovato-oblong petals, connivent at the points: the nectarium is undivided, equal in length to the petals, and furniſhed with a denticulation to each ſide: the fruit is a rugoſe, oblong, capſule, containing a great number of ſeeds.

NEPENTHES, νηπενθης, a medicine, mentioned by Homer, as moſt efficacious againſt grief and ſorrow. He ſays, that whoever ſhould take it mixed with wine, could not be ſenſible of grief for that whole day, though his father or mother were to die.

NEPER's RODS, or BONES, an inſtrument invented by J. Neper, baron of Merchiſton, in Scotland, whereby the multiplication and diviſion of large numbers are much facilitated.

As to the conſtruction of NEPER's ROD: ſuppoſe the common table of multiplication to be made upon a plate of metal, ivory, or paſte-board, and then conceive the ſeveral columns (ſtanding downwards from the digits on the head) to be cut aſunder; and theſe are what we call Neper's rods for multiplication. But then there muſt be a good number of each; for as many times as any figure is in the multiplicand, ſo many rods of that ſpecies (*i. e.* with that figure on the top of it) muſt we have; though ſix rods of each ſpecies will be ſufficient for any example in common affairs: there muſt be alſo as many rods of 0's.

But before we explain the way of uſing theſe rods, there is another thing to be known, viz. that the figures on every rod are written in an order different from that in the table. Thus, the little ſquare ſpace or diviſion in which the ſeveral products of every column are written, is divided into two parts by a line acroſs from the upper angle on the right to the lower on the left; and if the product is a digit, it is ſet in the lower diviſion; if it has two places, the firſt is ſet in the lower, and the ſecond in the upper diviſion; but the ſpaces on the top are not divided. Alſo there is a rod of digits, not divided, which is called the index rod, and of this we need but one ſingle rod.

Multiplication by NEPER's RODS: firſt lay down the index-rod; then on the right of it ſet a rod, whoſe top is the figure in the higheſt place of the multiplicand: next to this again, ſet the rod whoſe top is the next figure of the multiplicand; and ſo on in order, to the firſt figure. Then is your multiplicand tabulated for all the nine digits; for the ſame line of ſquares ſtanding againſt every figure of the index rod, you have the product of that figure, and therefore you have no more to do but to tranſfer the products and ſum them. But in taking out theſe products from the rods, the order in which the figures ſtand, obliges you to a very eaſy and ſmall addition: thus, begin to take out the figure in the lower part, or unit's place, of the ſquare of the firſt rod on the right; add the figure in the upper part of this rod to that in the lower part of the next, and ſo on, which may be done as faſt as you can look on them.

Diviſion of NEPER's RODS: firſt tabulate your diviſor; then you have it multiplied by all the digits, out of which you may chooſe ſuch convenient diviſors as will be next leſs to the figures in the dividend, and write the index anſwering in the quotient, and ſo continually till the work is done.

NEPHEW, a term relative to uncle and aunt, ſignifying a brother or ſiſter's ſon, who, according to the civil law, is in the third degree of conſanguinity; but according to the canon in the ſecond.

NEPHRITIC, ſomething that relates to the kidneys. See KIDNEY.

NEPHRITIC WOOD, *Lignum Nephriticum*, an American wood, brought to us in large compact ponderous pieces, without knots; the outer part is of a whitiſh, or pale yellowiſh colour; the medullary ſubſtance of a dark browniſh or reddiſh. This wood, macerated in water for half an hour or an hour, imparts a deep tincture, appearing, when placed betwixt the eye and the light, of a golden colour; in other ſituations of a fine blue: a property in which it agrees with the bark of the aſh tree, and differs from all other known woods. Pieces of a different kind of wood are often mixed with it, which give only a yellow tincture to water.

This wood ſtands greatly recommended in difficulties of urine, nephritic complaints, and all diſorders of the kidneys and urinary paſſages; and is ſaid to have this peculiar advantage, that it does not, like the warmer diuretics, heat or offend the parts. The blue aqueous tincture is directed to be uſed as common drink, and freſh water to be poured on the remaining wood ſo long as it communicates any blueneſs. For medicinal purpoſes Geoffroy ſays, he has ſeen ſome inſtances of its being uſed, but without ſucceſs; and indeed, whatever may be the virtues of ſtrong infuſions or extracts of the wood, the exceedingly dilute blue tincture cannot be expected to have much efficacy.

NEPHRITICS, in pharmacy, medicines proper for diſeaſes of the kidneys, eſpecially the ſtone. See the article STONE.

NEPHRITIS, *Dolor Nephriticus*, or NEPHRITIC CHOLIC, in medicine, a painful diſeaſe, occaſioned by the ſtone or gravel in the kidneys, in which there is an inflammation.

The word is Greek, and derived from νεφρος, a kidney.

That the kidneys labour under a true inflamnation, may be known from the burning pungent pain of the part where the kidneys lie; from an acute continual fever; from the ſmall quantity of urine, which is deep-coloured, or, in the height of the diſorder, aqueous; the ſtupor of the adjacent leg; the pain of the groin, and contiguous teſticle; pain of the ilium; the vomiting of bile, and continual eructations.

Such an inflammation is cured, when nature is benign, and the diſeaſe favourable, firſt, by reſolution; ſecondly, by a copious, red, and thick urine, continually diſcharged before the ſeventh, or at moſt the fourteenth day of the diſeaſe; and thirdly, by a copious diſcharge from the hæmorrhoidal veins in the beginning of the diſorder.

The diſorder, when the inflammation is known to be preſent, is to be cured firſt by the general remedies appropriated to the cure of all inflammations, as veneſection, revulſion, and dilution; ſecondly, by mild, emollient, and antiphlogiſtic decoctions, drank in large quantities.

Thirdly, this ſpecies of the diſorder is cured by clyſters, fomentations, and baths; and fourthly, by mild and moiſt aliments, by reſt, by not lying too warm in bed, and eſpecially not lying on the back.

If the pains and convulſions are exceſſively violent, opiates are beneficial. The exceſſive vomiting is to be relieved by a frequent exhibition of tepid water, edulcorated with honey. Thus a nephritis ariſing from a ſtone impacted in the ureters and kidneys, may be ſafely cured.

If the diſorder be protracted, notwithſtanding the above method of cure, beyond the ſeventh day, an abſceſs is to be dreaded, the formation of which may be known from a remiſſion of the pain, ſucceeded by a pulſation,

and frequently returning horror, a weight and ſtupor of the part, from fœtid, apparently ſaline, and putrified urine. We are firſt to uſe powerfully maturating and emollient medicines; then, when the urine appears purulent, we muſt exhibit diuretics, conſiſting of pure medicated waters, whey, &c. uſing at the ſame time balſamics.

If this ſuppuration ſhould continue long, the whole kidney, being conſumed, forms a kind of uſeleſs bag; and in this caſe, a tabes renalis is frequently preſent.

If a ſchirrhus be formed, there ariſes an incurable palſy, or lameneſs of the ſubjacent leg. Hence alſo are often produced a ſlow conſumption and dropſy.

If a ſmall quantity of the inflammatory matter remain in the minute follicle of the urine, it forms a kind of baſis, to which the ſabulous matter of the urine gradually adhering, forms a ſtone in the kidneys, which is by degrees augmented.

A nephritis alſo ſometimes degenerates into a gangrene. *Boerhaave's Aphor.*

NEREIDS, in the Pagan theology, ſea nymphs, daughters of Nereus and Doris. Heſiod reckons up fifty of them; and Homer gives us a liſt and deſcription of thirty-nine nereids. Virgil's liſt of the nereids is ſhorter, but diverſified with pretty circumſtances, as may be ſeen *Georg.* lib. iv. v. 336, *& ſeq.*

The nereids were eſteemed very handſome, inſomuch that Caſſiope, the wife of Cepheus, king of Ethiopia, having triumphed over all the beauties of her age, and daring to vie with the nereids, they were ſo enraged, that they ſent a prodigious ſea-monſter into the country; and to appeaſe them, ſhe was commanded by the oracle to expoſe her daughter Andromeda, bound to a rock, to be devoured by the monſter.

In ancient monuments the nereids are repreſented riding upon ſea-horſes, ſometimes with an entire human form, and, at other times, with the tail of a fiſh.

NERVES, *nervi*, in anatomy, are cylindrical whitiſh parts, uſually fibroſe in their ſtructure, or compoſed of cluſters of filaments, ariſing from the brain, or rather from its medulla oblongata within the ſkull, and from the ſpinal marrow, and running from thence to every part of the body.

Structure and Uſe of the NERVES. This is eaſily perceived in moſt of the larger, and ſome of the ſmaller ones; for beſides the blood-veſſels they receive, and the membranes they are ſurrounded with, they are ſeen to be compoſed of a fibrous matter, or, as it were, of bundles or cluſters of white, cylindrical, and very ſlender filaments; which, on the ſtricteſt examination, appear to be ſolid, and without any cavity. Liewenhoeck indeed affirms, that he had often found a cavity in them; but he is not free from errors in many of his microſcopical obſervations. But though we cannot diſcover any cavity, much leſs a fluid contained in them; yet it is very poſſible that there may be ſuch cavities, and ſuch a fluid, only too ſmall to be perceived by us: and for the actual exiſtence of ſuch a fluid, known by the name of animal ſpirits, many probable arguments are adduced.

The great uſe of the nerves, therefore, though we are not able perfectly to demonſtrate it, ſeems to be to convey to all parts of the body a fluid of an extremely ſubtile kind, ſecreted in the brain and ſpinal marrow, and deſtined for no leſs noble a purpoſe than the ſenſation, motion, and nutrition of the ſeveral parts of the whole human fabric. Thoſe who would enter farther into this ſubject, may conſult Heiſter's Anatomy; Boerhaave's Chapter on the Brain, in his Inſtitutes; Morgagni's Adverſar. where he treats it judiciouſly and deeply; and after theſe, Burggrave on the Exiſtence of the Animal Spirits. See alſo the article BRAIN.

Origin, Diſtribution, and Names of the NERVES. The nerves are uſually divided into two kinds, thoſe which ariſe from the brain, and thoſe ariſing from the ſpinal marrow.

The nerves of the brain are nine pair. 1. The olfactory pair, which paſſing through the os cribroſum, are ſpread over the membrane of the noſtrils. 2. The optic pair, which by their expanſion form the retina of the eye. 3. The motory pair of the eyes, each of which is divided near the orbit, into ſix parts, or branches; of which, in human ſubjects, the firſt branch goes to the elevator palpebræ; the ſecond, to the elevator of the eye; the third, to the depreſſor; the fourth, to the adducent; the fifth, to the inferior oblique muſcle; and the ſixth, into the tunics of the eye: but, in other animals, they are divided much otherwiſe. 4. The pathetic pair of Willis, which are very ſmall, and run to the trochlear muſcle of the eye. 5. The guſtatory pair, which are very large, and divided within the cranium into three branches immediately under the dura mater: of theſe the firſt branch, called the ophthalmic, runs to various parts of and about the eye, the eye-lids, the muſcles of the forehead and noſe, and the integuments of the face. The ſecond branch may be called the ſuperior maxillary one, as being finally diſtributed through all parts of the upper jaw, the lips, noſe, palate, uvula, gums, teeth; a branch of it alſo runs to the ear, and joining with a branch of the ſeventh pair, forms the chorda tympani. The third branch may be called the maxillaris inferior, as being diſtributed over the ſeveral parts of the lower jaw, the tongue, and other parts of the mouth; whence the whole pair of nerves has obtained the name of par guſtatorium; though a great part of them ſerves to very different purpoſes, and is carried to parts that have nothing to do with taſting. 6. The abducent pair, except a branch from the formation of the intercoſtal nerve, is wholly carried to the abducent muſcle of the eye; whence its name. The intercoſtal nerve is formed either of ramifications of the two preceding nerves, or only of thoſe of the ſixth pair. It makes its way out of the cranium by the paſſage of the internal carotid, and deſcends near the eighth pair through the neck; and thence through the breaſt and abdomen, even to the pelvis; and, in its way, makes various plexuſes and ganglia, and ſends branches to almoſt all the parts contained in the breaſt and abdomen. 7. The auditory pair ariſe with two trunks; the one of which is called the portio dura, or hard portion; the other the portio mollis, or ſoft portion. This laſt enters the foramen of the os petroſum, and thence through various little apertures gets into the labyrinth of the ear, where it is expanded over all its parts, and conſtitutes the primary organ of hearing. The harder portion, paſſing the aquæduct of Fallopius, ſends back one branch into the cavity of the cranium: it alſo ſends off another branch which helps to form the chorda tympani; and others to the muſcles of the tympanum. The reſt of this pair goes to the external ear, the pericranium, the muſcles of the os hyoides, the lips, the eye-lids, and the parotids. 8. The par vagum, with the acceſſorius of Willis, paſs out near the laternal ſinuſes of the dura mater, and deſcending through the neck and thorax to the abdomen, ſend out branches by the way to the larynx, the pharynx, the heart, the lungs, and eſpecially to the ſtomach. It alſo ſends off from the upper part of the thorax, large branches, which are variouſly implicated in the neck, thorax, and abdomen, with the linguals, the cervicals, and the intercoſtals. 9. The lingual pair go immediately to the tongue, and are called by ſome the motory nerves of the tongue; but by others, with more juſtice, the guſtatory nerves.

We are to obſerve, ſays Heiſter, that the pair of nerves, which the generality of writers have called the tenth pair of the head, are, for many unanſwerable reaſons, to be properly called the firſt pair of nerves of the neck.

Of the nerves which ariſe from the ſpinal marrow, there are properly thirty-two pair.

Thoſe of the neck are no leſs than eight pair; and from them there are innumerable branches diſtributed through the muſcles of the head, the neck, the ſcapula, and the humerus: from the third, fourth, and fifth pair are formed the nerves of the diaphragm; and the ſixth, ſeventh, and eighth pair, together with the firſt pair of the back, form the ſix robuſt nerves of the arm and hands. To this diviſion is the acceſſory ſpinal nerve of Willis to be referred, which ariſes about the origin of the third or fourth pair.

The nerves of the back are twelve pair, which, beſides the branch they give to the brachial nerves, run entirely in the ſame furrow along the courſe of the ribs, and are diſperſed over the pleura, the intercoſtal, pectoral,

toral, and abdominal muſcles, the breaſt, and other parts of the thorax.

The nerves of the loins are five pair. Theſe are in general diſperſed over the loins, the peritonæum, and the integuments and muſcles of the abdomen: and beſides this, their firſt pair often gives, on each ſide, a branch to the diaphragm. The ſecond pair after inoſculating with the branches of the firſt, third, and fourth pair, forms the crural nerves, which are diſtributed over the anterior part of the thigh: and in the ſame manner a branch is formed of the conjunctions of the ſecond, third, and fourth pair, which paſſes through the great foramen of the os pubis to the ſcrotum, the teſticles, and the adjoining parts. The fourth and fifth pair of the nerves of the loins, joining with the firſt, ſecond, third, and fourth pair of the os ſacrum, compoſe the nerve called iſchiatic, which is the largeſt in the body; it deſcends along the hinder part of the thigh, and its branches are diſtributed over the whole leg, the foot, and toes.

The nerves of the os ſacrum form five or ſix pair, though not always determinately and regularly ſo: they paſs through the foramina of this bone, and the ſuperior ones of them, as already obſerved, compoſe the iſchiatic nerve; and what remains is diſperſed, in a multitude of ramifications, over the parts contained in the pelvis, the inteſtinum rectum, the bladder, the parts of generation, and the parts adjacent.

NEST, *Nidus*. See NIDUS.

NESTORIANS, a Chriſtian ſect, the followers of Neſtorius, biſhop and patriarch of Conſtantinople; who, about the year 429, taught that there were two perſons in Jeſus Chriſt, the divine and the human, which are united, not hypoſtatically or ſubſtantially, but in a myſtical manner: whence he concluded, that Mary was the mother of Chriſt, and not the mother of God. For this opinion, Neſtorius was condemned and depoſed by the council of Epheſus; and the decree of this council was confirmed by the emperor Theodoſius, who baniſhed the biſhop to a monaſtery.

Thoſe Chriſtians who at this day are called Neſtorians and Chaldeans, are very numerous, and are ſpread over Meſopotamia, and along the river Tigris and Euphrates: they are even got into the Indies, and into Tartary and China. Thoſe of India ſettled there under a Neſtorian prieſt called John, who, in the year 1145, got himſelf declared king of Indoſtan, and grew very famous under the name of Preſter John. The Neſtorians, though they ſpeak the language of the reſpective countries, only officiate in the Chaldee or Syriac tongue. The Neſtorian monks are habited in a black gown tied with a leathern girdle, and wear a blue turban. The nuns are dreſſed much after the ſame manner, excepting that they tie a kind of black veil about their heads, and about their chins. They muſt be forty years old before they take the monaſtic habit.

NETHERLANDS, anciently called Belgia, but ſince denominated Low-Countries, or Netherlands, from their low ſituation, are ſituated between 2 and 7° of eaſt longitude, and between 50 and 53° 30′ of north latit. and are bounded by the German ſea on the north; Germany on the eaſt; by Lorrain and France on the ſouth; and by another part of France and the Britiſh ſeas on the weſt; extending near three hundred miles in length from north to ſouth, and two hundred miles in breadth from eaſt to weſt. They conſiſt of ſeventeen provinces, ten of which are called the Auſtrian and French Netherlands, and the other the Seven United Provinces.

NETTLE, *Urtica*, in botany, a genus of plants, without any flower petals: the ſeed is ſingle, and contained in the cup, which cloſes for that purpoſe.

The root of the common-nettle is accounted diuretic and lithontriptic: it ſerves alſo to purify the blood, and is good in ſpittings of blood, hæmorrhages, and the menſes. The ſeeds of the Roman-nettle are recommended in the aſthma, and other diſorders of the lungs.

NEURITICS, *Nervines*, *Neuritica*, *Nervina*, in phyſic, are ſuch medicines as are proper for diſeaſes of the nerves and nervous parts, as the membranes, ligaments, &c.

The word is Greek, and formed from νευρον, a nerve.

NEUROGRAPHY, *Neurographia*, a deſcription of the nerves, with figures thereof engraved.

The word is Greek, and formed of νευρον, a nerve, and γραφω, to deſcribe.

NEUTER, or NEUTER-GENDER, in grammar, a ſort of gender of nouns in the learned languages, which are neither maſculine nor feminine. See the article GENDER.

NEUTRAL SALTS, in chemiſtry, are a ſort of intermediate ſalts between acids and alcalies, participating of the nature of both, ſo that one does not predominate over the other.

Perfectly neutral ſalts are ſuch as produce no degree of effervеſcence, but become quite ſaturated upon the affuſion of any acid or alcaline liquor. The chief of this kind among the native ſalts are common ſalt, nitre, aphronitrum, the eſſential ſalts of plants, and thoſe obtained by boiling from ſome medicinal and acidulated ſprings. Thoſe prepared by art, are the arcanum duplicatum, antimoniated nitre, Glauber's ſalts, and vitriolated tartar.

Salts of a temperate and neutral nature, are not only of all others the moſt ſalutary, but alſo the ſafeſt and moſt efficacious, both for preventing and curing ſome of the diſorders incident to the human body.

NEUTRALITY, the ſtate of a perſon or thing that is neuter.

NEW-MOON, *Neomenia*, that ſtate of the moon a little before and a little after her conjunction with the ſun. See MOON and NEOMENIA.

NEWEL, in architecture, is the upright poſt which a pair of winding-ſtairs turn about: this is properly a cylinder of ſtone, which bears on the ground, and is formed by the end of the ſteps of the winding-ſtairs. There are alſo newels of wood, which are pieces of timber placed perpendicularly, receiving the tenons of the ſteps of the wooden-ſtairs into their mortiſes, and on which are fitted the ſhafts and reſts of the ſtair-caſe, and the flights of each ſtory.

NEWT, or EFT, in zoology. See the articles EFT and LIZARD.

NEWTONIAN PHILOSOPHY, the doctrine of the univerſe, and particularly of the heavenly bodies; their laws, affections, &c. as delivered by Sir Iſaac Newton.

The term Newtonian philoſophy is applied very differently by different authors. Some, under this philoſophy, include all the corpuſcular philoſophy, conſidered as it now ſtands corrected and reformed by the diſcoveries and improvements made in the ſeveral parts thereof by Sir Iſaac Newton. In this ſenſe it is that 'sGraveſande calls his Elements of Phyſics, an Introduction to the Newtonian Philoſophy; and in this ſenſe the Newtonian is the ſame with the new philoſophy, in oppoſition to the Carteſian, the Peripatetic, and the ancient corpuſcular philoſophy. See CARTESIAN, &c.

Others, by Newtonian philoſophy, mean the method or order which Sir Iſaac obſerves in philoſophizing, viz. the reaſoning and drawing of concluſions directly from phænomena, excluſive of all previous hypotheſes; the beginning from ſimple principles, deducing the firſt powers and laws of nature from a few ſelect phænomena, and then applying thoſe laws, &c. to account for other things: and in this ſenſe, the Newtonian is the ſame with the experimental philoſophy. See the article EXPERIMENTAL.

Others again, by Newtonian philoſophy, mean that wherein phyſical bodies are conſidered mathematically, and where geometry and mechanics are applied to the ſolution of phænomena; in which ſenſe, the Newtonian is the ſame with the mechanical and mathematical philoſophy. See MECHANICAL.

Others again, by Newtonian philoſophy, underſtand that part of the phyſical knowledge which Sir Iſaac Newton has handled, improved, and demonſtrated in his Principia.

And laſtly, others, by Newtonian philoſophy, mean the new principles which Sir Iſaac has brought into philoſophy, the new ſyſtem founded thereon, and the new ſolutions of phænomena thence deduced; or that which characterizes and diſtinguiſhes his philoſophy from all others:

others: and this is the ſenſe in which we ſhall chiefly conſider it.

As to the hiſtory of this philoſophy, we have but little to ſay: it was firſt made public in 1686, by the author, then a fellow of Trinity College, Cambridge; and in the year 1713, republiſhed with conſiderable improvements. Several other authors have ſince attempted to make it plainer, by ſetting aſide many of the more ſublime mathematical reſearches, and ſubſtituting either more obvious reaſonings or experiments in lieu thereof; particularly Mr. Whiſton, in his Prelect. Phyſ. Mathem. 's Graveſande, in his Elem. and Inſt. and lately, by the learned Comment of Le Seur and Jacquier upon Sir Iſaac's Principia.

The philoſophy itſelf is laid down chiefly in the third book of the Principia; the two preceding books being taken up in preparing the way, and laying down ſuch principles of mathematics as have the moſt relation to philoſophy: ſuch are the laws and conditions of powers; and theſe, to render them leſs dry and geometrical, the author illuſtrates by ſcholia in philoſophy, relating chiefly to the denſity and reſiſtance of bodies, the motion of light and ſounds, a vacuum, &c.

In the third book he proceeds to the philoſophy itſelf; and from the ſame principles deduces the ſtructure of the univerſe, and the powers of gravity, whereby bodies tend towards the ſun and planets; and from theſe powers, the motions of the planets and comets, the theory of the moon and the tides. This book, which he calls De Mundi Syſtemate, he tells us, was firſt wrote in the popular way; but conſidering, that ſuch as are unacquainted with the ſaid principles, would not conceive the force of the conſequences, nor be induced to lay aſide their ancient prejudices; for this reaſon, and to prevent the thing from being in continual diſpute, he digeſted the ſum of that book into propoſitions, in the mathematical manner, ſo as it might only come to be read by ſuch as had firſt conſidered the principles; not that it is neceſſary a man ſhould maſter them all, many of them, even the firſt rate mathematicians, would find a difficulty in getting over. It is enough to have read the definitions, laws of motion, and the three firſt ſections of the firſt book; after which, the author himſelf directs us to paſs on to the book De Syſtemate Mundi.

The great principle on which the whole philoſophy is founded, is the power of gravity: this principle is not new; Kepler, long ago, hinted it in his Introduct. ad Mot. Martis. He even diſcovered ſome of the properties thereof, and their effects in the motions of the primary planets; but the glory of bringing it to a phyſical demonſtration, was reſerved to the Engliſh philoſopher. See GRAVITATION.

His proof of this principle from phænomena, together with the application of the ſame principle to the various other appearances of nature, or the deducing thoſe appearances from that principle, conſtitute the Newtonian ſyſtem; which, drawn in miniature, will ſtand thus:

1. The phænomena are, 1. That the ſatellites of Jupiter do, by radii drawn to the center of the planet, deſcribe areas proportional to their times; and that their periodical times are in a ſeſquiplicate ratio of their diſtances from its center; in which the obſervations of all aſtronomers agree. 2. The ſame phænomenon holds of the ſatellites of Saturn, with regard to Saturn; and of the moon, with regard to the earth. 3. The periodical times of the primary planets about the ſun, are in a ſeſquiplicate ratio of their mean diſtances from the ſun. But, 4. The primary planets do not deſcribe areas any way proportional to their periodical times about the earth; as being ſometimes ſeen ſtationary, and ſometimes retrograde, with regard thereto. See SATELLITE, PERIOD, &c.

2. The powers whereby the ſatellites of Jupiter are conſtantly drawn out of their rectilinear courſe, and retained in their orbits, reſpect the center of Jupiter, and are reciprocally as the ſquares of their diſtances from the ſame center. The ſame holds of the ſatellites of Saturn, with regard to Saturn; of the moon, with regard to the earth; and of the primary planets, with regard to the ſun. See CENTRAL FORCES.

3. The moon gravitates towards the earth, and by the power of that gravity is retained in her orbit: and the ſame holds of the other ſatellites with reſpect to their primary planets; and of the primaries with reſpect to the ſun.

As to the moon, the propoſition is thus proved: the moon's mean diſtance is ſixty ſemidiameters of the earth; her period, with regard to the fixed ſtars, is twenty-ſeven days, ſeven hours, forty-three minutes; and the earth's circumference 123249600 Paris feet. Now, ſuppoſing the moon to have loſt all her motion, and to be let drop to the earth, with the power which retains her in her orbit, in the ſpace of one minute ſhe will fall $15\frac{1}{12}$ Paris feet; the arch ſhe deſcribes in her mean motion, at the diſtance of 60 diameters of the earth, being the verſed ſign of $15\frac{1}{12}$ Paris feet. Hence, as the power, as it approaches the earth, increaſes in a duplicate ratio of the diſtance inverſely, ſo as at the ſurface of the earth it is 60×60 greater than at the moon; a body, falling with that force in our region, muſt, in a minute's time, deſcribe the ſpace of 60×60 $15\frac{1}{12}$ Paris feet, and $15\frac{1}{12}$ Paris feet in the ſpace of one ſecond.

But this is the rate at which bodies fall by their gravity at the ſurface of our earth; as Huygens has demonſtrated by experiments with pendulums. Conſequently, the power whereby the moon is retained in her orbit, is the very ſame we call gravity; for, if they were different, a body, falling with both powers together, would deſcend with double the velocity, and in a ſecond of time deſcribe $30\frac{1}{6}$ feet. See the articles DESCENT and MOON.

As to the other ſecondary planets, their phænomena, with reſpect to their primary ones, being of the ſame kind with thoſe of the moon about the earth, it is argued by analogy, they depend on the ſame cauſes; it being a rule or axiom all philoſophers agree to, that effects of the ſame kind have the ſame cauſes. Again, attraction is always mutual, that is, the re-action is equal to the action; conſequently the primary planets gravitate towards their ſecondary ones, the earth towards the moon, and the ſun towards them all. And this gravity, with regard to each ſeveral planet, is reciprocally as the ſquare of its diſtance from the center of gravity. See ATTRACTION, &c.

4. All bodies gravitate towards all the planets, and their weight towards any one planet, at equal diſtances from the center of the planet, is proportional to the quantity of matter in each. See WEIGHT.

For the law of the deſcent of heavy bodies towards the earth, ſetting aſide their unequal retardation from the reſiſtance of the air, is this, that all bodies fall equal ſpaces in equal times; but the nature of gravity or weight, no doubt, is the ſame on the other planets as on the earth.

Suppoſe, e. gr. ſuch bodies raiſed to the ſurface of the moon, and together with the moon deprived at once of all progreſſive motion, and dropped towards the earth: it is ſhewn, that in equal times they will deſcribe equal ſpaces with the moon; and therefore, that their quantity of matter is to that of the moon, as their weight to its weight.

Add, that ſince Jupiter's ſatellites revolve in times that are in a ſeſquiplicate ratio of their diſtances from the center of Jupiter, and conſequently at equal diſtances from Jupiter, their accelerating gravities are equal; therefore, falling equal altitudes in equal times, they will deſcribe equal ſpaces; juſt as in heavy bodies on our earth. And the ſame argument will hold of the primary planets with regard to the ſun, and the powers whereby unequal bodies are equally accelerated, are as the bodies, that is, the weights are as the quantities of matter in the planets, and the weights of the primary and ſecondary planets towards the ſun, are as the quantities of matter in the planets and ſatellites. See JUPITER.

And hence are ſeveral corollaries drawn relating to the weights of bodies on the ſurface of the earth, magnetiſm, and the exiſtence of a vacuum. See WEIGHT and MAGNET.

5. Gravity extends itſelf towards all bodies, and is in proportion to the quantity of matter in each.

That all planets gravitate towards each other, has been already ſhewn; likewiſe, that the gravity towards any

one, conſidered apart, is reciprocally as the ſquares of its diſtance from the center of the planet; conſequently, gravity is proportionable to the matter therein. Further, as all the parts of any planet, A, gravitate towards another planet B; and the gravity of any part is to the gravity of the whole, as the matter of the part to the matter of the whole; and re-action equal to action: the planet B will gravitate towards all the parts of the planet A; and its gravity towards any part will be to its gravity towards the whole, as the matter of the part to the matter of the whole. Hence we derive the methods of finding and comparing weights of bodies towards different planets; of finding the quantity of matter in the ſeveral planets, and their denſities; ſince the weights of equal bodies, revolving about planets, are as the diameters of their orbits directly, and as the ſquares of the periodical times inverſely; and the weights at any diſtance from the center of the planet are greater or leſs in a duplicate ratio of their diſtances inverſely: and ſince the quantities of matter in the planets are as their powers at equal diſtances from their centers: and laſtly, ſince the weights of equal and homogeneous bodies towards homogeneous ſpheres are, at the ſurfaces of the ſpheres, as the diameters of thoſe ſpheres; conſequently, the denſities of heterogeneous bodies are as the weights at the diameters of the ſpheres.

6. The common center of gravity of the ſun and all the planets is at reſt; and the ſun, though always in motion, yet never recedes far from the common center of all the planets.

For the matter in the ſun being to that in Jupiter as 1033 to 1; and Jupiter's diſtance from the ſun to the ſemidiameter of the ſun in a ratio ſomewhat bigger; the common center of gravity of Jupiter and the ſun will be a point a little without the ſun's ſurface; and by the ſame means, the common center of Saturn and the ſun will be a point a little within the ſun's ſurface; and the common center of the earth, and all the planets, will be ſcarce one diameter of the ſun diſtant from the center thereof: but the center is always at reſt; therefore, though the ſun will have a motion this and that way, according to the various ſituations of the planets, yet it can never recede far from the center; ſo that the common center of gravity of the earth, ſun, and planets, may be eſteemed the center of the whole world. See the article PLANET.

7. The planets move in ellipſes that have their foci in the center of the ſun, and deſcribe areas proportionable to their times. This we have already laid down, *à poſteriori*, as a phænomenon; and now that the principle of the heavenly motions is ſhewn, we deduce it therefrom, *à priori*. Thus, ſince the weights of the planets towards the ſun are reciprocally as the ſquares of their diſtances from the center of the ſun; if the ſun were at reſt, and the other planets did not act on each other, their orbits would be elliptical, having the ſun in the common umbilicus, and would deſcribe areas proportionable to the times; but the mutual actions of the planets are very ſmall, and may be well thrown aſide. See ORBIT.

Indeed the action of Jupiter on Saturn is of ſome conſequence; and hence, according to the different ſituation and diſtances of thoſe two planets, their orbits will be a little diſturbed. The earth's orbit too is ſenſibly diſturbed by the action of the moon; and the common center of the two deſcribes an ellipſis round the ſun placed in the umbilicus; and, with a radius drawn to the center of the ſun, deſcribes areas proportionable to the times. See EARTH, ORBIT, &c.

8. The aphelia and nodes of the planets are at reſt, excepting for ſome inconſiderable irregularities ariſing from the action of the revolving planets and comets. Conſequently, as the fixed ſtars retain their poſition to the aphelia and nodes, they too are at reſt. See the article NODE, &c.

9. The axis, or polar diameter of the planets, is leſs than the equatorial diameter.

The planets, had they no diurnal rotation, would be ſpheres, as having an equal gravity on every ſide: but by this rotation the parts receding from the axis endeavour to riſe towards the equator, which, if the matter they conſiſt of be fluid, will be affected very ſenſibly. Accordingly Jupiter, whoſe denſity is found not much to exceed that of water on our globe, is obſerved by aſtronomers to be conſiderably leſs between the two poles than from eaſt to weſt. And, on the ſame principle, unleſs our earth were higher at the equator than towards the poles, the ſea would riſe under the equator, and overflow all near it. But this figure of the earth Sir Iſaac Newton proves likewiſe *à poſteriori*, from the oſcillations of pendulums being ſlower and ſmaller in the equinoctial, than in the polar parts of the globe. See EARTH.

10. All the moon's motions, and all the inequalities of theſe motions, follow from theſe principles, e. gr. her unequal velocity, and that of her nodes and apogee in the ſyzygies and quadratures; the differences in her eccentricity and her variation. See MOON.

11. From the inequalities of the lunar motions, we can deduce the ſeveral inequalities in the motions of the ſatellites.

12. From theſe principles, particularly the action of the ſun and moon upon the earth, it follows, that we muſt have tides, or that the ſea muſt ſwell and ſubſide twice every day. See TIDE.

13. Hence, likewiſe, follows the whole theory of comets, as that they are above the region of the moon, and in the planetary ſpaces; that they ſhine by the ſun's light, reflected from them; that they move in conic ſections, whoſe umbilici are in the center of the ſun; and, by radii drawn to the ſun, deſcribe areas proportional to the times; that the orbits or trajectories are very nearly parabolas; that their bodies are ſolid, compact, &c. like thoſe of the planets, and muſt therefore acquire an immenſe heat in their perihelia; that their tails are exhalations ariſing from and encompaſſing them like atmoſpheres. See COMET.

NICHE, in architecture, a hollow ſunk into a wall, for the commodious and agreeable placing of a ſtatue.

The ordinary proportion of a niche is to have two circles in height and one in width; but M. Le Clerc makes their height ſomething more, the exceſs being to compenſate for the height of the pedeſtal of the ſtatue. The hollow is ſemicircular at bottom, that is, in its plan; and at top it terminates in a kind of canopy. Niches have frequently an impoſt, and an archivolt or headband, and the canopy wrought and enriched in the manner of a ſhell. The breadth of the archivolt may be made equal to a ſixth or ſeventh part of the niche, and the height of the impoſt to a fifth or ſixth part of the ſame: and the impoſt and archivolt ought to conſiſt of ſuch mouldings as have ſome relation to the architecture of the place. Niches are ſometimes made with ruſtic-work, ſometimes with ſhell-work, and ſometimes of cradle or arbour-work. Niches are ſometimes made ſquare, but theſe want all the beauty of the others.

NICOLAITANS, in church-hiſtory, Chriſtian heretics who aſſumed this name from Nicolas of Antioch; who, being a Gentile by birth, firſt embraced Judaiſm, and then Chriſtianity; when his zeal and devotion recommended him to the church of Jeruſalem, by whom he was choſen one of the firſt deacons. Many of the primitive writers believe that Nicolas was rather the occaſion than the author of the infamous practices of thoſe who aſſumed his name, who were expreſsly condemned by the ſpirit of God himſelf, Apoc. ii. 6. And indeed their opinions and actions were highly extravagant and criminal. They allowed a community of wives: made no difference between ordinary meats and thoſe offered to idols: and told I know not what fables of the creation and diſpoſition of the world. According to Euſebius, they ſubſiſted but a ſhort time; but Tertullian ſays, that they only changed their name, and that their hereſies paſſed into the ſect of the Cainians. See the article CAINIANS.

NICOTIANA, in botany, a plant more commonly known by the name of tobacco. See TOBACCO.

NICTITATING *Membrane*, in comparative anatomy, a thin membrane, chiefly found in the bird and fiſh-kind, which covers the eyes of theſe animals, ſheltering them from the duſt, or too much light; yet is ſo thin and pellucid, that they can ſee pretty well through it.

NIDUS, among naturaliſts, ſignifies a neſt, or proper repoſitory for the eggs of birds, inſects, &c. wherein the young of theſe animals are hatched and nurſed.

NIECE, a brother or ſiſter's daughter, which in the civil law, is reckoned the third degree of conſanguinity.

NIGHT, that part of the natural day during which the ſun is underneath the horizon; or that ſpace wherein it is duſky. See DAY.

Night was originally divided by the Hebrews, and other eaſtern nations, into three parts, or watchings. The Romans, and afterwards the Jews from them, divided the night into four parts, or watches, the firſt of which began at ſun-ſet and laſted till nine at night, according to our way of reckoning; the ſecond laſted till midnight; the third till three in the morning; and the fourth ended at ſun-riſe. The ancient Gauls and Germans divided their time not by days but by nights; and the people of Iceland and the Arabs do the ſame at this day. The like is alſo obſerved of our Saxon anceſtors.

NIGHT-MARE, in medicine, a diſeaſe called by phyſicians ephialtes and incubus. See INCUBUS.

NIHILS, or NICHILS, iſſues which a ſheriff who is oppoſed in the Exchequer, ſays are nothing worth, and not to be levied, through the inſufficiency of the parts from whom the ſame are due.

NIMBUS, in antiquity, a circle obſerved on certain medals, or round the head of ſome emperors, anſwering to the circles of light, drawn around the images of ſaints. The nimbus is ſeen on the medals of Maurice, Phocas, and others, even of the upper empire.

NIPPERS, in the manege, are four teeth in the fore part of a horſe's mouth, two in the upper, and two in the lower jaw. A horſe puts them forth between the ſecond and third year.

NIPPERS is alſo an inſtrument in uſe among ſmiths and farriers, being a kind of pincers, wherewith in ſhoeing a horſe, they cut the nails before they rivet them. It is alſo uſed in taking off a ſhoe.

NIPPLES, *Papillæ*, in anatomy. See BREAST.

NISI PRIUS, in law, a judicial writ which lies in caſes where the jury being impannelled and returned before the juſtices of the bank, one of the parties requeſts to have ſuch a writ, for the eaſe of the country, in order that the trial may come before the juſtices in the ſame county on their coming thither. Theſe trials by niſi prius are intended for the eaſe of the country, by ſaving the parties, jurors, and witneſſes, the trouble of coming to Weſtminſter. The purport of a writ of niſi prius is, that the ſheriff is thereby commanded to bring to Weſtminſter the men impannelled, at a certain day before the juſtices, *niſi prius juſticiarii domini regis ad aſſiſas capiendas venerint*; that is, unleſs the juſtices go before the day into ſuch a county to take aſſizes. See the article JUSTICES.

NITRE, or SALTPETRE, a neutral ſalt, formed by the coalition of the common vegetable fixed alcaline ſalt with a peculiar acid: of a ſharp, penetrating, cooling taſte: ſoluble in eight times its weight of very cold water, in leſs than thrice its weight of water temperately warm, and in one third its weight of boiling water: concreting from its ſaturated ſolutions, on evaporation of a part of the fluid, or a gradual diminution of the heat that kept it diſſolved, into colourleſs tranſparent cryſtals, which in figure are hexagonal priſms terminated by pyramids of the ſame number of ſides: melting thin as water in a moderate heat: when heated to ignition, deflagrating on the contact of any inflammable ſubſtance, with a bright flame and a conſiderable hiſſing noiſe; and leaving, after the detonation, its fixed alcaline ſalt, the acid being deſtroyed in the act of accenſion.

The origin of nitre, or rather of the acid which makes the characteriſtic part of nitre, is unknown. Thus much only is known with certainty, that common waters, both atmoſpherical and ſubterraneous, often contain a little of this acid in combination with earthy or other bodies, ſo as to yield, by cryſtallization, on ſupplying the vegetable fixed alcali, a perfect nitre: and that when animal or vegetable ſubſtances, mixed with porous abſorbent earths, have lain expoſed to the air till they are thoroughly rotted, they are found in like manner to contain a ſmall portion of nitrous acid, ſo as to give out a little nitre to water, on being ſupplied with the proper alcaline baſis. On this foundation, ſome nitre is prepared in different parts of Europe; but the greateſt quantities are the produce of the Eaſt-Indies: the means by which it is there ſo plentifully obtained, or whether it is a natural production, have not yet, ſo far as we can learn, been revealed.

Nitre, as brought into the ſhops, has generally a greater or leſs admixture of ſea-ſalt, from which it is purified, by diſſolving it in boiling water, and, after duly evaporating the filtered ſolution, ſetting it in a cold place to cryſtallize. The more impure brown nitre requires repeated diſſolution and cryſtallization; to promote the purification, it is commonly diſſolved in lime-water, or the ſolution ſuffered to percolate through quick-lime and wood aſhes. It is obſervable that nitrous ſolutions differ from thoſe of moſt other ſalts in contracting no pellicle in evaporation: if a ſolution of rough nitre, containing ſea-ſalt, be boiled down till a pellicle appears, or till a part of the ſalt begins to concrete and fall to the bottom, all that thus ſeparates is found to be ſea-ſalt, boiling water keeping far leſs of this ſalt diſſolved than it does of nitre: but if the liquor be now poured off, though it ſhould ſtill retain a quantity of the ſea-ſalt, only the nitre will cryſtallize in cooling, ſea-ſalt continuing diſſolved in nearly as little water when cold, as was ſufficient to keep it diſſolved when boiling.

This ſalt is one of the principal medicines of the antiphlogiſtic claſs; of general uſe in diſorders accompanied with inflammatory ſymptoms whether chronical or acute, and as a corrector of the inflammation or irritation produced by ſtimulating drugs. Hoffmann thinks it has an advantage above the refrigerants of the acid kind, in not being liable to coagulate the animal juices; ſolutions of it mingling with or diſſolving recent thick blood, and in ſome degree preſerving it from coagulation, as well as corruption; at the ſame time changing its colour, when dark or blackiſh, to a crimſon; an effect which it produces alſo, in a leſs degree, upon the fleſhy parts of dead animals. It retards likewiſe the coagulation of milk, but ſeems, from Stahl's account, to increaſe the conſiſtence of thin ſerous humours; for he obſerves, that when uſed in gargariſms for inflammations of the fauces in acute fevers, it thickens the ſalival fluid into a mucus, which keeps the parts moiſt for a conſiderable time; whereas, when nitre is not added, a dryneſs of the mouth preſently enſues.

This medicine generally promotes urine, and often gives relief in ſtranguries and heat of urine, whether ſimple, or proceeding from a venereal taint. It ſometimes looſens the belly, particularly in hot diſpoſitions: in cold phlegmatic temperaments it rarely has this effect, though given in very large doſes, even to an ounce: the diarrhæas of acute diſeaſes, and fluxes in other circumſtances, from an acrimony of the bile or inflammation of the inteſtines, have been frequently reſtrained by it. In high fevers it often promotes a diaphoreſis or ſweat; in malignant fevers, where the pulſe is low, and the ſtrength greatly depreſſed, it impedes that ſalutary excretion and the eruption of the exanthemata, in conſequence of its general power of diminiſhing inflammation and heat. It ſeems to be prejudicial in diſorders of the lungs, though ſome have ventured to preſcribe it in hemoptyſes.

The uſual doſe of nitre, among us, is from two or three grains to a ſcruple; though in many caſes it may be given with great ſafety, and to better advantage, in larger quantities. It has been ſaid, that nitre loſes in being melted, half its weight of watery moiſture, and recovers this weight again, on being diſſolved and cryſtallized; from whence it would follow, that one part of melted nitre is equivalent to two of the cryſtals: but there was probably ſome miſtake in this experiment; for Mr. Lewis ſays, he has often repeated it with different parcels of nitre, and never found the loſs to be ſo much as one twentieth of its weight.

Nitre may be commodiouſly taken in the form of troches; one part of the purified ſalt is commonly ground with three parts of fine ſugar, and the mixture made up with muciſage of gum tragacanth. In this and all other ſolid forms it is accompanied, however, with one inconvenience,

venience, being liable, eſpecially when the doſe is conſiderable, to occaſion a pain or uneaſineſs at the ſtomach, which can be prevented only by plentiful dilution. A liquid form is therefore, in general, the moſt eligible, and may be eaſily rendered grateful by a proper addition of ſugar: commonly half an ounce of nitre, and two ounces of fine ſugar, with a ſcruple of cochineal, as a colouring material, are boiled in two pints and a half of water, till half a pint is waſted, and after ſtanding to ſettle, the clear purpliſh red liquor poured off for uſe. The boiling ſerves only to haſten the ſolution, and needs not be continued longer than till the ſalts are diſſolved, and a ſufficient colour extracted from the cochineal.

The chemiſts have thought to improve the virtue of nitre by deflagration with a ſmall portion of ſulphur: they melt the nitre in a crucible, and gradually ſprinkle on it one twenty-fourth of its weight of flowers of ſulphur: when the deflagration is over, they pour out the melted ſalt into clean, dry, warm braſs moulds, ſo as to form it into little cakes; whence it is called *ſal prunellæ*, or *cryſtallus mineralis*.

In this proceſs, a part of the acid of the nitre, and the inflammable principle of the ſulphur, detonating together, are both deſtroyed; while that part of the alcali of the nitre, which is thus forſaken by its acid, unites with the acid of the ſulphur, which is the ſame with that of vitriol, into a new neutral ſalt, the ſame with vitriolated tartar; and the preparation is found to be no other than a mixture of unchanged nitre, with a ſmall portion of this vitriolated ſalt. If the nitre and ſulphur be taken in equal quantities, the mixture injected by a little at a time into a red hot crucible, and, after the detonation ceaſes, kept in the fire about an hour, nearly the whole of the nitre will thus be changed; and the remaining ſalt, purified by ſolution in water, proves almoſt wholly the ſame with vitriolated tartar. This is called *ſal polychreſtum*.

The ſame ſalt is produced by pouring gradually on nitre the pure acid of vitriol or ſulphur: this acid, uniting with the alcali, diſengages the acid of the nitre, which begins to exhale, immediately on mixture, in yellow or red fumes, and may be collected by diſtillation in a glaſs retort with a moderate fire. Some previouſly dilute the vitriolic acid with equal its quantity of warm water; and afterwards purify the diſtilled nitrous ſpirit from this ſuperfluous phlegm, by a ſecond diſtillation in a glaſs cucurbit; the watery part riſing in the heat of a water-bath, and leaving the more concentrated acid behind. One part of oil of vitriol extricates all the acid of two parts of nitre; the remaining ſalt is nearly a pure vitriolated ſalt. If three parts of nitre be uſed to one of the vitriolic acid, a part of the nitre remains unchanged: on diſſolving the whole reſiduum in hot water, and ſetting the filtered ſolution to cryſtallize, the vitriolated ſalt ſhoots firſt, greateſt part of the nitre continuing diſſolved.

The nitrous ſpirit is obtained alſo by diſtillation in a ſtrong fire with vitriol in ſubſtance; the vitriol parting in the fire with its own acid, which then acts upon the nitre, and extricates its acid in the ſame manner as when the pure vitriolic acid is uſed The ſpirit thus diſtilled, called aqua fortis, is more phlegmatic than the preceding, in proportion as the vitriol employed contains more phlegm than the oil of vitriol: it is likewiſe liable to an admixture of the vitriolic acid, more or leſs of which is generally forced over. The proportions commonly followed are, three parts of nitre, three of green vitriol uncalcined, and one and a half of the ſame vitriol calcined; or one of nitre, and two of vitriol calcined to whiteneſs; or equal parts of nitre, calcined vitriol, and dry clay, which laſt ingredient appears to be of very little uſe in the proceſs. The ingredients are well mixed together, the diſtillation performed in an earthen retort, or an iron pot, fitted with an earthen head and a receiver, and continued ſo long as any red vapours ariſe.

The nitrous ſpirit, uſually diſtilled from rough nitre, contains often an admixture of the marine acid, as well as of the vitriolic. The firſt is diſcovered and ſeparated, by dropping in a little ſolution of ſilver; the latter by a ſolution of chalk, or any other calcareous earth, made in the pure nitrous acid; the ſilver abſorbing the marine acid, and the chalk the vitriolic, and forming with thoſe acids reſpectively, indiſſoluble concretes, which immediately render the liquor milky, and on ſtanding ſettle to the bottom. The ſolutions are to be cautiouſly and ſlowly dropped in, ſo long only as they continue to produce a milkineſs: in caſe of an exceſs in their quantity, if the ſpirit is required perfectly pure, it is to be rectified by rediſtillation.

By the property on which the above method of purification depends, the nitrous ſpirit may be readily diſtinguiſhed from the other two mineral acids. By the red or yellowiſh red colour of its fumes; by its forming with one fourth its weight of ſal ammoniac, or with ſea ſalt, or its acid, a menſtruum called aqua regia, that perfectly diſſolves gold; by its deflagrating on the contact of any inflammable matter, when heated to ignition, whatever other body it be previouſly combined with; it may with certainty be diſtinguiſhed, both from thoſe and from every other known ſpecies of acid.

This acid has been ſometimes given as a diuretic, from two or three to fifty drops, diluted largely with water; but its principal uſe is in combination with other bodies.

Combined with vegetable fixed alcalies, it reproduces common nitre. With the mineral fixed alcali or ſoda, it compoſes a ſpecies of nitre in ſome reſpects different from the common, cryſtallizing not into a priſmatic, but a cubical figure; with volatile alcalies, ſubtile pungent ſalt, remarkable for its ſolubility in ſpirit of wine: of theſe two compounds, the medicinal qualities are little known, though they ſhould ſeem to be well deſerving of enquiry. The acid, in the moſt concentrated ſtate in which it is commonly met with, ſaturates about five ſixths its weight of vegetable fixed alcali; but of volatile alcali little more than half its weight. For obtaining the combination with the mineral alcali, ſea-ſalt may be uſed equally with ſoda or the alcali in its pure ſtate; for the nitrous acid extricates the ſea-ſalt's acid, and unites with only its pure alcaline baſis.

Solutions of calcareous earths in this acid are in taſte bitteriſh, and very pungent. They are difficultly made to aſſume a cryſtalline appearance; and when evaporated and exſiccated by heat, the dry ſalt deliquiates again in the air. This ſalt has not hitherto been employed medicinally, nor is it as yet much known. It is a common ingredient in waters, which when its quantity is conſiderable, it renders hard, and indiſpoſed to putrefy, apparently impeding putrefaction in a much greater degree than an equal quantity of ſea-ſalt. Alcaline ſalts, fixed or volatile, added to the ſolutions, precipitate the earthy baſis; and uniting with the acid in its ſtead, compoſe therewith, according to the ſpecies of alcali employed, the common cubical or ammoniacal nitre, mentioned in the preceding paragraph.

The nitrous ſpirit diſſolves zinc, iron, copper, lead, biſmuth, mercury, and ſilver, the moſt readily of all the acids: tin it diſſolves immediately; regulus of antimony it only corrodes.

The concentrated acid, combined with a due proportion of rectified ſpirit of wine, loſes its acidity; the coalition of the two producing a new compound, called *ſpiritus nitri dulcis*, of a gratefully pungent taſte and odour, and which is given from a few drops to a teaſpoonfull, or more, as mildly aperient, diuretic, antiphlogiſtic, in ſome degree anodyne and antiſpaſmodic. On mixing the two ſpirits together, a great heat, ebullition, and noxious red vapours ariſe: this conflict is leſs violent, when cautiouſly, and by little and little, the acid ſpirit is added to the vinous, than when the vinous is added to the acid. One part of the ſtrong acid ſpirit is commonly taken to three of the ſpirit of wine, or half a pound to a quart: the mixture, after ſtanding for ſome time, that the two liquors may in ſome degree unite, is ſet to diſtil with a gentle fire, by which the union is completed, and the very volatile dulcified ſpirit ſeparated from the more fixed acid that remains undulcified. The diſtillation is directed to be continued ſo long as the ſpirit that comes over raiſes no effervescence with fixed alcaline ſalts; it may be regulated more commodiouſly by performing the proceſs in a water-bath,

5 JA 59

Fig. 1. Nocturnal.

Fig. 4.

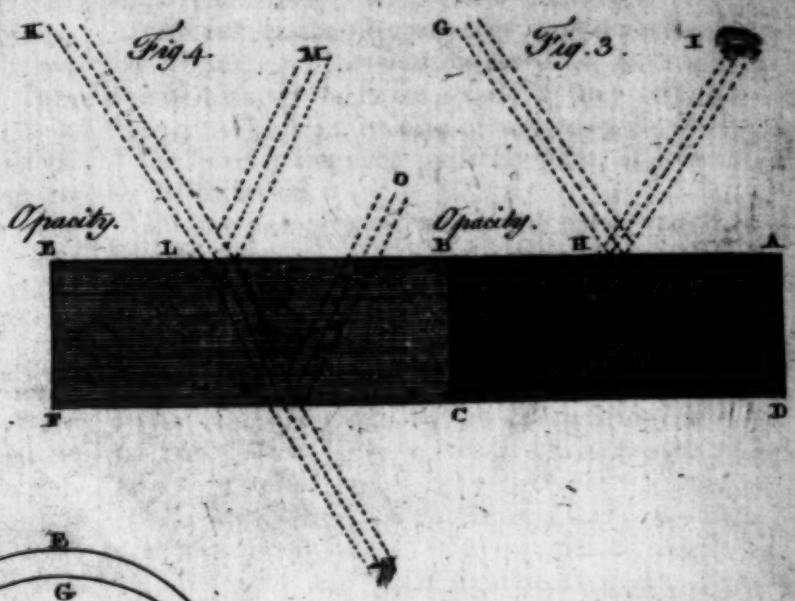


Fig. 3.

Fig. 2.
Nodes.

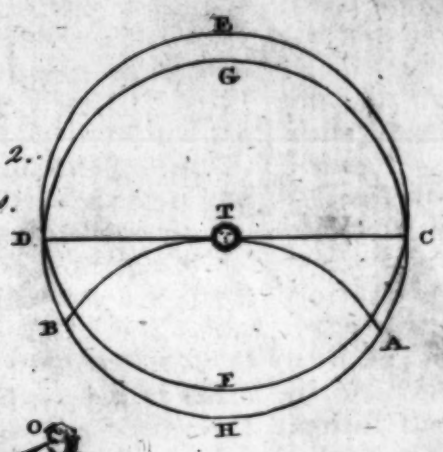


Fig. 7.
Optics.

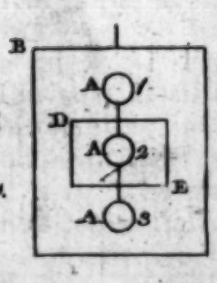


Fig. 5.
Optic Pyramid.

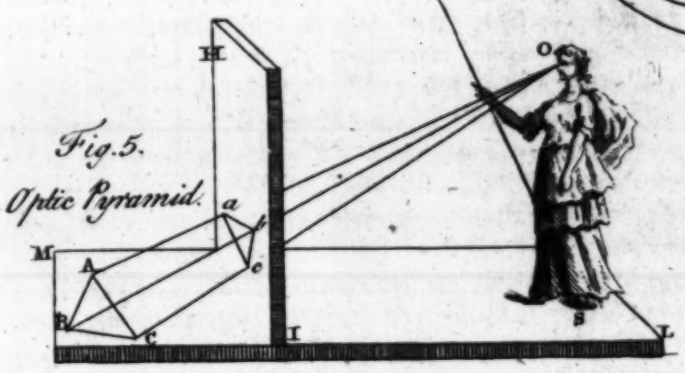


Fig. 6.
Optics.

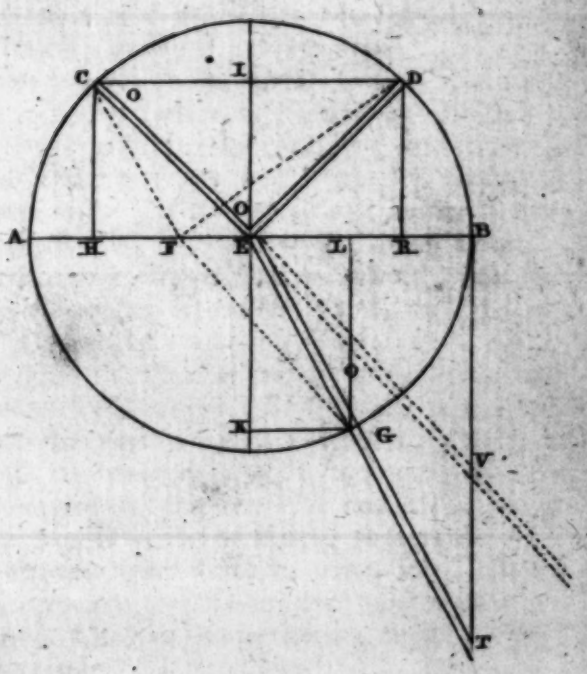


Fig. 8.
Optics.

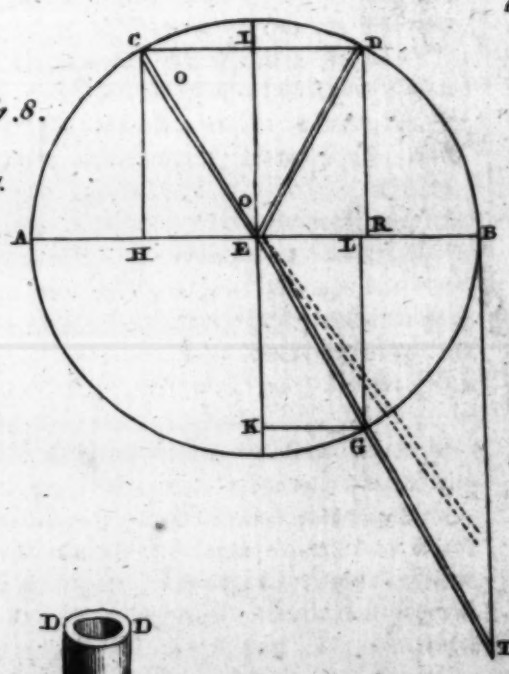


Fig. 9.
Organ.

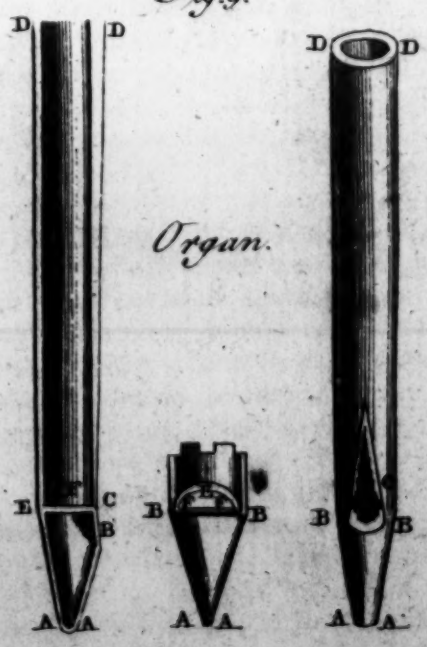


Fig. 11. Oval.

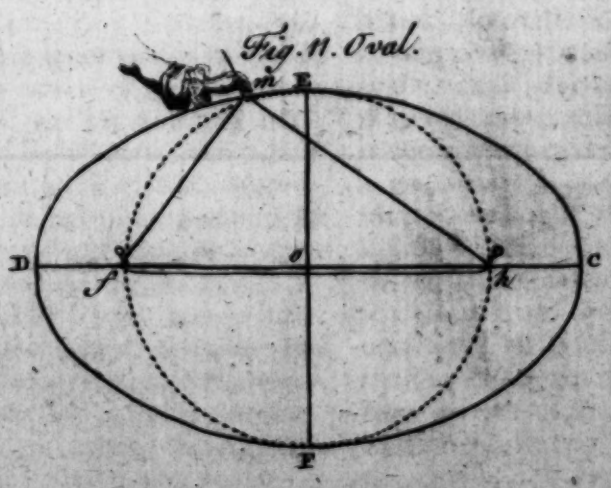
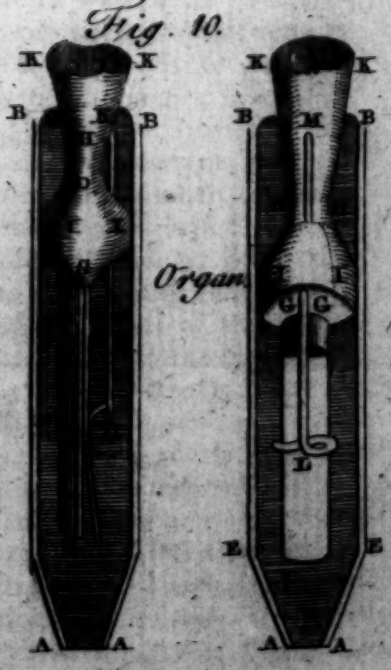


Fig. 10.
Organ.



bath, for all that riſes in this heat will be found to be a pure dulcified ſpirit.

A ſubtile æthereal fluid, ſimilar in its general qualities to that deſcribed under the article Æther, is obtainable with the nitrous ſpirit in a more compendious manner. If equal parts by meaſure of ſpirit of nitre and ſpirit of wine, of moderate ſtrength, be mixed together, the bottle cloſely ſtopped and ſet in a cool place, a large proportion of æther riſes to the ſurface in a few days: it may be purified from the adhering acid, by ſhaking it with water in which ſome fixed alcaline ſalt has been diſſolved, and then drawing off the æther by diſtillation. The medicinal qualities of this ſubtile fluid are not as yet known.

NOBILITY, a quality that enables and raiſes a perſon poſſeſſed of it above the rank of a commoner.

The origin of nobility in Europe is by ſome referred to the Goths; who, after they had ſeized a part of Europe, rewarded their captains with titles of honour, to diſtinguiſh them from the common people. In Britain the term nobility is reſtrained to degrees of dignity above knighthood: but every where elſe nobility and gentility are the ſame. The Britiſh nobility conſiſts only of five degrees, viz. that of a duke, marquis, earl, or count, viſcount, and baron, each of which ſee under their proper articles.

In Britain theſe titles are only conferred by the king, and that by patent, in virtue of which it becomes hereditary. The privileges of the nobility are very conſiderable: they are all eſteemed the king's hereditary counſellors, and are privileged from all arreſts, unleſs for treaſon, felony, breach of peace, condemnation in parliament, and contempt of the king. They enjoy their ſeats in the houſe of peers by deſcent, and no act of parliament can paſs without their concurrence: they are the ſupreme court of judicature, and even in criminal caſes give their verdict upon their honour, without being put to their oath. In their abſence they are allowed a proxy to vote for them, and in all places of truſt are permitted to conſtitute deputies, by reaſon of the neceſſity the law ſuppoſes them under of attending the king's perſon: but no peer is to go out of the kingdom without the king's leave, and when that is granted, he is to return with the king's writ, or forfeit goods and chattels.

NOBLE, a money of account, containing ſix ſhillings and eight pence.

The noble was antiently a real coin, ſtruck in the reign of Edward III. and then called the penny of gold; but it was afterwards called a roſe-noble, from its being ſtamped with a roſe: it was current at 6s. 8d.

NOCTAMBULI, *Noctambulones*, *Somnambuli*, ſuch perſons as riſe and walk about in their ſleep.

The word is Latin, and formed of *nox*, night, and *ambulo*, to walk.

The diſorder conſiſts in this, that the proper organs of muſcular motion are at liberty, while thoſe deſtined for ſenſation are bound up, or inactive.

Certain ideas follow upon certain motions of the fibres of the brain, and certain motions of thoſe fibres upon certain ideas. Now, by much thinking on any one thing, the fibres acquire ſome permanent ſituation, which gives a freer paſſage to the ſpirits towards a certain part of the body than ordinary. If then the animal ſpirits become too copious, too much agitated, or conſiſt of parts too ſolid, they throw themſelves into the paſſages they find the next open, glide into the nerves and muſcles correſponding to theſe paſſages, and there produce the motions proper to thoſe muſcles.

The bilious, melancholic, and ſanguine, are moſt ſubject to thoſe nocturnal vagaries.

The remedies are all ſuch things as temper the agitation of the ſpirits and relax the fibres, as bleeding, and all coolers, either internally or externally exhibited: aperitives too have a good effect; but the beſt remedy, according to ſome, is the cold bath.

NOCTILUCA, in phyſiology, a ſpecies of phoſphorus, ſo called becauſe it ſhines in the night without any light being thrown upon it; ſuch is the phoſphorus made of urine. See PHOSPHORUS.

NOCTURNAL, ſomething relating to the night, in contradiſtinction to diurnal.

The word is formed of the Latin *nox*, night, and *luceo*, to ſhine.

NOCTURNAL ARCH, in aſtronomy, the arch of a circle deſcribed by the ſun, or ſtar in the night.

Semi-NOCTURNAL *arch of the Sun*, that portion of a circle he paſſes over between the lower part of our meridian, and the point wherein he ſets, or the point of the horizon wherein he riſes.

NOCTURNAL, *Noctulabium*, an inſtrument chiefly uſed at ſea, to take the altitude or depreſſion of ſome ſtars about the pole, in order to find the latitude and hour of the night.

Some nocturnals are hemiſpheres, or planiſpheres, on the plane of the equinoctial. Thoſe commonly in uſe among ſeamen are two; the one adapted to the polar ſtar, and the firſt of the guards of the little bear; the other to the pole ſtar, and the pointers of the great bear.

This inſtrument conſiſts of two circular plates (plate XCIV. *fig.* 1.) applied to each other. The greater, which has a handle to hold the inſtrument, is about 2½ inches diameter, and is divided into twelve parts, agreeing to the twelve months, and each month ſubdivided into every fifth day; and ſo as that the middle of the handle correſponds to that day of the year wherein the ſtar here regarded has the ſame right aſcenſion with the ſun. If the inſtrument be fitted for two ſtars, the handle is made moveable.

The upper left circle is divided into twenty-four equal parts for the twenty-four hours of the day, and each hour ſubdivided into quarters. Theſe twenty-four hours are noted by twenty-four teeth, to be told in the night. Thoſe at the hour 12 are diſtinguiſhed by their length. In the center of the two circular plates is adjuſted a long index, A, moveable upon the upper plate. And the three pieces, viz. the two circles and index, are joined by a rivet which is pierced through the center with a hole, through which the ſtar is to be obſerved.

To uſe the NOCTURNAL, turn the upper plate till the long tooth, marked 12, be againſt the day of the month on the under plate: then, bringing the inſtrument near the eye, ſuſpend it by the handle with the plane nearly parallel to the equinoctial; and viewing the pole ſtar through the hole of the center, turn the index about till, by the edge coming from the center, you ſee the bright ſtar of guard of the little bear (if the inſtrument be fitted to that ſtar); then that tooth of the upper circle, under the edge of the index, is at the hour of the night on the edge of the hour-circle: which may be known without a light, by counting the teeth from the longeſt, which is for the hour 12.

NODATED HYPERBOLA, a name given by Sir Iſaac Newton to a kind of hyperbola, which, by turning round, decuſſates or croſſes itſelf.

NODE, *Nodus*, in ſurgery, a tumour ariſing on the bones, and uſually proceeding from ſome venereal cauſe; being much the ſame with what is otherwiſe called exoſtoſis. See EXOSTOSIS.

This word is more particularly applied to the tumours or protuberances ariſing on the joints of old gouty people, called alſo tophi. See TOPHI.

Some give the denomination of nodes, to all tumours formed by a coagulation of viſcous matter in the external parts of the body. See TUMOUR, &c.

NODES, in aſtronomy, the two points where the orbit of a planet interſects the ecliptic.

Such are the two points C and D (plate XCIV. *fig.* 2.) of which the node C, where the planet aſcends northward above the plane of the ecliptic, is called the aſcending node, or the dragon's head, and is marked thus ☊. The other node D, where the planet deſcends to the ſouth, is called the deſcending node, or the dragon's tail, marked thus ☋. And the right line D C is called the line of the nodes.

NODULE, or NODULUS, a word uſed in pharmacy, for a knot tied in a rag, and including ſome medicinal ingredients to be ſuſpended in any liquor, as beer or wine, to give it a tincture, or the like.

It ſignifies alſo a parcel of odoriferous ſimples, tied up in a piece of ſilk, for the patient to be frequently ſmelling to.

NODUS, or NODE, in dialling, a certain point or pole in the gnomon of a dial, by the ſhadow or light whereof, either the hour of the day in dials without furniture, or the parallels of the ſun's declination, and his place in the ecliptic, &c. in dials with furniture, are ſhewn.

NODUS is alſo uſed for a hole in the cieling of a room, or in the window, for making of a dial on the floor, wall, or the like.

NOETIANS, in church hiſtory, Chriſtian heretics in the third century, followers of Noetius, a philoſopher of Epheſus, who pretended that he was another Moſes, ſent by God; and that his brother was a new Aaron: his hereſy conſiſted in affirming that there was but one perſon in the godhead; and that the word and the holy ſpirit were but external denominations given to God, in conſequence of different operations; that as creator, he is called Father; as incarnate, Son; and as deſcending on the apoſtles, Holy Ghoſt.

NOLI ME NANGERE, *Touch me not*, in medicine, a malignant eruption in the face, occaſioned by an extremely ſharp corroſive humour; thus called, either becauſe it affects thoſe who touch it, or becauſe the more it is touched, the worſe it grows, and the farther it ſpreads.

NOMADES, in antiquity, a name given to ſeveral nations or people, whoſe whole occupation was to feed their flocks, and who had no fixed place of abode, but were conſtantly ſhifting, according to the conveniences of paſturage.

NOMANCY, a name given to the art of divining the fates of perſons, by means of the letters that form their names; being nothing elſe but the cabbaliſtic gematria.

NOMBRIL POINT, in heraldry, is the next below the feſs-point, or the very center of the eſcutcheon. See POINT.

NOME, or NAME, in algebra, denotes any quantity with a ſign prefixed or added to it, whereby it is connected with ſome other quantity, upon which the whole becomes a binomial, trinomial, or the like: thus $a+b$ is a binomial, $a+b+c$ is a trinomial, whoſe reſpective names or nomes are a and b for the firſt, and a, b, and c, for the ſecond. See BINOMIAL, &c.

NOMENCLATURE, *Nomenclatura*, a catalogue of ſeveral of the more uſual words in any language, with their ſignifications, compiled in order to facilitate the uſe of ſuch words to thoſe who are to learn the tongue: ſuch are our Latin, Greek, French, &c. nomenclatures.

NOMINALS, or NOMINALISTS, a ſect of ſchool philoſophers, the diſciples and followers of Occam, or Ocham, an Engliſh Cordelier, in the fourteenth century. They were great dealers in words, whence they were vulgarly denominated Word-ſellers; but had the denomination of Nominaliſts, becauſe that, in oppoſition to the Realiſts, they maintained that words, and not things, were the object of dialectics.

NOMINATION, the art of naming and appointing a perſon for ſome function, employ, or benefice.

NOMINATION, in law, ſignifies the power that a perſon has of appointing a clerk to a patron of a benefice, by him to be preſented to the ordinary.

NOMINATIVE, in grammar, the firſt caſe of nouns which are declinable. See the articles CASE and NOUN.

The ſimple poſition or laying down of a noun, or name, is called the nominative caſe; yet it is not ſo properly a caſe as the matter or ground, whence the other caſes are to be formed, by the ſeveral changes and inflections given to this firſt termination. Its chief uſe is to be placed in diſcourſe before all verbs, as the ſubject of the propoſition or affirmation.

NOMINATOR, he who preſents a perſon to an office or benefice; whence the perſon named, or preſented, is called nominee. See NOMINATION.

NON-ABILITY, in law, incapacity, or an exception taken againſt a plaintiff, in a cauſe, on ſome juſt ground, why he cannot commence a ſuit in law; as his being attainted of felony, outlawry, &c.

NON-AGE, in law, generally ſignifies all the time a perſon continues under the age of one and twenty; but in a ſpecial ſenſe it is all the time a perſon is under the age of fourteen. See AGE.

NON-APPEARANCE, a default in not appearing in a court of judicature. Attornies ſubſcribing warrants for appearing in court, are liable to attachment and fine for non-appearance. If a defendant does not appear, and find bail upon a *ſcire facias* and rule given, judgment may be had againſt him.

NON COMPOS MENTIS, in law, is uſed to denote a perſon's not being of ſound memory and underſtanding. Of theſe perſons there are four different kinds, an ideot, a madman, a lunatic who has lucid intervals, and a drunkard who deprives himſelf of reaſon by his own act and deed. In all theſe caſes, except the laſt, one that is non compos mentis ſhall not loſe his life for felony or murder; but the drunkard can have no indulgence on account of the loſs of his reaſon, for, in the eye of the law, his drunkenneſs does not extenuate but aggravate his offence.

NON-NATURALS, in medicine, ſo called becauſe by their abuſe they become the cauſes of diſeaſes. See the article DISEASE.

Phyſicians have divided the non-naturals into ſix claſſes, viz. the air, meats and drinks, ſleep and watching, motion and reſt, the paſſions of the mind, the retentions and excretions. See the articles AIR, MEATS, DRINKS, &c.

NON-RESIDENCE is particularly applied to ſpiritual perſons, who wilfully abſent themſelves for the ſpace of one month together, or two months at different times in the year, from their benefices; for which they are liable to penalties, by the ſtatute of non-reſidence: but biſhops, the king's chaplains, &c. are excepted.

NON-SUIT ſignifies the dropping of a ſuit or action, or a renouncing thereof by the plaintiff or defendant, which happens moſt commonly upon the diſcovery of ſome error in the plaintiff's proceedings, when the cauſe is ſo far proceeded in, that the jury is ready at the bar to deliver in their verdict.

A non-ſuit, it is ſaid, may be in the following caſes, viz. where a perſon brings a perſonal action, and does not proſecute it with effect; or if, upon the trial, he refuſes to ſtand a verdict, then he becomes non-ſuited; ſo where the plaintiff is not ready for trial at the calling and ſwearing of the jury, it is preſumed he does not ſtand to proceed in his cauſe, and on that account the court may call him non-ſuited. Likewiſe, on a trial, when the jury comes in to deliver their verdict, and when the plaintiff is called on to hear the ſame, in that caſe, if he does not appear after being thrice called by the crier of the court, he is non-ſuited; which non-ſuit is to be recorded by the ſecondary, by the direction of the court: but if he afterwards appears, before the non-ſuit is actually recorded, the court may take the verdict, for that is not a non-ſuit, till it be recorded, upon motion made by the counſel for this purpoſe; and then it is a part of the record, in the nature of a judgment againſt the plaintiff.

NONCONFORMISTS, the ſame with diſſenters. See DISSENTERS.

NONE, one of the ſeven canonical hours in the Romiſh church, anſwering to three o'clock in the afternoon.

NONES, *Nonæ*, in the Roman calendar, the fifth day of the months January, February, April, June, Auguſt, September, November, and December; and the ſeventh of March, July, and October. March, May, July, and October, had ſix days in their nones; becauſe theſe alone, in the ancient conſtitution of the year by Numa, had thirty-one days apiece, the reſt having only twenty-nine, and February thirty; but when Cæſar reformed the year, and made other months contain thirty-one days, he did not allot them ſix days of nones.

NORMAL-LINE, in geometry, is uſed for a perpendicular line, drawn to a tangent of a curve from the point of contact, and intercepted by the axis thereof. See PERPENDICULAR and SUBNORMAL.

NORROY, the title of the third of the three kings at arms.

NORTH, in cosmography, one of the four cardinal points. See COMPASS.

NORTHING, in navigation, the latitude made by a ship, in sailing towards the north-pole.

NORWAY, a kingdom of Europe, situated between the fourth and thirtieth degree of east long. and between the fifty-eighth and seventy-second of north lat. It is bounded by the Atlantic ocean on the north and west, by Swedish Lapland and other provinces of Sweden on the east, and by the sea called the Categate and Schaggerac on the south. It is a cold barren country, subject to Denmark.

NOSE, *Nasus*, in anatomy, may be divided two different ways; from their situation, into internal and external parts; and from their structure, into hard and soft parts.

The external parts are the root of the nose, the arch, the back, or spine of the nose, the sides of the nose, the tip of the nose, the alæ, the external nares, and the part under the septum.

The internal parts are the internal nares, the septum narium, the circumvolutions, the conchæ superiores, the conchæ inferiores, the posterior openings of the internal nares, the sinus frontales, sinus maxillares, sinus sphænoidales, the ductus lachrymales, and ductus palatini.

The firm or hard parts are mostly bony, and the rest cartilaginous; to these we may add the periosteum and perichondrium.

The soft parts are the integuments, muscles, sacculus lachrymalis, membrana pituitaria, vessels, nerves, and hairs of the nares.

The external nose is covered by the common integuments, the skin, epidermis, and fat. Those which cover the tip of the nose, and alæ narium, are a great number of glandular bodies, which Morgagni called glandulæ sebaceæ, the contents of which may easily be squeezed out by the fingers.

Six muscles are commonly reckoned to belong to the nose; two recti, called also pyramidales or triangulares; two obliqui or laterales, and two transversi, or myrtiformes. In very muscular bodies, there are likewise some supernumerary muscles, or small accessorii. The nose may also be moved in some measure by the muscles of the lips, which in many cases become assistants to the proper muscles of this organ.

The arteries of all these parts come from the external carotid. Those of the external parts of the nose are in general ramifications of the arteria maxillaris externa, or angularis, and of the temporalis; and the arteries of the internal parts are ramifications of the maxillaris interna.

The veins are almost in the same manner branches of the external jugular, and they communicate with the orbitary sinus, and by that means with the sinuses of the dura mater, and with the internal jugulars.

The principal nerves belonging to the nose are filaments of the newiolfactorii, which run down through the holes of the transverse lamina of the os ethmoides, and are distributed to the common membrane of the internal nares, especially to the villous portions thereof. The inner branch of the orbitary or ophthalmic nerve sends a filament through the internal anterior orbitary hole into the cranium, which comes out again in company with one of the filaments of the olfactory nerve through the ethmoidal lamina.

The internal branch advances afterwards towards the os unguis, and is distributed partly to the sacculus lachrymalis, the upper portion of the musculus pyramidalis, and of the integuments of the nose. The suborbitary nerve, having passed through the inferior orbitary hole, sends filaments to the lateral external parts of the nose. Another branch of the superior maxillary nerve goes to the posterior opening of the nares, being spent on the conchæ and other internal parts of the nose. The nose is the organ of smelling, by means of the villous portion of the internal membranes, to which the olfactory nerves are principally distributed. It is likewise of use in respiration; and the mucilaginous fluid, spread over the whole pituitary membrane, prevents the air from drying that membrane, and so rendering it incapable of being affected. The nose serves likewise to regulate and modify the voice; and to this the sinuses also contribute.

The sacculus lachrymalis receives the serum from the eyes, and discharges it upon the palate, whence the greatest part of it runs to the pharynx. *Winslow.*

Bleeding at the NOSE. See HÆMORRHAGE.

NOTARICON, the third part of the Jewish cabbala. See CABBALA.

NOTARY, *Notarius*, signifies a person usually some scrivener, who takes notes, or frames short draughts of contracts, obligations, charter parties, or other writings. At present we call him a notary public, who publicly attests deeds or writings, in order to make them authentic in another nation: but he is principally employed in business concerning merchants, as making protests of bills of exchange, &c. And noting a bill, is where he goes to take notice of a merchant's refusal to accept or pay the same. See BILL.

Ecclesiastical NOTARIES were officers in the first ages of the church, whose business it was to collect and preserve the acts of martyrs.

NOTATION, in arithmetic and algebra, the method of expressing numbers or quantities by signs or characters, appropriated for that purpose. See NUMERATION, ALGEBRA, CHARACTER, &c.

NOTE, *Nota*, is used for a character or abbreviature, serving to denote or express something in a little compass.

NOTE, in music, a character which marks the sound, that is, the elevation and falling of the voice, and the swiftness and slowness of its motions. In general under notes are comprehended all the signs or characters used in music, though in propriety the word only implies the marks which denote the degrees of gravity and acuteness to be given to each sound. See CHARACTER.

NOTE is likewise used for a mark made in a book or writing where there occurs something remarkable and worthy of particular notice: as also for an observation or explication of some passage in an author added in the margin, at the bottom of the page, or elsewhere, by an editor, in which sense it stands contradistinguished to text. The notes make the principal difference in the editions of classic, &c. authors. We have Virgil, Horace, Terence, &c. with Dacier's notes, Dauphin's notes, notes variorum, &c.

NOTE is also a minute, or short writing, containing some article of business, in which sense we say, promissory note, note of hand, bank note, &c.

NOTE *of a fine*, in law, an abstract of the fine or contract made by the chirographer, before the same is engrossed.

NOTHÆ CASTÆ, in anatomy, the five lowest ribs on each side. They are called bastard or spurious ribs, in regard they do not join with the breast-bone as the other ribs do; nor are they, like the rest, bony, but cartilaginous. See RIBS.

NOTHING, *Nihil.* The schoolmen distinguish between nothing taken strictly, being that which is impossible, or implies a contradiction, and nothing taken more generally, being applied both to what is possible and impossible. Again, they distinguish nothing into negative, which is the absence of reality in any subject; and privative, which is the absence of reality in a subject capable thereof, or wherein it ought to be found.

NOTHUS, νοθος, signifies spurious or bastard, whence it is figuratively applied by physicians, &c. to such diseases, as though in respect of a similitude of symptoms, &c. they have the same denomination as some others, yet are of a different origin, seat, or the like, from the same.

NOTICE, in law, is defined to be the making of something known, which a man might be ignorant of before: and it has divers effects in our laws; for thereby the party giving the same, may reap a benefit which he otherwise should not have had; and by this means the person to whom it is given, is liable to some charge or action, to which without it he had not been subject.

NOTION, in logic, an idea or representation of any thing in the mind. See IDEA.

NOVALE, in our ancient customs, signifies land newly

newly ploughed, that had not been tilled before in the memory of man. Novale is alſo ſometimes uſed for fallow land.

NOVATIONS, a Chriſtian ſect which ſprang up in the third century, ſo called from Novatian, a prieſt of Rome, or Novatus, an African biſhop, who ſeparated from the communion of pope Cornelius, whom Novatian charged with a criminal lenity towards thoſe who had apoſtatized during the perſecution of Decius. He denied the church's power of remitting mortal ſins, upon the offender's repentance; and at laſt went ſo far as to deny that the apoſtles could ever hope for pardon even from God himſelf. Novatus coming to Rome, joined with the followers of Novatian, and added to theſe rigid doctrines another, which was the unlawfulneſs of ſecond marriages, againſt which this became as ſevere as againſt apoſtates; denying communion to ſuch as married a ſecond time after baptiſm, and treating widows who married again, as adultereſſes. The two leaders were proſcribed and declared heretics, not for excluding penitents from communion, but for denying that the church had the power of remitting ſins.

NOVEL, in the civil law, a term uſed for the conſtitutions of ſeveral emperors, as of Juſtin, Tiberius, Leo, and more particularly of thoſe of Juſtinian. The conſtitutions of Juſtinian were called novels, either from their producing a great alteration in the face of the ancient law, or becauſe they were made on new caſes, and after the reviſal of the ancient code, compiled by order of that emperor. Thus the conſtitutions of the emperors Theodoſius, Valentinian, Marcian, &c. were alſo called novels, on account of their being publiſhed after the Theodoſian code.

NOVEL, in matters of literature, a fictitious hiſtory of a ſeries of ſurprizing and entertaining events in common life, wherein the rules of probability are or ought to be ſtrictly preſerved; in which it differs from a romance, where the hero and heroine is ſome prince and princeſs, and the events which lead to the cataſtrophe, are in general highly abſurd and unnatural.

NOVEL ASSIGNMENT, in law, an aſſignment of time, place, or the like, in an action of treſpaſs, otherwiſe than it was before aſſigned.

NOVEMBER, in chronology, the eleventh month of the Julian year, conſiſting only of thirty days: it got the name of November, as being the ninth month of Romulus's year, which began with March. See MONTH and YEAR.

NOVICE, in general, denotes a perſon not yet ſkilled or experienced in any art or profeſſion.

NOUN, *Nomen*, in grammar, a name or word expreſſing the thing ſpoken of, as king, queen, prince, &c.

Beſides the particular name which each perſon bears, he gives himſelf another when he ſpeaks of himſelf, as I or myſelf; the former are called nouns, and the latter pronouns. Nouns are again divided into nouns-ſubſtantive, and nouns-adjective.

They are called ſubſtantives, when the objects they expreſs are conſidered ſimply in themſelves, as ſoul, &c. and adjectives, when their objects are conſidered as clothed with any qualities, as vicious ſoul, &c.

Nouns are alſo divided into proper and appellative; nouns proper are thoſe which expreſs a particular thing or perſon, ſo as to diſtinguiſh it from all others of the ſame kind, as Ariſtotle, &c.

Nouns appellative are thoſe common to ſeveral individuals of the ſame kind, as man, beaſt, fiſh, &c.

NOWED, in heraldry, ſignifies knotted, from the Latin *nodatus*; being applied to the tails of ſuch creatures as are very long, and ſometimes repreſented in coat-armour, as if tied up in a knot.

NUCIFEROUS, in botany, is applied to ſuch trees as bear nuts.

NUCKIANÆ GLANDULÆ, in anatomy, a number of ſmall glands, ſituate between the abducent muſcle of the eye, and the upper part of the os jugale. See EYE, GLAND, &c.

NUCLEUS, in general, denotes the kernel of a nut, or even any ſeed incloſed within a huſk.

The term nucleus is alſo uſed for the body of a comet, otherwiſe called its head. See the article COMET.

Among the ancient architects, nucleus ſignified the middle flooring, which conſiſted of a ſtrong cement, over which they laid the pavement bound with mortar.

NUDITIES, in painting and ſculpture, denotes thoſe parts of an human figure which are not covered with any drapery; or thoſe parts where the carnation appears.

NUL TIEL RECORD, in law, is what the plaintiff generally pleads on the defendant's pleading matter of record in bar of the action brought by the plaintiff.

NULLITY, in law, ſignifies any thing that is null or void: thus there is a nullity of marriage, where perſons marry within the degrees, or where infants marry without conſent of their parents or guardians.

NUMBER, *Numerus*, in arithmetic, an aſſemblage of ſeveral units, or things of the ſame kind.

Stevinus defines number as that by which the quantity of any thing is expreſſed; agreeably to which Sir Iſaac Newton conceives number to conſiſt in the abſtract ratio of a quantity of any kind to another quantity of the ſame kind, which is accounted as unity; and on this view he divides number into integers, fractions, and ſurds.

Wolfius defines number to be ſomething which refers to unity, as one right line refers to another. Thus aſſuming a right line for unity, a number may likewiſe be expreſſed by a right line. A leſs general definition will not, he thinks, comprehend the ſeveral kinds of whole numbers, fractions, rationals, and ſurds. Mathematicians, conſidering number under a great many relations, have eſtabliſhed the following diſtinctions.

Broken NUMBERS are the ſame with fractions. See FRACTION.

Cardinal NUMBERS are thoſe which expreſs the quantity of units, as 1, 2, 3, 4, &c. whereas ordinal numbers are thoſe which expreſs order, as 1ſt, 2d, 3d, &c.

Compound NUMBER, one diviſible by ſome other number beſides unity; as 12, which is diviſible by 2, 3, 4, and 6. Numbers, as 12 and 15, which have ſome common meaſure beſides unity, are ſaid to be compound numbers among themſelves.

Cubic NUMBER is the product of a ſquare number by its root: ſuch is 27, as being the product of the ſquare number 9, by its root 3. All cubic numbers whoſe root is leſs than 6, being divided by 6, the remainder is the root itſelf: thus $27 \div 6$ leaves the remainder 3, its root; 216, the cube of 6, being divided by 6, leaves no remainder; 343, the cube of 7, leaves a remainder 1, which, added to 6, is the cube root; and 512, the cube of 8, divided by 6, leaves a remainder 2, which, added to 6, is the cube root. Hence the remainders of the diviſions of the cubes above 216, divided by 6, being added to 6, always gives the root of the cube ſo divided, till that remainder be 5, and conſequently 11, the cube-root of the number divided. But the cubic number above this being divided by 6, there remains nothing, the cube-root being 12. Thus the remainders of the higher cubes are to be added to 12, and not to 6; till you come to 18, when the remainder of the diviſion muſt be added to 18; and ſo on *ad infinitum*.

Determinate NUMBER is that referred to ſome given unit, as a ternary or three: whereas an indeterminate one is that referred to unity in general, and is called quantity.

Homogeneal NUMBERS are thoſe referred to the ſame unit; as thoſe referred to different units are termed heterogeneal.

Whole NUMBERS are otherwiſe called integers. See INTEGER.

Rational NUMBER is one commenſurable with unity; as a number, incommenſurable with unity, is termed irrational or a ſurd. See the article SURD.

In the ſame manner a rational whole number is that whereof unity is an aliquot part; a rational broken number, that equal to ſome aliquot part of unity; and a rational mixed number, that conſiſting of a whole number and a broken one.

Even NUMBER, that which may be divided into two equal parts without any fraction, as, 6, 12, &c. The ſum, difference, and product of any number of even numbers, is always an even number.

An evenly even NUMBER is that which may be meaſured, or divided, without any remainder, by another even number, as 4 by 2.

An unevenly even NUMBER, when a number may be equally divided by an uneven number, as 20 by 5.

Uneven NUMBER, that which exceeds an even number, at leaſt by unity, or which cannot be divided into two equal parts, as 3, 5, &c.

The ſum or difference of two uneven numbers makes an even number; but the factum of two uneven ones makes an uneven number.

If an even number be added to an uneven one, or if the one be ſubtracted from the other, in the former caſe the ſum, in the latter the difference, is an uneven number; but the factum of an even and uneven number is even.

The ſum of any even number of uneven numbers is an even number; and the ſum of any uneven number of uneven numbers is an uneven number.

Primitive or *Prime* NUMBERS are thoſe only diviſible by unity, as 5, 7, &c. And prime numbers among themſelves are thoſe which have no common meaſure beſides unity, as 12 and 19.

Perfect NUMBER, that whoſe aliquot parts added together, make the whole number, as 6, 28; the aliquot parts of 6 being 3, 2, and 1=6; and thoſe of 28, being 14, 7, 4, 2, 1, = 28.

Imperfect NUMBERS, thoſe whoſe aliquot parts, added together, make either more or leſs than the whole. And theſe are diſtinguiſhed into abundant and defective; an inſtance in the former caſe is 12, whoſe aliquot parts 6, 4, 3, 2, 1, make 16; and in the latter caſe 16, whoſe aliquot parts 8, 4, 2, and 1, make but 15.

Plain NUMBER, that ariſing from the multiplication of two numbers, as 6, which is the product of 3 by 2; and theſe numbers are called the ſides of the plane.

Square NUMBER is the product of any number multiplied by itſelf; thus 4, which is the factum of 2 by 2, is a ſquare number.

Every ſquare number added to its root makes an even number.

Polygonal, or *Polygonous* NUMBERS, the ſums of arithmetical progreſſions beginning with unity: theſe, where the common difference is 1, are called triangular numbers; where 2, ſquare numbers; where 3, pentagonal numbers; where 4, hexagonal numbers; where 5, heptagonal numbers, &c. See POLYGONAL.

Pyramidal NUMBERS. The ſums of polygonous numbers, collected after the ſame manner as the polygons themſelves, and not gathered out of arithmetical progreſſions, are called firſt pyramidal numbers: the ſums of the firſt pyramidals are called ſecond pyramidals, &c.

If they ariſe out of triangular numbers, they are called triangular pyramidal numbers; if out of pentagons, firſt pentagonal pyramidals.

Golden NUMBER, in chronology. See the article GOLDEN *Number*.

NUMBER, in grammar, a modification of nouns, verbs, &c. to accommodate them to the varieties in their objects, conſidered with regard to number. See the articles NOUN and VERB.

Nouns or names agreeing to ſeveral things, may be conſidered either as applied to one of thoſe things ſingularly, or to a number of them; and thoſe conſidered either as ſeveral, or as united. To diſtinguiſh theſe caſes, two numbers have been invented, the ſingular and plural.

When a noun indicates an object conſidered as ſingle, or alone, or a number of them conſidered as united together, it is ſaid to be of the ſingular number, as a plant, an army, a church. When it indicates ſeveral objects, and thoſe as diſtinct, it is of the plural number, as plants, armies, churches: and when I ſpeak of myſelf as making a part of ſeveral others, inſtead of ſaying I, it is proper to ſay we, &c.

The Greeks have a third number, which they call dual number, as ſignifying two: the Hebrews have ſomething like it; but then it only takes place when the words ſignify a thing double, either by nature, as the hands, eyes, &c. or by art, as ſciſſars, tongs, &c. As to common and appellative names, they ſeem all naturally to require a plural number, yet are there ſeveral which have none, as the name of gold, ſteel, &c.

The difference of numbers in nouns is expreſſed by a difference of termination. In Engliſh the ſingular is uſually converted into plural by adding s, as plant, plants; book, books, &c. Where the pronunciation requires it, as where the ſingular ends in s or x, ſh or ch, it is uſually done by the addition of es, inſtead of s. Very often the plural is formed by en, as from ox is formed the plural oxen; and from man, men; brother, brethren, &c. Thoſe nouns whoſe ſingulars end in f, or fe, form the plural by ves; as calf, calves; loaf, loaves; wife, wives, &c. However, the formation of the plural of many words can be reduced to no rule at all, being mere irregulars; as from mouſe is formed the plural mice; from foot, feet, &c. And in many words there is no difference of number; as in ſheep, deer, &c. Again, ſome words have no ſingular numbers; as aſhes, bellows, lungs, breeches, &c. and others no plural; as the names of countries, virtues and vices, metals, herbs, and corn. The plurals of adjectives, though varied from the ſingular in moſt languages, yet in Engliſh are generally the ſame.

NUMBERS, in poetry, oratory, muſic, &c. are certain meaſures, proportions, or cadences, which render a verſe, period, or ſong, agreeable to the ear. See the article METRE.

Poetical numbers conſiſt in a certain harmony in the order, quantities, &c. of the feet and ſyllables, which make the piece muſical to the ear, and fit for ſinging, for which all the verſes of the ancients were intended. See MEASURE and RYTHMUS.

Book of NUMBERS, the fourth book of the Pentateuch, taking its denomination from its numbering the families of Iſrael.

A great part of this book is hiſtorical, relating to ſeveral remarkable paſſages in the Iſraelites march through the wilderneſs. It contains a diſtinct relation of their ſeveral movements from one place to another, or their two and forty ſtages through the wilderneſs, and many other things, whereby we are inſtructed and confirmed in ſome of the weightieſt truths that have immediate reference to God and his providence in the world. But the greateſt part of this book is ſpent in enumerating thoſe laws and ordinances, whether civil or ceremonial, which were given by God, but not mentioned before in the preceding books.

NUMERAL LETTERS, thoſe letters of the alphabet which are generally uſed for figures.

NUMERAL CHARACTERS. See the article CHARACTER.

NUMERALS, in grammar, thoſe words which expreſs numbers.

NUMERATION, *Numeratio*, in arithmetic, the art of eſtimating or pronouncing any number.

The characters whereby numbers are ordinarily expreſſed are the nine following, 1, 2, 3, 4, 5, 6, 7, 8, 9.

That theſe nine numerical notes may expreſs not only units, but alſo tens, hundreds, thouſands, &c. they have a local value given them; ſo that when either alone, or when placed in the right-hand place, they denote units; in the ſecond place, tens; in the third, hundreds; in the fourth, thouſands.

To expreſs any number, it is to be divided by commas into claſſes, allowing three characters for each, and beginning at the right hand. Over the right hand figure of the third claſs add a ſmall mark, over the right hand figure of the fifth claſs add two marks, over that of the ſeventh, three, &c. The number to the left of the firſt comma expreſs by thouſands; that which has over it the firſt tranſverſe line expreſs by millions; that which has two by billions; that with three by trillions, &c. Laſtly, the left-hand character of each claſs expreſs by hundreds; the middle one by tens; and the right-hand one by units. For inſtance, 2‴, 345 389″, 210 762′, 321 543, is thus read, two trillions, three hundred and forty-five thouſand three hundred eighty-nine millions of billions, two hundred and ten thouſand ſeven hundred and ſixty-two millions, three hundred and twenty one thouſand five hundred and forty-three.

NUMERATOR *of a Fraction*. See the article FRACTIONS.

NUMERICAL, NUMEROUS, or NUMERAL, ſomething belonging to numbers; as numerical algebra is that which makes uſe of numbers inſtead of letters of the alphabet. Alſo numerical difference is the difference whereby one individual is diſtinguiſhed from another. Hence a thing is ſaid to be numerically the ſame, when it is ſo in the ſtricteſt ſenſe of the word.

NUMISMATOGRAPHIA, a term uſed for the deſcription and knowledge of ancient medals and coins, whether of gold, ſilver, or braſs.

NUN, a woman, in ſeveral Chriſtian countries, who devotes herſelf, in a cloiſter or nunnery, to a religious life. See MONK.

There were women in the ancient Chriſtian church, who made public profeſſion of virginity before the monaſtic life was known in the world, as appears from the writings of Cyprian and Tertullian. Theſe, for diſtinction's ſake, are ſometimes called eccleſiaſtical virgins, and were commonly enrolled in the canon or matricula of the church. They differed from the monaſtic virgin chiefly in this, that they lived privately in their father's houſes, whereas the others lived in communities; but their profeſſion of virginity was not ſo ſtrict as to make it criminal in them to marry afterwards, if they thought fit. As to the conſecration of virgins, it had ſome things peculiar in it: it was uſually performed publicly in the church by the biſhop. The virgin made a public profeſſion of her reſolution, and then the biſhop put upon her the accuſtomed habit of ſacred virgins. One part of this habit was a veil called the ſacrum velamen, another was a kind of mitre or coronet worn upon the head. At preſent, when a woman is to be made a nun, the habit, veil, and ring of the candidate are carried to the altar, and ſhe herſelf, accompanied by her neareſt relations, is conducted to the biſhop, who, after maſs and an anthem, the ſubject of which is, "that ſhe ought to have her lamp lighted, becauſe the bridegroom is coming to meet her," pronounces the benediction: then ſhe riſes up, and the biſhop conſecrates the new habit, ſprinkling it with holy-water. When the candidate has put on her religious habit, ſhe preſents herſelf before the biſhop, and ſings, on her knees, *ancilla Chriſti ſum, &c.* then ſhe receives the veil, and afterwards the ring, by which ſhe is married to Chriſt; and laſtly, the crown of virginity. When ſhe is crowned, an anathema is denounced againſt all who ſhall attempt to make her break her vows. The ſeveral orders of nuns in the Romiſh and Greek churches, are mentioned under ſeparate articles.

NUNCIO, or NUNTIO, an ambaſſador from the pope to ſome Catholic prince or ſtate, or a perſon who attends on the pope's behalf at a congreſs, or an aſſembly of ſeveral ambaſſadors.

NUNCUPATIVE, in the ſchools, ſomething that is only nominal, or has no exiſtence but in name.

NUNCUPATIVE WILL denotes a laſt will or teſtament, only made verbally, and not put in writing. See WILL and TESTAMENT.

NUNDINAL, NUNDINALIS, a name which the Romans gave to the eight firſt letters of the alphabet uſed in their calendar.

NUPTIAL RITES, the ceremonies attending the ſolemnization of marriage, which are different in different ages and countries. See MARRIAGE.

NURSERY, or NURSERY GARDEN, is a piece of land ſet a-part for the raiſing and propagating of all ſorts of trees and plants to ſupply the garden and other plantations.

Of this ſort there are great numbers in the different parts of this kingdom, but particularly in the neighbourhood of London, which are occupied by the gardeners, whoſe buſineſs it is to raiſe trees, plants, and flowers for ſale; and in many of theſe there is at preſent a much greater variety of trees and plants cultivated than can be found in any other part of Europe. In France, their nurſeries (which are but few, when compared with thoſe in England) are chiefly confined to the propagation of fruit-trees, from whence they have the appellation of pepinier: for there is ſcarce any of thoſe gardens, where a perſon can be ſupplied either with ever-greens, flowering ſhrubs, or foreſt-trees. And, in Holland, their nurſeries are principally for flowers; ſome few of them indeed propagate tender exotic plants. But thoſe nurſeries in the neighbourhood of London do, ſeveral of them, include all theſe; and from hence moſt of the curious perſons abroad are ſupplied with furniture for their gardens. But I do not propoſe, in this place, to treat of theſe extenſive nurſeries, or to give a deſcription of them; therefore ſhall confine myſelf to treat of ſuch nurſeries only as are abſolutely neceſſary for all lovers of planting to have upon the ſpot, where they deſign to make their plantation: for if theſe are large, the expence of carrying a great number of trees, if the diſtance is great, will be no ſmall article, beſides the hazard of their growing; which, when plants have been trained up in good land, and removed to an indifferent one, is very great. Therefore it is of the utmoſt conſequence to every planter, to begin by making of a nurſery. But in this article I muſt beg leave to obſerve, that a nurſery ſhould not be fixed to any one particular ſpot: I mean by this, that it would be wrong to continue the raiſing of trees any number of years upon the ſame ſpot of ground: becauſe hereby the ground will be ſo much exhauſted by the trees, as to render it unfit for the ſame purpoſe. Therefore all good nurſery-gardeners ſhift and change their land, from time to time; for when they have drawn off the trees from a ſpot of ground, they either plant kitchen herbs, or other things, upon the ground for a year or two, by which time, as alſo by dunging and trenching of the land, it is recovered, and made fit to receive other trees. But this they are obliged to from neceſſity, being confined to the ſame land; which is not the caſe with thoſe gentlemen who have a large extent of ground in the country. Therefore all ſuch perſons I would adviſe to make nurſeries upon the ground which is intended for planting, where a ſufficient number of the trees may be left ſtanding, after the others have been drawn out, to plant in other places; which, for all large growing trees, but particularly ſuch as are cultivated for timber, will be found by much the moſt advantageous method: for all thoſe trees which come up from the ſeed, or which are tranſplanted very young into the places where they are deſigned to remain, will make a much greater progreſs, and become larger trees than any of thoſe which are tranſplanted at a greater age. Therefore the nurſeries ſhould be thinned early, by removing all thoſe trees which are intended for other plantations, while they are young; becauſe hereby the expence and trouble of ſtaking, watering, &c. will be ſaved, and the tree will ſucceed much better. But in expoſed ſituations, where there are nurſeries made, it will be neceſſary to permit the trees to ſtand much longer, that, by growing cloſe together, they may ſhelter each other, and draw themſelves up: and theſe ſhould be thinned gradually, as the trees advance; for by taking away too many at firſt, the cold will check the growth of the remaining trees. But then thoſe trees which are taken out from theſe nurſeries, after a certain age, ſhould not be depended on for planting; and it will be prudence rather to conſign them for fuel, than by attempting to remove them large, whereby, in endeavouring to get them up with good roots, the roots of the ſtanding trees will be often much injured.

What has been here propoſed, muſt be underſtood for all large plantations in parks, woods, &c. but thoſe nurſeries which are only intended for the raiſing of ever-greens, flowering ſhrubs, or plants which are deſigned to embelliſh gardens, may be confined to one ſpot, becauſe a ſmall compaſs of ground will be ſufficient for this purpoſe. Two or three acres of land, employed this way, will be ſufficient for the moſt extenſive deſigns; and one acre will be full enough for thoſe of moderate extent. And ſuch a ſpot of ground may be always employed for ſowing the ſeeds of foreign trees and plants; as alſo, for raiſing many ſorts of biennial and perennial flowers, to tranſplant into the borders of the pleaſure-gardens; and for raiſing many kinds of bulbous-rooted flowers from ſeeds, whereby a variety of new ſorts may be obtained annually, which will recompenſe for the trouble and expence, and will moreover be an agreeable diverſion to all

those persons who delight in the amusements of gardening.

Such a nursery as this should be conveniently situated for water; for where that is wanting, there must be an expence attending the carriage of water in dry weather. It should also be as near the house as it can with conveniency be admitted, in order to render it easy to visit at all times of the year; because it is absolutely necessary, that it should be under the inspection of the master; for unless he delights in it, there will be little hopes of success. The soil of this nursery should also be good, and not too heavy and stiff; for such land will be very improper for sowing most sorts of seeds; because, as this will detain the moisture in the spring and winter, so the seeds of most tender things, especially of flowers, will rot in the ground, if sown early. Therefore, where persons are confined to such land, there should be a good quantity of sand, ashes, and other light manures buried in order to separate the parts, and pulverise the ground; and if it is thrown up in ridges, to receive the frost in winter, it will be of great use to it; as will also the frequent forking or stirring of the ground, both before and after it is planted.

The many advantages which attend the having such a nursery, are so obvious to every person who has turned his thoughts in the least to this subject, that it is needless for me to mention them here; and therefore I shall only beg leave to repeat here what I have frequently recommended, which is, the carefully keeping the ground always clear from weeds; for if these are permitted to grow, they will rob the young trees of their nourishment. Another principal business is, to dig the ground between the young plants at least once a year, to loosen it for the roots to strike out; but if the ground is stiff, it will be better to be repeated twice a year, viz. in October and March; which will greatly promote the growth of the plants, and prepare their roots for transplanting. *Miller's Gardiner's Dict.*

NUSANCE, in law, a thing done to the annoyance of another.

Nusances are either public or private: a public nusance is an offence against the public in general, either by doing what tends to the annoyance of all the king's subjects, or by neglecting to do what the common good requires; in which case all annoyances and injuries to streets, highways, bridges, and large rivers; as also disorderly ale-houses, bawdy-houses, gaming-houses, stages for rope-dancers, &c. are held to be common nusances. A private nusance is when only one person or family is annoyed, by the doing of any thing; as where a person stops up the light of another's house, or builds in such a manner that the rain falls from his house upon his neighbours; as likewise the turning or diverting water from running to a man's house, mill, meadow, &c. stopping up a way that leads from houses to lands; suffering a house to decay, to the damage of the next house; erecting a brew-house in any place not convenient; or an house of office, &c. so near another person's house as to offend him by its smell.

Indictment lies for a public or common nusance at the king's suit, whereon the party offending shall be fined and imprisoned; but no action can be brought in this case except one man suffers more by a common nusance than another; as where a pit is dug in the highway, and he falls into it. Action on the case, or assise of nusance, lies for any private nusance, at the suit of the party aggrieved, and on such actions judgment is given that the nusance shall be removed, and the injured party recover damages; but if a person has only a term of years in a house or lands, as he has no freehold therein, he can only have an action on the case, by which the nusance will be removed without his recovering damages.

NUT, *Nux*, among botanists, denotes a pericarpium of an extraordinary hardness, including a kernel or seed. Of these there are several kinds, as filberts, walnuts, &c.

NUTATION, in astronomy, a kind of tremulous motion of the axis of the earth, whereby, in each annual revolution, it is twice inclined to the ecliptic, and as often returns to its former position.

Sir Isaac Newton observes, that the moon has the like motion, only very small, and scarce sensible.

NUTMEG, *nux moschata*, in natural history, the kernel of a large nut, produced by a tree said to resemble the pear tree, growing in the East-Indies. The outer part of the fruit is a soft fleshy substance like that of the walnut, which spontaneously opens when ripe; under this lies a red membrane called mace, forming a kind of reticular covering through the fissures of which is seen the hard woody shell that includes the nutmeg. Two sorts of this kernel are distinguished; one of an oblong figure, called male; the other roundish or of the shape of an olive, called female; this last is the officinal species, being preferred to the other on account of its stronger and more agreeable flavour, and its being, as is said, less subject to become carious. The nutmegs are cured, according to Rumphius, by dipping them in a somewhat thick mixture of lime and water, that they may be every where coated with the lime, which contributes to their preservation.

The nutmeg is a moderately warm, grateful, unctuous spice; supposed to be particularly useful in weakness of appetite, and the nauseæ and vomitings accompanying pregnancy, and in fluxes; but liable, when taken too freely, to sit very uneasy on the stomach, and, as is said, to affect the head. Roasted with a gentle heat, till it becomes easily friable, it proves less subject to these inconveniences, and is supposed likewise to be more useful in fluxes.

Nutmegs, distilled with water, yield nearly one sixteenth their weight of a limpid essential oil, very grateful, possessing the flavour of the spice in perfection, and which is said to have some degree of an antispasmodic or hypnotic power: on the surface of the remaining decoction is found floating an unctuous concrete matter like tallow, of a white colour, nearly insipid, not easily corruptible; and hence recommended as a basis for odoriferous balsams: the decoction, freed from this sebaceous matter, and inspissated, leaves a weakly bitter subastringent extract. Rectified spirit takes up, by maceration or digestion, the whole smell and taste of the nutmegs, and receives from them a deep bright yellow colour: the spirit, drawn off by distillation from the filtered tincture, is very slightly impregnated with their flavour; greatest part of the specific smell, as well as the aromatic warmth, bitterishness and subastringency of the spice remaining concentrated in the extract. The essential oil, and an agreeable cordial water, lightly flavoured with the volatile parts of the nutmeg by drawing off a gallon of proof spirit from two ounces of the spice, are kept in the shops. Both the oil, and the spirituous tincture and extracts, agree better with weak stomachs than an equivalent quantity of the nutmegs in substance.

Nutmegs, heated, and strongly pressed, give out a fluid yellow oil, which concretes on growing cold into a sebaceous consistence. Rumphius informs us, that in the Spice Islands, when the nuts are broken, those kernels which appear damaged, carious, or unripe, are separated for this use, and that seventeen pounds and a quarter of such kernels yield only one pound of oil, whereas when the nutmeg is in perfection, it is said to afford near one third its own weight.

Two kinds of sebaceous matter, said to be expressed from the nutmeg, are distinguished in the shops by the name of oil of mace: the best sort, brought from the East-Indies in stone jars, is somewhat soft, of a yellow colour, and of a strong agreeable smell greatly resembling that of the nutmeg itself: the other comes from Holland in solid masses, generally flat, and of a square figure, of a paler colour, and much weaker smell. These oils are employed chiefly externally in stomachic plasters, and in anodyne and nervine unguents and liniments. They appear to be a mixture of the gross sebaceous matter of the nutmeg with a little of the essential or aromatic oil; both which may be perfectly separated from one another by maceration or digestion in rectified spirit, or by distillation with water. The spirituous tincture, and the distilled water, and the essential oil, are nearly similar to those drawn from the nutmeg itself, the pure white sebaceous substance being left behind.

NUTRITION, *Nutritio*, in the animal œconomy, the accession or apposition of new parts to the body, similar to those it already consisted of, either for its augmentation, or the reparation of such as are worn off.

Buffon,

Buffon, in order to account for nutrition, ſuppoſes the body of an animal, or vegetable, to be a kind of mould, in which the matter neceſſary to its nutrition is modelled and aſſimilated to the whole. But, continues he, of what nature is this matter, which an animal, or vegetable, aſſimilates to its own ſubſtance? What power is it that communicates to this matter the activity and motion neceſſary to penetrate this mould? and, if ſuch a force exiſt, would it not be by a ſimilar force that the internal mould itſelf might be reproduced?

As to the firſt queſtion, he ſhews, that there exiſts in nature an infinite number of living organical parts, and that all organized bodies conſiſt of ſuch organical parts; that their production coſts nature nothing, ſince their exiſtence is conſtant and invariable; ſo that the matter which the animal, or vegetable, aſſimilates to its ſubſtance, is an organical matter, of the ſame nature with that of the animal, or vegetable, which conſequently may augment its volume, without changing its form, or altering the quality of the ſubſtance in the mould.

As to the ſecond queſtion: there exiſt, ſays he, in nature, certain powers, as that of gravity, that have no affinity with the external qualities of the body, but act upon the moſt intimate parts, and penetrate them throughout, and which can never fall under the obſervation of our ſenſes.

And as to the third queſtion, he anſwers, that the internal mould itſelf is reproduced, not only by a ſimilar power; but it is plain that it is the very ſame power that cauſes the unfolding and reproduction thereof: for it is ſufficient, proceeds he, that, in an organized body that unfolds itſelf, there be ſome part ſimilar to the whole, in order that this part may one day become itſelf an organized body, altogether like that of which it actually is a part.

NUX MOSCHATA. See NUTMEG.

NUX PISTACHIA. See PISTACHIA.

NUX VOMICA, a flat, compreſſed, round fruit, about the breadth of a ſhilling, brought from the Eaſt-Indies.

It is found a certain poiſon to dogs, cats, &c. and it is not to be doubted but it would alſo prove fatal to mankind. Its ſurface is not much corrugated, and its texture is firm like horn, and of a pale, greyiſh, brown colour.

NYCHTHEMERON, *νυχθημερον*, the natural day, or day and night, which together always make twenty-four hours. See DAY and NIGHT.

NYCTALOPIA, in medicine, a two-fold diſorder of the eye, one of which is oppoſite to the other. In the firſt, the ſight is beſt in the night, and in obſcure places; whereas, in a clear light, their ſight fails, ſo that they can hardly ſee any thing. In the other ſort of nyctalopia, the patient can ſee nothing at all except in a clear and bright light.

As theſe infirmities ariſe from a natural bad formation of the eye; they are therefore incurable.

NYCTANTHES, Arabian Jaſmine, in botany, a genus of plants, the flower of which conſiſts of a ſingle ſaucer-like petal, with the limb divided into eight oblong ſegments: the fruit is a didymous, bilocular berry, with a large roundiſh ſeed in each cell.

NYMPH, in mythology, an appellation given to certain inferior goddeſſes, inhabiting the mountains, woods, waters, &c. ſaid to be the daughters of Oceanus and Tethys. All the univerſe was repreſented as full of theſe nymphs, which are diſtinguiſhed into ſeveral ranks or claſſes. The general diviſion of them is into celeſtial and terreſtrial; the former of which were called Uraniæ, and were ſuppoſed to be intelligences that governed the heavenly bodies or ſpheres. The terreſtrial nymphs, called Epigeiæ, preſided over the ſeveral parts of the inferior world, and were divided into thoſe of the water, and thoſe of the earth. The nymphs of the water were the Oceanitides, or nymphs of the ocean; the Nereids, the nymphs of the ſea; the Naiads and Ephydriades, the nymphs of the fountains; and the Limniades, or nymphs of the lakes. The nymphs of the earth were the Oreades, or nymphs of the mountains; the Napœæ, nymphs of the meadows; and the Dryads and Hamadryads, who were nymphs of the foreſts and woods. Beſides theſe, we meet with nymphs who took their names from particular countries, rivers, &c. as the Cithæroniades, ſo called from Mount Cithæron in Bœotia; the Dodonides, from Dodona; the Tiberiades, from the Tiber, &c.

Goats were ſometimes ſacrificed to the nymphs; but their conſtant offerings were milk, oil, honey, and wine.

NYMPH, among naturaliſts, that ſtate of winged inſects between their living in the form of a worm, and their appearing in the winged or moſt perfect ſtate.

The eggs of inſects are firſt hatched into a kind of worms, or maggots; which afterwards paſs into the nymph-ſtate, ſurrounded with ſhells or caſes of their own ſkins: ſo that, in reality, theſe nymphs are only the embryo-inſects, wrapped up in this covering; from whence they at laſt get looſe, though not without great difficulty.

During the nymph-ſtate, the creature loſes its motion. Swammerdam calls it nympha aurelia, or ſimply aurelia; and others give it the name of chryſalis, a term of the like import. See CHRYSALIS.

NYMPHÆ, in anatomy, two membranaceous parts, ſituated on each ſide the rima. They are of a red colour, and cavernous ſtructure, ſomewhat reſembling the wattles under a cock's throat. They are ſometimes ſmaller, ſometimes larger, and are continuous to the præputium of the clitoris, and joined to the interior ſide of the labia.

NYMPHÆA, the water-lilly, in botany, a genus of plants, the flower of which conſiſts of a number of petals, uſually fifteen: they are ſmaller than the cup, and are inſerted into the ſide of the germen in more than a ſingle ſeries: the fruit is an oval fleſhy berry, containing a great many roundiſh ſeeds.

NYMPHÆUM, in antiquity, a public hall magnificently decorated for banqueting, &c. where thoſe who wanted conveniencies at home, held their marriage feaſts, &c.

The word is derived from the Greek, *νυμφη*, a bride.

O.

OAK

O, The fourth vowel, and fourteenth letter of the alphabet.

The ſound of the *o* is formed by the breath flowing out of the mouth, through the cylindric concavity of the tongue, and round configuration of the lips.

The Greeks had two *o*'s, viz. Omicron (ο) and Omega (ω); the firſt pronounced upon the tip of the lips with a ſharper ſound, and the other in the middle of the mouth, with a fuller ſound, equal to *o o* in our language. The long and ſhort pronunciations of our *o* are equivalent to the two Greek ones; the firſt, as in *ſuppoſe*; the ſecond, as in *obey*. Among the Latins the *o* bore ſo great an affinity to the *a*, that they frequently confounded them, writing it *canſul*, and pronouncing it *conſul*.

O, among the ancients, was a numeral letter, ſignifying eleven; and when a daſh was added at the top, as Ō, it ſignified eleven thouſand.

OAK, a tree well known. It is one of the principal materials in building ſhips, &c. being ſtrong in all poſitions.

All the ſorts of oaks are propagated from acorns, which ſhould be ſown as ſoon as poſſible after they are ripe; for if they are kept too long out of the ground, they ſeldom grow.

The manner of ſowing theſe acorns, if deſigned for a ſmall plantation, or to be removed, is, to prepare ſome beds of freſh earth, neither too ſtrong and heavy, nor too light and dry; in theſe beds you ſhould place the acorns in rows one foot aſunder, and about two inches diſtance in the rows, covering them about two inches thick with the ſame freſh earth; obſerving to leave none of them uncovered, to entice the vermin, which may, in a ſhort time, deſtroy all the ſeeds.

In the ſpring, when the plants begin to appear, you muſt carefully clear them from weeds; and if the ſeaſon proves dry, you ſhould refreſh them now-and-then with a little water, which will greatly promote their growth. In theſe beds the plants ſhould remain until the following autumn, obſerving conſtantly to keep them clear from weeds; at which time you ſhould prepare a ſpot of good freſh earth, in ſize proportionable to the quantity of plants, which ſhould be trenched and levelled: then towards the middle or latter end of October, you ſhould carefully take up the plants, ſo as not to injure their roots, and plant them out in rows three feet aſunder, and eighteen inches diſtance plant from plant; obſerving never to ſuffer the plants to abide long out of the ground, becauſe their roots would dry, and endanger the growth of the plants.

When they are planted, you ſhould lay a little mulch upon the ſurface of the ground, near their roots, to prevent the earth from drying too faſt; and if the ſeaſon ſhould prove very dry, you ſhould give them a little water to ſettle the earth to their roots.

When the plants have taken root in this nurſery, they will require little more care than to keep them clear from weeds, and dig the ground between the rows every ſpring; in doing of which, you ſhould cut off ſuch roots as extend very far from the trunk of the trees, which will render them better for tranſplanting again: you ſhould alſo prune off ſuch ſide-branches as extend themſelves very far, and would retard the upright ſhoot; but you ſhould by no means cut off all the ſmall lateral branches, ſome of which are abſolutely neceſſary to be left on, to detain the ſap for the augmentation of the trunk; for I have often obſerved, where trees have been thus cloſely pruned, that their heads have overgrown their bodies, ſo that they have bent downward and become crooked.

When theſe trees have remained in the nurſery three or four years, they will then be large enough to tranſplant to the places where they are to remain; for it is not proper to let them grow very large before they are planted out; becauſe theſe are very hazardous trees to remove when old, or after they have taken deep root.

The ſeaſon for this work is, as I ſaid before, in the autumn; at which time, if they are carefully taken up, there will be little danger of their ſucceeding. When they are planted, the ſurface of the ground ſhould be mulched about their roots, to prevent its drying too faſt; and if the ſeaſon is very dry, they ſhould be watered, to ſettle the earth to their roots, which may be repeated two or three times in very dry weather; but you muſt carefully avoid giving them too much water, which is very injurious to theſe trees, when newly removed.

You ſhould alſo ſtake them to prevent their being ſhaken and diſturbed by the winds, which would retard their rooting. In tranſplanting of theſe trees, you ſhould by no means cut their heads, which is too much practiſed: all that ſhould be done, muſt be only to cut off any bruiſed or ill-placed branches, which ſhould be taken off cloſe to the place where they are produced: but there can be no greater injury done to theſe trees than to ſhorten their roots; for when the leading bud, which is abſolutely neceſſary to draw and attract the nouriſhment, is taken off, the branch often decays entirely, or, at leaſt, down to the next vigorous bud.

The trees, thus raiſed and managed, will, if planted in a proper ſoil, grow to a conſiderable magnitude, and are very proper for a wilderneſs in large gardens, or to plant in clumps in parks, &c. but if they are deſigned for timber, it is much the better method to ſow the acorns in the places where they are to remain; in order to which, you ſhould provide yourſelf in autumn with a ſufficient quantity of acorns, which ſhould be always taken from ſtraight, upright, vigorous-growing trees; theſe ſhould be gathered from under the trees as ſoon as may be after they are fallen, and, if poſſible, in a dry time, laying them thin in ſome open room to dry; after which they may be put in dry ſand, and preſerved in a dry place until the end of November, when you ſhould prepare the ground for planting them.

The directions here given are deſigned only for ſmall plantations in a garden or park, which are only for pleaſure: but where theſe trees are cultivated with a view to profit, the acorns ſhould be ſown where the trees are deſigned to grow; for thoſe which are tranſplanted will never grow to the ſize of thoſe which ſtand where they are ſown, nor will they laſt near ſo long ſound: for in ſome places, where theſe trees have been tranſplanted with the greateſt care, and they have grown very faſt for ſeveral years after, yet they are now decaying, when thoſe which remain in the place where they came up from the acorns, are ſtill very thriving, and have not the leaſt ſign of decay: therefore, whoever deſigns to cultivate theſe trees for timber, ſhould never think of tranſplanting them, but ſow the acorns on the ſame ground where they are to grow; for the timber of all thoſe trees which are tranſplanted, is not near ſo valuable as that of the trees from acorns. I ſhall therefore add ſome plain directions for the ſowing of acorns, and managing of the young trees, during their minority, until they are out of danger, and require no farther care.

The firſt thing to be done is that of fencing the ground very well, to keep out cattle, hares, and rabbits; for if either of theſe can get into the ground, they will ſoon deſtroy all the young trees. Indeed, they will in a few years grow to be out of danger from the hares and rabbits; but it will be many years before they will be paſt injury from cattle, if they are permitted to get into the plantation; therefore, durable fences ſhould be put round the ground. If, in the beginning, a pale fence is made about the land, which may be cloſe at the bottom, and open above; and within the pale a quick-hedge planted; this will become a good fence, by the time the pale decays, againſt all ſorts of cattle; and then the trees will have got above the reach of hares and rabbits, ſo that they cannot injure them; for the bark of the trees will be too hard for them to gnaw.

After the ground is well fenced, it ſhould be prepared, by plowing of it three or four times, and, after each plowing, to harrow it well, to break the clods, and cleanſe the ground from couch, and the roots of all bad weeds. Indeed, if the ground is green ſward, it will be better to have one crop of beans, peaſe, or turneps, off the ground, before the acorns are ſown, provided theſe crops are well hoed to ſtir the ſurface, and deſtroy the weeds: for if this is obſerved, the crop will mend and improve the land for ſowing; but in this caſe, the ground ſhould be plowed as ſoon as poſſible, when the crop is taken off, to prepare it for acorns; which ſhould be ſown as ſoon as may be after the acorns are ripe: for although theſe may be preſerved in ſand for ſome time, yet they will be apt to ſprout; and, if ſo, the ſhoots are in danger of being broken and ſpoiled; therefore I ſhould adviſe the ſowing early, which is certainly the beſt method.

In making choice of the acorns, all thoſe ſhould be preferred which are taken from the largeſt and moſt thriving trees: and thoſe of pollard trees ſhould always be rejected, though the latter are generally the moſt productive of acorns; but thoſe of the large trees commonly produce the ſtrongeſt and moſt thriving plants.

The ſeaſon for the ſowing of the acorns being come, and the ground having been plowed, and levelled ſmooth, the next work is to ſow the acorns; which muſt be done by drawing of drills acroſs the ground, at about four feet aſunder, and two inches deep; into which the acorns ſhould be ſcattered, at two inches diſtance. Theſe drills may be drawn either with a drill plough, or by hand, with an hoe; but the former is the moſt expeditious method, therefore in large plantations ſhould be preferred. In the drawing of the drills, if the land has any ſlope to one ſide, theſe ſhould be made the ſame way as the ground ſlopes, that there may be no ſtoppage of the wet by the rows of plants croſſing the hanging of the land. This ſhould be particularly obſerved in all wet ground, or where the wet is ſubject to lie in the winter. When the acorns are ſown, the drills ſhould be carefully filled in, ſo as to cover the acorns ſecurely; for, if any of them are expoſed, they will entice the birds and mice; and, if either of theſe once attack them, they will make great havock with them.

The reaſon of my directing the drills to be made at this diſtance, is for the more convenient ſtirring of the ground between the rows, to keep the young plants clean from weeds; for if this is not carefully done, it cannot be expected that the young plants ſhould make much progreſs; and yet this is generally neglected by many who pretend to be great planters, who are often at a large expence to plant, but ſeldom regard them after: ſo that the young plants have the difficulty to encounter the weeds, which frequently are four or five times the height of the plants, and not only ſhade and draw them, but alſo exhauſt all the goodneſs of the ground, and conſequently ſtarve the plants: therefore, whoever hopes to have ſucceſs in their plantations, ſhould determine to be at the expence of keeping them clean for eight or ten years after ſowing, by which time the plants will have obtained ſtrength enough to keep down the weeds: the neglecting of this has occaſioned ſo many young plantations to miſcarry, as are frequently met with in divers parts of England.

About the end of March, or beginning of April, the young plants will appear above ground; but before this, if the ground ſhould produce many young weeds, it will be good huſbandry to ſcuffle the ſurface over with Dutch hoes, in a dry time, either the latter end of March, or the beginning of April, to deſtroy the weeds, whereby the ground will be kept clean, until all the plants are come up ſo as to be plainly diſcerned; by which time it may be proper to hoe the ground over again; for by doing it early, while the weeds are ſmall, a man will perform more of this work in one day than he can in three or four, when the weeds are grown large: beſides, there will be great hazard of cutting off or injuring the young plants, when they are hid by the weeds; and ſmall weeds, being cut, are ſoon dried up by the ſun; but large weeds often take freſh root, and grow again, eſpecially if rain ſhould fall ſoon after, had then the weeds will grow the faſter for being ſtirred; therefore, it is not only the beſt method, but alſo the cheapeſt huſbandry, to begin cleaning early in the ſpring, and to repeat it as often as the weeds are produced.

The firſt ſummer, while the plants are young, it will be the beſt way to perform theſe hoeings by hand; but afterwards it may be done with the hoe-plough; for as the rows are four feet aſunder, there will be room enough for this plough to work; and as this will ſtir and looſen the ground, it will be of great ſervice to the plants; but there will require a little hand labour where the plough is uſed, in order to deſtroy the weeds, which will come up in the rows between the plants; for theſe will be out of the reach of the plough, and, if they are not deſtroyed, they will ſoon overgrow and tear down the young plants.

After the plants have grown two years, it will be proper to draw out ſome of them, where they grow too cloſe; but in the doing of this, great care ſhould be had not to injure the roots of thoſe left; for as the plants which are drawn out are only fit for plantations deſigned for pleaſure, ſo theſe ſhould not be ſo much regarded in their being removed, as to ſacrifice any of thoſe which are deſigned to remain. In the thinning of theſe plantations, the plants may, at the firſt time, be left about one foot aſunder, which will give them room enough to grow two or three years longer; by which time it may be eaſy to judge which are likely to make the beſt trees. Therefore theſe may be then fixed on, as ſtandards, to remain; though it will be proper to have a greater number at this time marked than can be permitted to grow, becauſe ſome of them may not anſwer the expectation: and, as it will be improper to thin theſe trees too much at one time, ſo the leaving double the number intended at the ſecond thinning will not be amiſs. Therefore, if they are then left at about four feet diſtance in the rows, they will have room enough to grow three or four years longer; by which time, if the plants have made good progreſs, their roots will have ſpread over the ground; therefore it will be proper to take up every other tree in the rows. But, by this, I do not mean to be exact in the removing, but to make choice of the beſt plants to ſtand, which-ever rows they may be in, or if they ſhould not be exactly at the diſtance here aſſigned: all that is deſigned here, is, to lay down general rules, which ſhould be

be as nearly complied with as the plants will permit: therefore every perſon ſhould be guided by the growth of the trees in the performance of this work.

When the plants have been reduced to the diſtance of about eight feet, they will not require any more thinning. But in two or three years time, thoſe which are not to remain will be fit to cut down, to make ſtools for underwood; and thoſe which are to remain, will have made ſuch progreſs as to become a ſhelter to each other; for this is what ſhould be principally attended to, whenever the trees are thinned; therefore, in all ſuch places which are much expoſed to the wind, the trees ſhould be thinned with great caution, and by ſlow degrees; for if the air is let too much at once into the plantation, it will give a ſudden check to the trees, and greatly retard their growth; but, in ſheltered ſituations, there need not be ſo great caution uſed as in thoſe places; the plants will not be in ſo much danger of ſuffering.

The diſtance which I ſhould chuſe to allow to thoſe trees which are deſigned to remain for timber, is, from twenty-five to above thirty feet, which will not be too near, where the trees thrive well; in which caſe their heads will ſpread, ſo as to meet in about thirty or thirty-five years: nor will this diſtance be too great, ſo as to impede the upright growth of the trees. This diſtance is intended that the trees ſhould enjoy the whole benefit of the ſoil. Therefore, after one crop of the underwood, or, at the moſt, two crops are cut, I would adviſe the ſtubbing up the ſtools, that the ground may be intirely clear, for the advantage of the growing timber, which is what ſhould be principally regarded: but, in general, moſt people have more regard for the immediate profit of the underwood than the future good of the timber, and, frequently, by ſo doing, ſpoil both: for, if the underwood is left after the trees have ſpread ſo far as that their heads meet, the underwood will not be of much worth; and yet by their ſtools being left, they will draw away a great ſhare of nouriſhment from the timber trees, and retard them in their progreſs.

The ſoil in which oak makes the greateſt progreſs, is a deeprich loam, in which the trees grow to the largeſt ſize; and the timber of thoſe trees which grow upon this land, is generally more pliable than that which grows on a ſhallower or drier ground; but the wood of the latter is much more compact and hard. Indeed there are few ſoils in England in which the oak will not grow, provided there is proper care taken in their cultivation; though this tree will not thrive equally in all ſoils: but yet it might be cultivated to a national advantage upon many large waſtes in many parts of England, as alſo to the great profit of the eſtates where theſe tracts of land now lie uncultivated, and produce nothing to the owner. And, ſhould the preſent temper of deſtroying the timber of England continue in practice ſome years longer, in the ſame degree which it has for ſome years paſt, and as little care be taken to raiſe a ſupply, this country, which has been ſo long eſteemed for its naval ſtrength, may be obliged to ſeek for timber abroad, or be content with ſuch a naval ſtrength as the poor remains of ſome frugal eſtates may have left growing: for, as to the large foreſts, from whence the navy has been ſo long ſupplied, a few years will put an end to the timber there: and how can it be otherwiſe, when the perſons to whoſe care theſe are committed, reap an advantage from the deſtruction of the timber? *Miller's Gard. Dict.*

OAK-*leaf Galls.*—Theſe are of ſeveral kinds; the remarkable ſpecies, called the muſhroom gall, is never found on any other vegetable ſubſtance but theſe leaves; and, beſides this, there are a great number of other kinds.

The double gall of theſe leaves is very ſingular, in that, as the generality of productions of this kind affect only one ſide of a leaf, or branch, and grow all one way, this kind of gall extends itſelf both ways, and is ſeen on each ſide of the leaf, in form of two protuberances, oppoſite the one to the other. Theſe are of differently irregular ſhapes, but their natural figure ſeems that of two cones, with broad baſes, and very obtuſe points, though, ſometimes, they are round, or very nearly ſo. Theſe make their firſt appearance on the leaf in April, and remain on till June, or longer. They are at firſt green, but afterwards yelloviſh, and are ſofter to the touch than many other of the productions of this kind: they are uſually about the ſize of a large pea, but ſometimes they grow to the bigneſs of a nut. When opened, they are found to be of that kind which are inhabited each by one inſect only, and each contains one cavity. The cavity in this is, however, larger than in any other gall of the ſize, even in many others of three times the ſize; the ſides of it being very little thicker than the ſubſtance of the leaf.

On opening theſe leaf galls, which are properly the habitation only of one animal, it is common to find two, the ſtronger preying upon the body of the other, and ſucking its juices, as it does thoſe of the leaf; often it is found wholly employed in devouring its unoffending neighbour at once: this is probably the caſe when its time of eating is nearly over: and, in fine, when we find the gall inhabited by only one inſect, or containing only one chryſalis, as it ought in its natural ſtate to do, we are never certain that this is the proper inhabitant, as it may be one of thoſe deſtroyers who has eaten up the other, and ſupplied its place. *Reaumur's Hiſt. Inſ.*

OAT, in huſbandry, a grain, of which there are ſeveral ſpecies, as the black, red, white, &c. and which are cultivated in the following manner.

Black oats are commonly ſown upon an etch crop, or on a lay, which they plough up in January, when the earth is moiſt, taking care to turn the turf well, and to lay it even and flat. Oats are to be ſown earlier in the northern parts of England than in the ſouthern.

Oats are ſown with a broad caſt, at twice, as they do barley, harrowing it well in; but this muſt always be harrowed the ſame way that the furrows lie of a lay, or but very little croſs, for fear of raiſing the turf; but upon an etch, as ſoon as the land is ploughed on an edge, they ſow and harrow it in once; then ſow it a ſecond time, the full quantity, and harrow it five or ſix times over, obſerving to harrow it once or twice acroſs, which breaks the clods, and covers the ſeed better than harrowing all one way. They commonly ſow them upon a broad ridge, which they give the land but one ploughing for. The uſual time for ſowing black oats is, in the beginning of February, or a very few weeks later, ſometimes not till the beginning of March: they are a hardy grain, and will bear any thing of wet or cold. Four buſhels of ſeed is the quantity for an acre; but they grow beſt on a moiſt land, though they will not miſs any where. The farmer knows that his oats are ripe when the ſtalks turn yellow, the grain feels hard, and the huſk begins to open, and ſhew the ſeed. After they are cut they ſhould lie for the dew and the rain to plump them, and make them threſh well; and, if weedy, to kill the weeds: but, if there happen much rain, they muſt be got in again as ſoon as dry, otherwiſe the oats will ſoon fall out of the huſks, and great part of the crop be loſt.

Red oats is a kind of corn very common in Staffordſhire, and ſome of the northern counties; it is a ſort of naked oat, and is very proper for making oat-meal, becauſe the kernel threſhes out of the hull, without carrying it to the mill, or drying of it. This oat is cultivated in the ſame manner as barley.

White oats is commonly ſown upon an etch, after wheat, rye, or barley; they only give the land one ploughing, and ſow them, and harrow them, as they do the black oats, except the land is ſubject to weeds; in that caſe, it is good to plough up the wheat, or rye ſtubble, in November, which will make it rot the better, and be a kind of winter fallowing. Only, if you have a very dry burning ground, which black oats will not delight in, they often in that caſe, ſow them upon a lay. March and April are the uſual time of ſowing white oats, and the drier the weather is when they are ſown, the better; they grow beſt upon a dry, gravelly, or ſandy land, and they are the beſt of all to be ſowed upon a land very ſubject to weeds, becauſe, being ſowed late, they allow a very little ploughing, and, growing very thick after this, they over-top the weeds ſooner than any other plant. White oats generally yield about the ſame quantity as thoſe of the black, that is, about twenty buſhels from an acre. *Mortimer's Huſbandry.*

Wild OAT, in huſbandry, a kind of oat, or oat-graſs, which comes up of itſelf, without ſowing, and is much

hated

hated and dreaded by the farmers. This, in many counties of England, is the greateſt of all hindrances of the good crops of barley, and often of other grain. It is a rough and hairy oat, and uſually black. In the wetter years, and after much froſt, this is found to be moſt troubleſome.

The beſt remedy the farmer has againſt this, is, to ſow the land moſt apt to produce it with beans, and when they are come up to about three inches high, to turn in ſheep upon the ground, about twenty ſheep to an acre; theſe will eat up all the ſhoots of the wild oat, and not touch the beans ſo long as there is any of the oat ſhoots left. *Moreton's Northampt.*

OATH, *Jusjurandum*, is a ſolemn affirmation, in which the perſons ſworn invoke the Almighty to witneſs that their teſtimony is true, renouncing all claim to his mercy, and calling for his vengeance if it be falſe.

OBADIAH, or *the Prophecy of* OBADIAH, a canonical book of the Old Teſtament, which is contained in one ſingle chapter, and is partly an invective againſt the cruelty of the Edomites, who mocked and derided the children of Iſrael, as they paſſed into captivity, and with other enemies, their confederates, invaded and oppreſſed thoſe ſtrangers, and divided the ſpoil amongſt themſelves: and partly a prediction of the deliverance of Iſrael, and of the victory and triumph of the whole church over her enemies.

OBELISK, in architecture, a truncated, quadrangular, and ſlender pyramid, raiſed as an ornament, and frequently charged either with inſcriptions or hieroglyphics.

Obeliſks appear to be of very great antiquity, and to be firſt raiſed to tranſmit to poſterity precepts of philoſophy, which were cut in hieroglyphical characters: afterwards they were uſed to immortalize the great actions of heroes, and the memory of perſons beloved. The firſt obeliſk mentioned in hiſtory was that of Rameſes king of Egypt, in the time of the Trojan war, which was forty cubits high. Phius, another king of Egypt, raiſed one of forty-five cubits; and Ptolemy Philadelphus, another of eighty-eight cubits, in memory of Arſinoe Auguſtus erected one at Rome in the Campus Martius, which ſerved to mark the hours on an horizontal dial, drawn on the pavement. They were called by the Egyptian prieſts the fingers of the ſun, becauſe they were made in Egypt alſo, to ſerve as ſtyles, or gnomons to mark the hours on the ground. The Arabs ſtill call them Pharaoh's needles, whence the Italians call them aguglia, and the French aiguilles.

The proportions in the height and thickneſs are nearly the ſame in all obeliſks; their height being nine, or nine and a half, and ſometimes ten times their thickneſs; and their diameter at the top never leſs than half, and never greater than three-fourths of that at the bottom.

OBELISK, †, in grammar, a mark in form of a dagger, uſed to refer the reader to a note in the margin, at the ſide or bottom of a page.

OBJECT, in philoſophy, ſomething apprehended, or preſented to the mind, by ſenſation or by imagination.

Chauvinus defines an object to be that about which a power, act, or habit is employed: thus, good is the object of the will, truth of the underſtanding; and, in like manner, colour is the object of ſight, ſound of hearing, &c.

Object is alſo uſed for the matter of art or ſcience, or that about which it is employed; in which ſenſe, it alſo coincides with ſubject.

OBJECT GLASS *of a Teleſcope*, or *Microſcope*, the glaſs placed at the end of the tube which is next the object. See the articles TELESCOPE and MICROSCOPE.

OBIT, among Chriſtians, a funeral ſolemnity, or office for the dead, moſt commonly performed when the corpſe lies in the church uninterred.

It likewiſe ſignifies the anniverſary office, or annual commemoration of the dead, performed yearly on the day of their death, with prayers, alms, &c.

OBLATI, in church hiſtory, were ſecular perſons, who devoted themſelves and their eſtates to ſome monaſtery, into which they were admitted as a kind of lay-brothers.

OBLATION, a ſacrifice, or offering made to God. See SACRIFICE.

OBLIGATION, in general, denotes any act whereby a perſon becomes bound to another, to do ſomething; as to pay a ſum of money, be ſurety, or the like.

OBLIQUE, in geometry, ſomething aſlant, or that deviates from the perpendicular. Thus an oblique angle, is either an acute or obtuſe one, i. e. any angle except a right one. See ANGLE.

OBLIQUE. ASCENSION, in aſtronomy. See the article ASCENSION.

OBLIQUE CASES, in grammar, are all the caſes except the nominative. See CASE.

OBLIQUE DESCENSION, in aſtronomy. See the article DESCENSION.

OBLIQUE LINE, that which, falling on another line, makes oblique angles with it, viz. one acute, and the other obtuſe.

OBLIQUE PERCUSSION, in mechanics. See the article PERCUSSION.

OBLIQUE PLANES, in dialling, are thoſe which recline from the zenith, or incline towards the horizon. See the articles DIAL and PLANE.

The obliquity, or quantity of this inclination, or reclination, may be found by means of a quadrant.

OBLIQUE SAILING, in navigation, is when a ſhip ſails upon ſome rhumb between the four cardinal points, making an oblique angle with the meridian; in which caſe, ſhe continually changes both latitude and longitude. See SAILING.

OBLIQUE SPHERE is where the pole is elevated any number of degrees leſs than 90°; in which caſe, the axis of the world, the equator, and parallels of declination will cut the horizon obliquely. See SPHERE.

OBLIQUITY *of the Ecliptic*. See ECLIPTIC.

OBLONG, in general, denotes a figure that is longer than broad: ſuch is a parallelogram, ellipſis, &c. See PARALLELOGRAM and ELLIPSIS.

OBOLUS, in antiquity, an ancient Athenian coin.

Among ancient phyſicians, obolus likewiſe denoted a weight, equal to ten grains.

OBSECRATION, in rhetoric, a figure whereby the orator implores the aſſiſtance of God, or man.

OBSEQUIES, the ſame with funeral ſolemnities. See BURIAL, FUNERAL, &c.

OBSERVATION, among navigators, ſignifies the taking the ſun's, or a ſtar's meridian altitude, in order thereby to find the latitude.

OBSERVATORY, a place deſtined for obſerving the heavenly bodies; being, generally, a building erected on ſome eminence, covered with a terrace for making aſtronomical obſervations.

OBSIDIONALIS, an epithet applied by the Romans to a ſort of crown. See CROWN.

OBSTRUCTION, in medicine, ſuch an obturation of the veſſels, as prevents the circulation of the fluids, whether of the ſound and vital, or of the morbid and peccant kind, through them, ariſing from an acceſs of the bulk of the fluid to be tranſmitted, above the capacity of the veſſel which ought to tranſmit it.

Such an obſtruction, then, proceeds either from the narrowneſs of the veſſels, or the exceſſive bulk of the fluids to be tranſmitted through them, or a concurrence of both theſe circumſtances. The narrowneſs of the veſſels is produced either by external compreſſion, the proper contraction of the veſſels themſelves, or an increaſed thickneſs in their membranes. The bulk of the molecules of the blood is increaſed by the viſcidity of the fluids, or by means of an error loci.

An obſtruction may alſo proceed from a narrowneſs of the veſſels in conjunction with the preternatural bulk of the molecules of the fluids.

The veſſels may be externally compreſſed, 1. By an adjacent tumour, either of the plethoric, inflamed, purulent, ſchirrous, cancerous, œdematous, encyſted, ſteatomatous, atheromatous, melicerous, hydatidic, aneuriſmatic, varicoſe, tophous, pituitous, calculous, or callous kind. 2. By fractures, luxations, diſtortions, or diſtractions of the harder parts of the body, compreſſing the flexible and pliant veſſels. 3. By every cauſe which preter-

ternaturally ſtretches and lengthens the veſſels, whether by a tumour, or the preſſure of a part when out of its natural ſituation, or by any external ſtretching force. 4. By external compreſſing cauſes, ſuch as too tight cloths, bandages, the weight of an incumbent body preſſing upon one particular part, and ligatures. This effect may alſo be produced by motion, attrition, and embracing other bodies; for when any part of the human body is moved againſt an hard obſtacle, the flexible veſſels are neceſſarily compreſſed. An increaſed contraction, eſpecially of the ſpiral fibres, and alſo of the longitudinal, leſſens the cavities of the veſſels; and this contraction ariſes firſt from every cauſe which increaſes the elaſtic force of the fibres, veſſels, and viſcera; ſecondly, from the tumour and preternatural diſtention of thoſe minute veſſels, by a contexture of which the ſides of the larger veſſels are formed; and thirdly, by a diminution of that cauſe which dilates the veſſels, whether for inſtance inanition, or a languid ſtate of the veſſels.

The thickneſs of the membranes of the veſſels is increaſed firſt by every tumour happening in thoſe veſſels, by the union and contexture of which the membranes are formed; and ſecondly, by calluſes, either of a cartilaginous, membranous, or bony nature, formed there.

The effects of an obſtruction are various, according to the diverſity of the obſtructed veſſel, and obſtructing matter. In the ſanguiferous arterial veſſels, an inflammation of the firſt kind happens; in the dilated lymphatic arterial veſſels, an inflammation of the ſecond kind; in the larger lymphatic veſſels, an œdema; in the ſmaller, pains without any apparent tumour; but in the pinguiferous, oſſeous, medullary, and biliary veſſels, other diſorders ariſe from an obſtruction.

When the different kinds of obſtructions are diſtinctly known, it is no difficult matter to find a cure adapted to each. For that ſpecies of obſtruction which ariſes from external compreſſion indicates the removal of the compreſſing cauſe, if poſſible. That ſpecies of obſtruction which ariſes from an increaſed contraction of the fibres may be removed, firſt, by ſuch medicines as correct the too great contraction of the fibres, veſſels, and viſcera; ſecondly, and more eſpecially, if their virtues have immediate acceſs to the part affected, which advantage is principally to be obtained by fomentations, fumigations, baths, and ointments; thirdly, by ſuch remedies as empty the too full veſſels compoſing the membranes. This intention is anſwered by evacuants, in general, but eſpecially by laxative, diluting, reſolvent, attenuating, deterſive, and evacuant medicines applied to the veſſels themſelves; and fourthly, by ſuch medicines as reſolve calloſities when formed.

The unfitneſs of the fluids for paſſing through the veſſels, which depends upon their loſing their ſpherical figure, may be known from an inveſtigation of its cauſes, which are for the moſt part ſubjected to the ſenſes. It is cured by ſuch remedies as reſtore the ſpherical figure of the globules of the blood. Of this kind are all thoſe things which increaſe the motion of the fluids through the veſſels and viſcera; ſuch as all ſtimulating and corroborating medicines, as alſo briſk motion.

As the concretion and inſpiſſation of the fluids ariſe from different cauſes, ſo it requires different methods of treatment, and different medicines, according to the various conditions of the patient. And this diverſity of cauſes, when inveſtigated, will diſcover the moſt proper medicines, and the beſt method of uſing them. In general, the concretion of humours is removed firſt by the reciprocal motion of the veſſels; ſecondly, by dilution; thirdly, by an attenuating fluid conveyed to the maſs of blood mixed with it, and circulating along with it; and fourthly, by removing the coagulating cauſe.

The reciprocal motion of the veſſels is procured firſt by ſuch remedies as diminiſh the diſtending cauſes, ſuch as veneſection; ſecondly, by ſuch medicines as corroborate the veſſels; thirdly, by friction and muſcular motion.

The cauſe which coagulates the fluids, is removed by the influence of ſtrongly attracting remedies; but when the fluids propelled into improper places become incapable of circulating, and by that means generate obſtructions, many and violent diſorders are produced; for which reaſon the ſource and cauſe from which they proceed ought to be carefully attended to. The cure is obtained, firſt by repelling the impacted matter with a retrograde motion into larger veſſels; ſecondly, by reſolving it; thirdly, by relaxing the veſſels; and fourthly, by ſuppuration.

The impacted motion is repelled with a retrograde motion, firſt by evacuating the fluid which acts upon the impacted matter by a liberal and ſudden veneſection, by which means the obſtructing matter is forced back by the effort of the contracted veſſel; and ſecondly, by friction performed from the extremities of the baſes of the veſſels.

OBTURATOR, in anatomy, a name for the two muſcles of the thigh, one of which is the marſupialis, and is called obturator internus, and the other the obturator externus. Theſe two muſcles ſhut up the foramen or aperture between the os pubis and the hip-bone. The obturator internus comes from the internal circumference of the hole that is between the iſchium and the os pubis; and paſſing through the ſinuoſity of the iſchium, it is inſerted into the dent of the great trochanter. Its tendon lies between the gemini: it turns the thigh to the outſide. The obturator externus comes from the external circumference of the ſame hole as the former; it embraces the neck of the thigh bone, and paſſes under the quadratus to the ſmall cavity of the great trochanter.

OBTUSE ſignifies blunt, dull, &c in oppoſition to acute, ſharp, &c. thus we ſay obtuſe angle, obtuſe angled triangle, &c. See ANGLE, &c.

OCCATION, a term in the ancient huſbandry, by which they expreſſed what we do by harrowing, though they performed it with a different inſtrument, being a kind of rake, with the teeth of which they levelled the ground, and broke the clods; and with the hand ſtrewed the corn over this level ground. Then they brought on the plough and ploughed it in, ſo that the grain was ſown in furrows, as we expreſs it, and uſually came up as we ſee it does at this time with us in the ſame caſe in the lower parts only. After it had got a few leaves they went over the ground again with the ſame inſtrument to clear away the weeds, and move the earth about the roots of the young plants.

OCCIDENT, in geography, the weſtward quarter of the horizon, or that part of the horizon where the ecliptic, or the ſun therein, deſcends into the lower hemiſphere, in contradiſtinction to orient. Hence we uſe the word occidental, for any thing belonging to the weſt, as occidental bezoard, occidental pearl, &c.

OCCIPITAL, in anatomy, a term applied to the parts of the occiput. See OCCIPUT.

OCCIPITALES, or the OCCIPITAL MUSCLES, ariſe on each ſide from the os occipitis, where it adheres to the temporal bones: they aſcend upwards over the oſſa bregmatis, and join their aponeuroſes with the frontal ones, to which they ſeem to afford their fixed point: they, together with the frontal ones, cover the head as it were with a helmet, or cap, and they aſſiſt their actions. Morgagni has obſerved, that theſe occipital muſcles are ſometimes entirely wanting, and at others, when not abſolutely deficient, that they are ſo thin that it is ſcarce poſſible to ſee them; ſometimes alſo they are larger than uſual, and are divided as it were each into two. It has been from an examination of them in ſome ſubject, in which they were of this kind, that Sanctorius makes two occipital muſcles of each ſide.

OCCIPITIS Os, the OCCIPITAL BONE, in anatomy, the fourth bone of the cranium, ſo called from its ſituation in the occiput, or back part of the ſkull. See the article SKULL.

Its figure reſembles a lozenge, irregularly notched, or indented; being convex on the outſide, and concave within. It is very thick, and has a protuberance about the middle of its convex ſide: it has alſo three apophyſes, two of which are condyloide, ſerving for its articulation with the upper vertebra of the neck, whereby the whole head is ſupported.

OCCIPUT, in anatomy, the hinder part of the head, or ſkull.

OCCULT, ſomething ſecret, hidden or inviſible. The occult ſciences are magic, necromancy, cabbala, &c.

Occult, in geometry, is uſed for a line that is ſcarce perceivable, drawn with the point of the compaſſes, or a leaden pencil. Theſe lines are uſed in ſeveral operations, as the raiſing of plans, deſigns of building, pieces of perſpective, &c. They are to be effaced when the work is finiſhed.

OCCULTATION, in aſtronomy, the time a ſtar or planet is hid from our ſight, by the interpoſition of the body of the moon, or of ſome other planet. See Eclipse.

Circle of Perpetual Occultation is a parallel in an oblique ſphere, as far diſtant from the depreſſed pole, as the elevated pole is from the horizon. See the article Horizon.

All the ſtars between this parallel and the depreſſed pole, never riſe, but lie conſtantly hid under the horizon of the place.

OCCUPANT, in law, the perſon that firſt ſeizes or gets poſſeſſion of a thing; and this by law muſt be of what has a natural exiſtence, as of land, &c.

OCCUPATION, in a legal ſenſe, is taken for uſe or tenure, as in deeds it is frequently ſaid, that ſuch lands are or lately were in the tenure or occupation of ſuch a perſon. This is likewiſe uſed for a trade, or myſtery.

Occupation, or Occupancy, in the civil law, denotes the poſſeſſion of ſuch things as at preſent properly belong to no private perſon; but are capable of being made ſo, as by ſeizing or taking of ſpoils in war, by catching things wild by nature, as birds and beaſts of game, &c. or by finding things before undiſcovered, or loſt by their proper owners.

OCEAN, in geography, that vaſt collection of ſalt and navigable waters in which the two continents, the firſt including Europe, Aſia, and Africa, and the laſt America, are incloſed like iſlands. The ocean is diſtinguiſhed into three grand diviſions. 1. The Atlantic ocean, which divides Europe and Africa from America, which is generally about three thouſand miles wide. 2. The Pacific ocean, or South-ſea, which divides America from Aſia, and is generally about ten thouſand miles over: and, 3. The Indian ocean, which ſeparates the Eaſt-Indies from Africa, which is three thouſand miles over. The other ſeas, which are called oceans, are only parts or branches of theſe, and uſually receive their names from the countries they border upon.

OCHLOCRACY, οχλοκρατεια, that form of government wherein the populace has the chief adminiſtration of affairs.

OCHRE, *Ochra*, in natural hiſtory, a genus of earths ſlightly coherent, and compoſed of fine, ſmooth, ſoft, argillaceous particles, rough to the touch, and readily diffuſible in water.

Ochres are of various colours, as red, yellow, blue, brown, green, &c. Of the red there are eleven ſpecies, of the yellow as many, of blue one, of brown two, of green one, and of black two. All which have, at one time or other, been uſed in painting.

The earths of this kind, uſed in medicine, are only three. 1. A yellow kind, deſcribed by Dioſcorides under the name of ochra Attica, and eſteemed a very valuable external medicine in inflammations and tumours, applied in form of a cataplaſm. 2 The deep red kind, called rubrica ſinopica, and ſaid to be an excellent aſtringent, and conſequently good in diarrhœas, dyſenteries, and hæmorrhages of all kinds. 3. The ſpecies of ochre, called lapis armenus. See Lapis.

OCIMUM, or Ochymum, baſil, in botany, a genus of plants, with a bilabiated cup: its flower is monopetalous and ringent: and its ſeeds, which are four in number, are contained in the cup, which cloſes for that purpoſe.

Both the herb and ſeeds of baſil are uſed in medicine, and are ſaid to be good in diſorders of the lungs, and to promote the menſes.

OCTAETERIDES, in chronology, denotes a cycle of eight years, at the end of which three entire lunar months were added.

This cycle was in uſe at Athens, till Meton diſcovered the golden number.

OCTAGON, or Octogon, in geometry, is a figure of eight ſides and angles; and this, when all the ſides and angles are equal, is called a regular octagon, or one which may be inſcribed in a circle. If the radius of a circle circumſcribing a regular octagon be $= r$, and the ſide of the octagon $= y$; then $y = \sqrt{2r^2 - r\sqrt{2r^2}}$.

Octagon, in fortification, denotes a place that has eight baſtions. See the article Fortification.

OCTAHEDRON, or Octaedron, in geometry, one of the five regular bodies, conſiſting of eight equal and equilateral triangles.

The word is compounded of the Greek οκτω, eight, and εδρα, a ſide.

The ſquare of the ſide of the octahedron is to the ſquare of the diameter of the circumſcribing ſphere, as 1 to 2.

If the diameter of the ſphere be 2, the ſolidity of the octahedron inſcribed in it will be 1,33333, nearly.

The octahedron is two pyramids put together at their baſes, therefore its ſolidity may be found by multiplying the quadrangular baſe of either of them, by one third of the perpendicular height of one of them, and then doubling the product.

OCTANDRIA, in botany, one of the claſſes of plants eſtabliſhed by Linnæus, the eighth in order; the characters of which are, that all the plants comprehended in it have hermaphrodite flowers, and eight ſtamina or male parts in each.

It is ſub-divided into orders, which are denominated from the number of piſtils contained in each flower: thus the octandria-monogynia contain eight ſtamina, and only one piſtil; the octandria-digynia, eight ſtamina, and two piſtils; and ſo on, trigynia, tetragynia, &c. denoting three, four, &c. piſtils.

OCTANT, or Octile, in aſtronomy, that aſpect of two planets, wherein they are diſtant an eighth part of a circle, or 45° from each other.

OCTATEUCH, an appellation given to the eight firſt books of the Old Teſtament. See the article Canon.

OCTAVE, in muſic, an harmonical interval, conſiſting of ſeven degrees, or leſſer intervals.

The moſt ſimple perception that we can have of two ſounds, is that of uniſons; in regard the vibrations there begin and end together. The next to this is the octave, where the more acute ſound makes preciſely two vibrations, while the grave or deeper one makes one; and wherein, by conſequence, the vibrations of the two meet at every vibration of the more grave one. Hence uniſon and octave paſs almoſt for the ſame concord: hence alſo the proportion of the two ſounds that form the octave are in numbers or in lines, as 1 : 2; ſo that two chords or ſtrings of the ſame matter, thickneſs, and tenſion, one whereof is double the length of the other, produce the octave.

Octave, in law, ſignifies the eighth day incluſive after any feaſt.

OCTILE, or Octant. See Octant.

OCTOBER, in chronology, the tenth month of the Julian year, conſiſting of thirty-one days: it obtained the name of October from its being the eighth month in the calendar of Romulus. See the article Month and Year.

OCTOSTYLE, in the ancient architecture, is the face of an edifice adorned with eight columns.

The eight columns of the octoſtyle may either be diſpoſed in a right line, as in the Pantheon, and the pſeudodiptere temple of Vitruvius; or in a circle, as in the round monothere temple of Apollo Pythius at Delphi, &c.

OCULUS, the eye, in anatomy. See Eye.

Oculus Beli, in natural hiſtory, one of the ſemi-pellucid gems, of a greyiſh white colour, variegated with yellow, and with a black central nucleus: it is of a roundiſh form, and its variegations very beautifully repreſent the pupil and iris of the eye; whence the name.

Oculus Cati. See Asteria.

Oculus Mundi, one of the ſemi-pellucid gems, of a whitiſh grey colour, without any variegations.

ODA, in the Turkiſh ſeraglio, ſignifies a claſs, order, or chamber. The grand ſignior's pages are divided into five claſſes or chambers. The firſt, which is the loweſt in dignity, is called the great oda, from the great number of perſons that compoſe it: theſe are the juniors, who are taught to read, write, and ſpeak the languages. The ſecond is called the little oda, where, from the age of fourteen or fifteen years, till about twenty, they are trained up to arms, and the ſtudy of all the polite learning the Turks are acquainted with. The third chamber, called kilar oda, conſiſts of two hundred pages, which, beſides their other exerciſes, are under the command of the kilardgi-bachi, and ſerve in the pantry and fruitery. The fourth conſiſts only of twenty-four, who are under the command of the khazineda-bachi, and have charge of the treaſure in the grand ſignior's apartment, which they never enter with cloaths that have pockets. The fifth is called kas-oda, or privy-chamber, and is compoſed of only forty pages, who attend in the prince's chamber. Every night eight of theſe pages keep guard in the grand ſignior's bed-chamber, while he ſleeps: they take care that the light, which is conſtantly kept in the room, does not glare in his eyes, leſt it ſhould awake him; and if they find him diſturbed with troubleſome dreams, they cauſe him to be awaked by one of their agas.

ODA-BACHI, or ODDOBASSI, among the Turks, an officer equivalent to a ſerjeant or corporal among us. The common ſoldiers and janizaries, called oldachis, after having ſerved a certain term of years, are always preferred, and made biquelars; and from being biquelars, they in time become oda-bachis; that is, corporals of companies, whoſe numbers are not fixed; being ſometimes ten, and ſometimes twenty.

Their pay is ſix doubles per month, and they are diſtinguiſhed by a large felt a foot broad, with two large oſtrich-feathers.

ODE, in poetry, a ſong, or compoſition proper to be ſung.

Among the ancients, odes ſignified no more than ſongs; but with us they are very different things. The ancient odes were generally compoſed in honour of their gods, as many of thoſe of Pindar and Horace.

Theſe had originally but one ſtanza, or ſtrophe, but afterwards they were divided into three parts, the ſtrophe, the antiſtrophe, and the epode. The prieſts going round the altar ſinging the praiſes of the gods, called the firſt entrance, when they turned to the left, the ſtrophe; the ſecond, turning to the right, they called antiſtrophe, or returning; and laſtly, ſtanding before the altar, they ſung the remainder, which they called the epode.

Heroes and triumphs were alſo ſubjects for the ode; and in courſe of time love and entertainments were likewiſe thought very ſuitable to it. Here Anacreon and Sappho excelled, and Horace has left us ſome of both ſorts wrote with peculiar ſweetneſs and elegance. Among the moderns, Dryden's ode on St. Cecilia's day, and Pope's on the ſame ſubject, are juſtly allowed to exceed every thing of the kind, either in this, or in any of the modern languages.

The diſtinguiſhing character of an ode is ſweetneſs; the poet is to ſoothe the minds of his readers by the variety of his verſe, and the delicacy of words; the beauty of numbers, and the livelineſs of expreſſions: for variety of numbers is eſſential to the ode. At firſt, indeed, the verſe of the ode was but of one kind, but for the ſake of pleaſure, and to adapt it to muſic, the poets ſo varied the numbers and feet, that their kinds are now almoſt innumerable. One of the moſt conſiderable is the Pindaric, diſtinguiſhed by its boldneſs, and the rapidity of its flights.

An ode may either be ſublime or of the lower ſtrain, jocoſe or ſerious, mournful or exulting, even ſometimes ſatirical, but never epigrammatical; and, in ſhort, it may conſiſt of wit, but not of that turn which is the peculiar characteriſtic of an epigram.

ODEUM, in Grecian antiquity, a muſic-theatre, built by Pericles, the inſide of which was filled with ſeats and ranges of pillars, and on the outſide the roof deſcended ſhelving downwards from a point in the center, with many bendings, in imitation of the king of Perſia's pavillion. Here the muſical prizes were contended for, and here alſo, according to Ariſtophanes, was a tribunal.

ODONTALGIA, the tooth-ach, in medicine. See TOOTH-ACH.

ODONTOIDE, in anatomy, an appellation given to a proceſs of the ſecond vertebra of the neck, from its reſemblance to a tooth.

ODOR, or ODOUR. See SMELL.

ODOROUS, or ODORIFEROUS, appellations given to whatever ſmells ſtrongly, whether they be fetid or agreeable; but chiefly to things whoſe ſmell is briſk, and agreeable.

ODYSSEE, *ὀδυσσεια*, a celebrated epic poem of Homer, wherein are related the adventures of Ulyſſes, in his return from the ſiege of Troy. See the articles EPIC and ILIAD.

The moral of the odyſſee is, that a perſon's abſence from home, ſo that he cannot have an eye to his affairs, occaſions great diſorders; and, accordingly, the hero's abſence is the principal and moſt eſſential action of the whole poem. This poem, adds Boſſu, is better calculated for the people than the Iliad, where the ſubjects ſuffer rather from the bad conduct of their princes, than by their own fault; whereas the meaneſt people are as liable to ruin their eſtates and families by negligence, as the greateſt princes; and, conſequently, have as much need of Homer's lectures, and are as capable of profiting by them as kings themſelves.

OECONOMICS, the art of managing the affairs of a family, or community; and hence the perſon who takes care of the revenues and other affairs of churches, monaſteries, and the like, is termed oeconomus.

OECONOMY, *οἰκονομια*, denotes the prudent conduct, or diſcreet and frugal management, whether of a man's own eſtate, or that of another.

Animal OECONOMY, the firſt branch of the theory of medicine; or that which explains the parts of the human body, their ſtructure and uſe, the nature and cauſe of life and health, and the effects, or phænomena ariſing from them.

OECUMENICAL, general or univerſal. As an oecumenical council, or ſynod; that is, one at which the whole Chriſtian church aſſiſted.

The word is Greek, and derived from *οἰκουμενη*, the habitable earth.

OEDEMA, or PHLEGMATIC TUMOUR, in medicine and ſurgery, a ſort of tumour attended with paleneſs and cold, yielding little reſiſtance, retaining the print of the finger when preſſed with it, and accompanied with little or no pain. See TUMOUR.

This tumour obtains no certain ſituation in any particular part of the body, ſince the head, eye-lids, hands, ſometimes part, ſometimes the whole body, is afflicted with it. When the laſt-mentioned is the caſe, the patient is ſaid to be troubled with a cachexy, leucophlegmatia, or dropſy. See CACHEXY, &c.

But if any part of the body is more ſubject to this diſorder than another, it is certainly the feet, which are at that time called ſwelled or oedematous feet. We ſhall treat diſtinctly of them in this place, that it may appear what is the true nature and rational method of phlegmatic tumours in whatever part of the body they ſhall be found.

The proximate cauſe of an oedema, ſays Heiſter, is doubtleſs to be found in the too great ſeroſity or viſcidity of the blood, which ſtagnates in the very minuteſt veſicles of the fat, or tunica celluloſa, and by this means ſtretches out the ſkin, with which it is immediately covered. This vitiated ſtate of the blood chiefly ariſes in men who are either of a cold and phlegmatic habit of body, or are advanced in years. It chiefly falls upon them in cold weather, or in the winter, when the inclemency of the ſeaſon heightens the diſorder of nature. Another cauſe of this diſorder is an irregularity in diet, by over-eating or drinking, and by the conſtant uſe of crude, cold, and hard meats. Intermitting fevers or agues conduce very much to this diſorder, eſpecially if the patient indulges himſelf in an intemperate uſe of cooling liquors, while the fit is upon him, and his thirſt urgent: the diſeaſe frequently owes its riſe to too plentiful a diſcharge of blood from a wound, the noſe, or any other way; and

ſometimes

ſometimes to obſtructions of the menſtrual diſcharge in women, or to a compreſſion of the vena cava by the weight of the fœtus in women far gone with child; or by any ſchirrhous body in the abdomen, which greatly hinders the return of the blood from the lower limbs; or to too ſedentary a way of life; or too great an indulgence in lying in bed; or laſtly, to a phthiſis and difficulty of breathing; or to any diſorder or fatigue of body, which diſturbs or deſtroys the natural force of the heart in maintaining the circulation with due vigour.

From what has been ſaid it plainly appears by what ſigns an oedema manifeſts itſelf; therefore this obſervation alone remains to be added, that the harder the tumour is, and the longer the pitting which is made by the finger remains viſible, the ſtagnating fluid is in ſuch proportion thicker, and more tenacious.

The method of treating oedematous tumours is very different, according to the different cauſes to which they owe their riſe: therefore we are firſt to make diligent ſearch after the genuine cauſe of the diſorder, before we attempt its cure. The external method of treating theſe tumours in the legs and feet, is uſually to have recourſe to frequent frictions with warm cloths, to be repeated evening and morning till the parts grow red and hot; then the limbs are to be diligently preſerved from the injuries of the cold air, by wearing ſtockings made of ſome warm fur, and at night keeping hot bricks about the legs and feet. After this there is a proper bandage to be applied, which is to aſcend gradually from the feet up to the knees. The firſt ſtep towards a cure by internal medicines, according to Junker, muſt be the correcting the mucous and viſcid ſtate of the humours by the neutral ſalts, as tartarum vitriolatum, and the like; and by gum ammoniacum, the roots of pimpernel, and woods of ſaſſafras, guaiacum, and the like; with the warm aromatics, as ginger and the ſpices, and carminative ſeeds; the matter when thus attenuated is to be evacuated by purges of a ſtrength proportioned to the conſtitution of the patients. After the uſe of theſe internal and the external medicines juſt before-mentioned, Heiſter thinks it proper to uſe ſtrengthening remedies externally; for which end the limb is to be placed over burning rectified ſpirits of wine, wrapping it up in cloths, in ſuch a manner as it may receive the ſteam. This will incline the ſtagnating fluids to eſcape through the ſkin, or render them fit to return into the circulation, and at the ſame time reſtore the natural tone of the limb.

OENANTHE, water-dropwort, in botany, a genus of plants, with a radiated flower; the leſſer hermaphrodite ones of the diſc being compoſed of five inflexo-cordated petals: the fruit is compoſed of two oblong ſeeds, convex and ſtriated on one ſide, and plain on the other.

A ſpecies of this plant, called the hemlock-dropwort, with all the leaves multifid and obtuſe, is a terrible poiſon.

OENAS, a name uſed by ſome authors for the wood-pigeon, or bluiſh columba, with a blackiſh ſpot on the wing.

ONELÆUM, in pharmacy, a mixture of wine and oil, uſually of a thick black wine and oil of roſes; ſaid to be good for anointing wounds, to prevent an inflammation.

OENOTHERA, the PRIMROSE of VIRGINIA, in botany, a genus of plants, the flower of which conſiſts of four obverſely cordated petals: the fruit is a cylindrical capſule, with four low angles, being formed of four valves, and containing four cells, with numerous angulated ſeeds.

OESOPHAGUS, in anatomy, the gula, or gullet, is a membranaceous canal, reaching from the fauces to the ſtomach, and conveying into it the food taken in at the mouth. Its figure is ſomewhat like that of a funnel, and its upper part is called by anatomiſts the pharynx. Its ſituation is almoſt exactly behind the aſpera arteria, and longitudinally with the vertebræ of the neck and back; but when it enters the cavity of the thorax, it turns a little to the right, on account of the aorta. Its ſubſtance is compoſed of five coats, of which the firſt is membranaceous, and is continuous with the pleura in the thorax. The ſecond is robuſt and muſcular; and, in the human body, is compoſed of a double ſtratum of fibres; thoſe of one ſeries longitudinal, and thoſe of the other circular. The third coat is cellular, much like that of the inteſtines. The fourth is nervous, and diviſible into a number of other lamellæ, and furniſhed with a multitude of glands and veſſels: hence it is divided by Verheyen into two, under the names of a vaſculous and glandulous coat: this is continuous with the interior membrane of the mouth and ſtomach. The fifth is villoſe, and is called cruſta villoſa: this is always covered with a mucous liquor.

The muſcles of the pharynx ſerve to open and ſhut the oeſophagus. See PHARYNX.

The arteries of the oeſophagus are from the carotids, the aorta, the intercoſtals, and the cœliac. The veins are from the jugulars, the azygos, and the coronary vein of the ſtomach; and the nerves from the par vagum. There are alſo certain excretory ducts, called ductus excretorii novæ Vercelloni, which ariſe from the glands, and convey a ſaltiſh liquor into the œſophagus and ſtomach. The glands, from which theſe have their origin, are of three kinds: 1. The gaſtric glands, which are conglomerate, and are ſituated near the left orifice of the ſtomach. 2. The dorſal ones, which are ſituated near the fifth vertebra of the thorax. And, 3. The bronchial, tracheal, and thyroide. The uſe of the oeſophagus is for deglutition, and a commixtion of the liquid ſerving for digeſtion.

OFFICE, a particular charge or truſt, or a dignity attended with a public function.

OFFICE alſo ſignifies a place or apartment appointed for officers to attend in order to diſcharge their reſpective duties and employments.

OFFICE, in architecture, denotes all the apartments appointed for the neceſſary occaſions of a palace or great houſe, as kitchens, pantries, confectionaries, &c.

OFFICE, in the canon-law, is uſed for a benefice that has no juriſdiction annexed to it.

OFFICER, a perſon poſſeſſed of a poſt or office.

Commiſſion-OFFICERS are thoſe appointed by the king's commiſſion: ſuch are all from the general to the cornet incluſive, who are thus denominated in contradiſtinction to warrant-officers, who are appointed by the colonel's or captain's warrant, as quarter-maſters, ſerjeants, corporals, and even chaplains and ſurgeons.

Field OFFICERS are ſuch as command a whole regiment, as the colonel, lieutenant-colonel, and major.

Flag-OFFICERS. See FLAG *Officers* and ADMIRALS.

General-OFFICERS are thoſe whoſe command is not limited to a ſingle company, troop or regiment; but extends to a body of forces, compoſed of ſeveral regiments: ſuch are the general, lieutenant-general, major-generals, and brigadiers.

OFFICERS *of Police* are thoſe in whom the government and direction of the affairs of a community are inveſted, as mayors, aldermen, ſheriffs, &c.

Royal OFFICERS are thoſe who adminiſter juſtice in the king's name, as the judges, &c. See the article JUDGE.

Sea OFFICERS, or OFFICERS *of the Marine*, are thoſe who command ſhips of war. See the article NAVY.

Staff-OFFICERS are ſuch as, in the king's preſence, bear a white ſtaff, or wand; and at other times, on their going abroad, have it carried before them by a footman bare-headed: ſuch are the lord ſteward, lord chamberlain, lord treaſurer, &c.

The white ſtaff is taken for a commiſſion, and at the king's death each of theſe officers breaks his ſtaff over the hearſe made for the king's body, and by this means lays down his commiſſion, and diſcharges all his inferior officers.

Subaltern OFFICERS are all who adminiſter juſtice in the name of ſubjects; as thoſe who act under the earl marſhal, admiral, &c. In the army, the ſubaltern officers are the lieutenants, cornets, enſigns, ſerjeants, and corporals.

OFFICIAL, in the canon-law, an eccleſiaſtical judge, appointed by a biſhop, chapter, abbot, &c. with charge of the ſpiritual juriſdiction of the dioceſe. Of theſe there are two kinds; the one is, as it were, the vicar general of the dioceſe, and is called by the canoniſts officialis principalis, and in our ſtatute-law, the biſhop's chancellor,

cellor. There is no appeal from his court to the biſhop, his being eſteemed the biſhop's court. See BISHOP'S COURT.

OFFICIAL is alſo a deputy appointed by an archdeacon, as his aſſiſtant, who ſits as judge in the archdeacon's court.

OFFICINAL, in pharmacy, an appellation given to ſuch medicines, whether ſimple or compound, as are required to be conſtantly kept in the apothecaries ſhops.

OFF-SETS, in gardening, are the young ſhoots that ſpring from the roots of plants; which, being carefully ſeparated, and planted in a proper ſoil, ſerve to propagate the ſpecies.

OFF-SETS, in ſurveying, are perpendiculars let fall, and meaſuring from the ſtationary lines to the hedge, fence, or extremity of an encloſure.

OGEE, or O. G. in architecture, a moulding, conſiſting of two members, the one concave, and the other convex; or, of a round and a hollow, like an S. See MOULDING and CYMATIUM.

OGIVE, in architecture, an arch, or branch of a Gothic vault; which, inſtead of being circular, paſſes diagonally from one angle to another, and forms a croſs with the other arches.

The middle, where the ogives croſs each other, is called the key; being cut in form of a roſe, or a cul de lampe.

The members or mouldings of the ogives are called nerves, branches, or reins; and the arches which ſeparate the ogives, double arches.

OIL, *Oleum*, in natural hiſtory, an unctuous inflammable matter drawn from ſeveral natural bodies, as animal and vegetable ſubſtances.

The word is formed from the Latin *oleum*, which is derived from *olea*, an olive-tree, the fruit of which abounds with oil.

The chymiſts call it ſulphur, being the ſecond of their hypoſtatical, and of the true five chemical principles. To this they attribute all the diverſity of colours, and all the beauty and deformity of bodies: probably their various odours in a great meaſure ariſe from it. It ſweetens the acrimony of ſalts; and by ſtopping, or filling up the pores of a mixed body, keeps it longer from corruption, where it abounds. And we find that the ever-greens, ſuch as box, holly, &c. abound more with oil than other plants.

There are two ſorts of oils; one of which ſeems to be mixed with ſpirit, for it can never be drawn pure, and which will ſwim upon water; ſuch as oil of anniſeeds, lavender, roſemary, &c. which the chemiſts call eſſential, and is commonly drawn in an alembic, with ſtore of water. And another kind, which probably is mixed with ſalts, and theſe will ſink in water; ſuch are the oils of ponderous woods, as guaiacum, box, cloves, &c.

There are ſome things which are very improperly called oils; as oil of tartar per deliquium, which is only a fixed ſalt diſſolved. Oil of vitriol, which is nothing but the moſt cauſtic and ſtrongeſt part of the ſpirit of vitriol. Oil of antimony, which is only a mixture of antimony and an acid ſpirit.

Oils are of two kinds, the one obtained by expreſſion, and the other by diſtillation.

The method of procuring oil by expreſſion from nuts, ſeeds, maſt, &c.

Take two pounds of ſweet almonds, blanched and beat ſmall in a ſtone mortar; wrap the maſs up in a piece of ſtrong thick canvas, and commit it to a ſtrong ſcrew preſs; when, being ſqueezed between two cold iron cheeks, it will gradually part with a conſiderable quantity of oil.

This method holds of all thoſe vegetable matters that contain a copious oil, in a looſe manner, or in certain cavities or receptacles; the ſides whereof being broke, or ſqueezed, makes them let go the oil they contain: and thus the zeſt or oil of lemon-peel, orange-peel, citron-peel, &c. may be readily obtained by preſſure, without the uſe of fire. But how far this method of obtaining oils may be applied to advantage, ſeems not hitherto conſidered. It has been commonly applied to olives, almonds, linſeed, rape-ſeed, beech-maſt, ben-nuts, walnuts, bay-berries, mace, nutmeg, &c. but not that we know of to juniper-berries, Caſhew-nuts, Indian cloves, pine-apples, and many other ſubſtances that might be enumerated, both of foreign and domeſtic growth. It has, however, been of late ſucceſsfully applied to muſtard-ſeed, ſo as to extract a curious gold-coloured oil, leaving a cake behind, fit for making the common table-muſtard.

Certain dry matters, as well as moiſt ones, may be made to afford oils by expreſſion, by grinding them into a meal, which, being ſuſpended to receive the vapour of boiling water, will thus be moiſtened ſo as to afford an oil, in the ſame manner as almonds; and thus an oil may be procured from linſeed, hemp-ſeed, lettuce ſeed, white poppy-ſeed, &c.

As to the treatment of oils, obtained by expreſſion, they ſhould be ſuffered to depurate themſelves by ſtanding in a moderately cool place, to ſeparate from their water, and depoſite their fæces; from both which they ought to be carefully freed. And if they are not thus rendered ſufficiently pure, they may be waſhed well with freſh water, then thoroughly ſeparated from it again, by the ſeparating-glaſs, whereby they will be rendered bright and clear.

Particular care muſt be had to keep ſuch of theſe oils cool as are deſigned for eating, or for any internal uſe; becauſe they are apt in a few days to turn rancid and corroſive with the heat of the ſummer's ſun, ſo as to prove very unwholeſome. Hence the phyſician and apothecary ſhould be curious that the oils given in pleuriſies and other diſtempers be freſh drawn from ſound ſubjects, no way tainted, or already turned rancid; as almonds, piſtachios, and other nuts are apt to do: and again, that theſe oils have felt no conſiderable heat, either by drawing or ſtanding long in a warm place: and the ſame caution ſhould likewiſe extend to animal oils, intended both for internal and external uſe; ſince theſe alſo become rancid, or change to a yellow, red, or grey colour in hot weather; and thus become exceedingly nauſeous and corroſive, as we ſee in butter, bacon, and other fat bodies; which then prove only fit for the tallow-chandler, or other ignoble uſes.

The ſame method is likewiſe applicable to the procuring oils or fats from certain animal bodies which contain much fat, being chopped ſmall, and, ſet in a pan over the fire, become fit for the canvas bag; and by preſſure afford a large quantity of fat, as we ſee in the art of chandlery; which, thus extracting the oily matter, leaves an hard cake, or what they commonly call graves, behind.

Theſe graves, and all the reſiduums of the preſent proceſs, after being ſqueezed ever ſo hard with the preſs, will ſtill afford a copious oil by boiling it in water; ſo that perhaps it might be made more profitable for the tallow-chandler to boil his graves for oil, as bones are uſually boiled for it, than to diſpoſe of them in the ordinary manner.

So likewiſe if the almonds remaining in canvas, after the expreſſion of their oil, be ground in a mortar with warm water, the water will thus extract the remaining oil, and turn therewith into a milky liquor or emulſion. And if this operation had been performed upon the almonds at firſt, before we committed them to the preſs, we might thus have diſſolved out all their oil, and left only a dry chaffy, or light huſky, and exhauſted matter behind. Whence we have a method of diſſolving oils in water, and thereby of making a kind of artificial milk, which by ſtanding will afford a cream, and turn ſour, like the milk of animals; which will not grow rancid with heat as oil. Whence ſuch emulſions may, in ſome caſes, be medicinally uſed, with greater ſafety and ſucceſs than expreſſed oils.

Any of theſe expreſſed oils will receive particular colours and odours, at the diſcretion of the artiſt. Thus, for example, if a little alkanet root be barely infuſed in olive oil, it gives a beautiful red colour to that oil, without altering its taſte; ſo again if a few drops of the eſſential oil of cinnamon be added to a pint of ſallad oil, ſuch ſallad oil may be rendered agreeable to thoſe who admire the flavour of cinnamon. And thus may oil, butter, &c. be diverſified, infinite ways, by a proper uſe of tingng ingredients and ſuitable chemical oils.

The ſame contrivance has likewiſe its uſes in making eſſences for the ſervice of the perfumer; not only where eſſential oils are procurable, but alſo where theſe either cannot well be obtained, or only in ſmall quantity. The eſſential oil of jaſmin flowers, honey-flowers, ſweet briar, damaſk roſes, lilies of the valley, &c. are either extremely dear, or ſcarce obtainable by diſtillation, and in ſome of them the odorous matter is ſo ſubtile as almoſt to be loſt in the operation. But if jaſmin flowers, damaſk roſes, lilies of the valley, &c. be barely infuſed in fine oil of nuts, oil of ben, drawn without heat, and kept in a cool place, the ſubtile odorous matter of the flowers will thus paſs into the oil, and richly impregnate it with their native and odoriferous ſpirit, which can ſcarce otherwiſe be procured, or ſeparated from the flowers, without loſs or debaſement. And theſe eſſences may be rendered perfect by ſtraining of the oil at firſt put on, and letting it ſtand again, without heat, upon freſh flowers; thus repeating this operation twice or thrice.

To conſider the thing attentively; we ſhall find that the eſſences thus obtained are a kind of eſſential oils, not greatly differing from thoſe prepared by diſtillation from the flowers, ſeeds, or barks of odoriferous vegetables; for all ſuch eſſential oils are found to be little more than the native odorous ſpirits of the vegetable ſubject, wrapped up, lodged, or entangled in an unctuous or direct oily ſubſtance. This oily ſubſtance indeed riſes or becomes vegetable by the heat of boiling water; but ſo do not the oils gained by expreſſion; whence the principal difference betwixt thoſe natural and artificial eſſential oils, as we may call them, ſeems to conſiſt in the different tenacity, volatility, or fixedneſs of their unctuous or direct oily parts; the native ſpirit appearing the ſame in both; though indeed, it is the more delicate and unimpaired in the artificial kind of eſſential oils, as not having here felt the force of fire. And hence, perhaps, ſome conſiderable improvements might be made in the arts of the oilman, perfumer, and apothecary; not to mention other œconomical uſes, and the art of the dairy.

The method of procuring eſſential oil is in the following manner.

Take eight pounds of juniper-berries, bruiſe them in a ſtone mortar, put them into a ſtill, along with four gallons of river water; and, working with a briſk fire, draw off a gallon of water, with it will be obtained a conſiderable proportion of a fragrant eſſential oil, which muſt be ſeparated from the water by a ſeparating glaſs.

This proceſs is applicable to the diſtilling of the eſſential oils from flowers, leaves, barks, roots, woods, gums, and balſams, with a ſlight alteration of circumſtances, as by longer digeſtion, briſker diſtillation, &c. according to the tenacity and hardneſs of the ſubject, the ponderoſity of the oil, &c.

Eſſential oils may be divided into two claſſes, according to their different ſpecific gravities; ſome floating upon water, and others readily ſinking to the bottom. Thus, the eſſential oils of cloves, cinnamon, and ſaſſafras, readily ſink; whereas thoſe of lavender, marjoram, mint, &c. ſwim in water: the lighteſt of theſe eſſential oils, is, perhaps, that of citron-peel, which even floats in ſpirit of wine; and the heavieſt ſeems to be oil of ſaſſafras. See the article GRAVITY.

For obtaining the full quantity of the more ponderous oils from cinnamon, cloves, ſaſſafras, &c. it is proper to reduce the ſubjects to powder; to digeſt this powder for ſome days in a warm place, with thrice its quantity of ſoft river-water, made very ſaline by the addition of ſea-ſalt, or ſharp with oil of vitriol; to uſe the ſtrained decoction, or liquor left behind in the ſtill, inſtead of common water, for freſh digeſtion; to uſe for the ſame purpoſe the water of the ſecond running, after being cleared of its oil; not to diſtil too large a quantity of theſe ſubjects at once; to leave a conſiderable part of the ſtill, or about one fourth empty; to uſe a briſk fire, or a ſtrong boiling heat, at the firſt, but to ſlacken it afterwards; to have a low ſtill-head, with a proper internal ledge and current leading to the noſe of the worm; and, finally, to cohobate the water, or pour back the liquor of the ſecond running upon the matter in the ſtill, repeating this once or twice.

Theſe cautions are all neceſſary, in order to diſtil the ponderous eſſential oils to profit and perfection. The phyſical reaſons whereon they depend may deſerve to be conſidered. 1. The reduction of the ſubject to powder expoſes all its parts the better to the action of the water and ſalt; whereby the oil is the more mollified, attenuated, and rendered fitter to riſe along with the aqueous vapour in diſtillation. 2. The digeſtion is requiſite for the ſame reaſon, as being no more than allowing time for this action to be performed in a moderate warmth. The water ſhould rather be the ſoft water of rivers than that of rain, which is more corruptive or fermentative; or, than of ſprings, which is often ſo hard as not to mollify the oil, but rather defend it from the action of the ſalt, or acid, which are added not only to prevent all tendency to fermentation or corruption, that would abſolutely change or deſtroy the oil; but, more particularly, as having the known property of attenuating, liquefying, diſſolving, and purifying groſs viſcous and tenacious oils. Beſides which, it likewiſe increaſes the ſpecific gravity of the water; whereby the ſubject is now buoyed up, ſo that it cannot readily touch the bottom of the ſtill, or come in the way of the fire to be ſcorched: and at the ſame time, this addition alſo increaſes the heat of the liquor, or makes it exceed that of mere boiling water, whence the aſcent of the oil is likewiſe promoted. 3. The ſtrained decoction is properly uſed inſtead of water, as being already ſaturated with oily particles; ſo that it cannot much rob the ſubject. And, 4. The ſame holds alſo of the water of the ſecond running, which neceſſarily contains ſome oily particles. 5. If too large a quantity of the ſubject be diſtilled at once, the heat will neceſſarily act unequally, or ſtrong upon ſome parts, and weak upon others; whence, as the oil is ſo extremely ponderous, a large part of it will be left behind in the ſubject. 6. If too much empty ſpace be left in the ſtill, it will be difficult for the ponderous oil to aſcend; and, if too intenſe a heat be uſed, it deſtroys the grateful odour of the oil without raiſing any conſiderable quantity; and, if the ſtill be filled too full, the matter will be apt to boil over and foul the oil. 7. The fire is ordered to be briſk at firſt, to prevent the oil, now in ſome meaſure ſeparated by the heat, from going back into the ſubject; but, after a part is thus come over, if the fire be not a little ſlackened, the oil is apt to ſcorch, and come out of the noſe of the worm, in the form of a ſmoke, that cannot be catched and condenſed; yet the whole operation needs not be long continued, or above two hours, becauſe the valuable part of the oil ſoon comes over. 8. If the head of the ſtill be not low, the ponderous oil will have too far to riſe; and, unleſs the oil be directed to the worm by a proper ledge and current, a conſiderable part will fall back into the ſtill, and ſo prolong the operation or leſſen the produce. 9. Laſtly, two or three cohobations or returns of the water upon the ſubject in the ſtill, muſt needs bring over all the oil that will any way riſe. And water, already ſomewhat impregnated with the oil, is manifeſtly better for the purpoſe, than ſuch as has never been uſed before.

Many of the eſſential oils being dear, it is a very common practice to adulterate or debaſe them ſeveral ways, ſo as to render them cheaper both to the ſeller and the buyer. Theſe ſeveral ways ſeem reducible to three general kinds, each of which has its proper method of detection, viz. 1. With expreſſed oils. 2. With alcohol. And, 3. With cheaper eſſential oils.

If an eſſential oil be adulterated with an expreſſed oil, it is eaſy to diſcover the fraud, by adding a little ſpirit of wine to a few drops of the ſuſpected eſſential oil, and ſhaking them together; for the ſpirit will diſſolve all the oil that is eſſential, or procured by diſtillation, and leave all the expreſſed oil that was mixed with it, untouched.

If an eſſential oil be adulterated with alcohol, or rectified ſpirit of wine, it may be done in any proportion, up to that of an equal quantity, without being eaſily diſcoverable, either by the ſmell or taſte: the way to diſcover this fraud, is to drop a few drops of the oil into a glaſs of fair water: and if the oil be adulterated with ſpirit, the water will immediately turn milky, and by continuing to ſhake the glaſs, the whole quantity of ſpirit will be abſorbed by the water, and leave the oil pure at top.

Finally,

Finally, if an eſſential oil be adulterated by a cheaper eſſential oil, this is commonly done very artfully: the method is to put fir-wood, turpentine, or oil of turpentine into the ſtill, along with the herbs to be diſtilled for their oil, ſuch as roſemary, lavender, origanum, &c. and, by this means, the oil of turpentine diſtilled from theſe ingredients comes over in great quantity, and intimately blended with the oil of the genuine ingredient. The oils thus adulterated always diſcover themſelves in time, by their own flavour being overpowered by the turpentine-ſmell; but the ready way to detect the fraud is to drench a piece of rag, or paper, in the oil, and hold it before the fire; for thus the grateful flavour of the plant will fly off, and leave the naked turpentine-ſcent behind.

The virtues of oils being the ſame with thoſe of the ſubſtances from whence they are obtained, may be learned under their ſeveral articles.

Oil is well known to ſtop the violent ebullition of various ſubſtances: thus, if ſugar, honey, &c. be boiling, and in danger of riſing over the ſides of the veſſel, the pouring in a little oil, makes it immediately ſubſide.

OIL-MILL, one that ſerves to bruiſe or break the nuts, olives, and other fruits and grains, whoſe juice is to be drawn by expreſſion, to make oil.

There are two different methods of expreſſing oils; one chiefly uſed in extracting oil from olives, &c. by means of a very ſtrong preſs, a deſcription of which the reader will find under the article PRESS.

The other, which is commonly called an oil-mill, is chiefly uſed for expreſſing oils from ſeeds, &c. we have given a perſpective view of on plate XCIII. where A is a large wheel turned either by water or horſes, the cogs of which work in the trundle-head B, and give motion to the large ſhaft H K. N, N, N, N, are lifting cogs, which raiſe the ſtampers O P, O P, &c. Q, Q, are larger lifting cogs, being intended to raiſe the ſtampers R R, S S, &c. to a much greater height than the former. T V, *c d*, are battens for guiding the ſtampers in their motion; and *a*, *b*, battens to which the catches are fixed for ſuſpending the ſtampers. The ſeeds are ground either in the mill repreſented in *fig.* 2, or pounded in the mortars *f*, *f*, *f*, *f*. When the ſeeds are thus thoroughly bruiſed, the maſh is taken out, and put into ſmall bags of hair lined with thin canvas. The bags thus filled are placed in the preſs at 1, 5, and the oil extracted by the force of wedges driven by the ſtampers S, S. 6, 4, 4, 7, are pieces of wood for filling up the vacuities when the bags are placed in the preſs. 3 is the wedge driven by the ſtamper S S, which forces the bags filled with the bruiſed ſeed into a leſs compaſs, and conſequently extracts the oil. When the ſeeds are ſufficiently preſſed, the ſtamper R R is raiſed, and by falling on the inverted wedge 2, the whole preſſure is removed, and the bags together with the wedge 3, eaſily taken out of the preſs. X Y repreſents the outſide of the preſs and mortars; and Z Æ, a ſection of both.

Fig. 2, is a mill for grinding the ſeeds. It conſiſts of two large ſtones moving on their edges in a circular bed. The mill is put in motion by means of the cog-wheel G, whoſe cogs play in the rounds of the lantern D. A B C D is a frame of wood for turning the ſtones *m*, *b*. *e k f* is a kind of hook for ſtirring the ſeeds while the ſtones revolve round their axis. The baſis L of the mill-bed is hollow, for receiving the oil preſſed out of the ſeeds in grinding.

OINTMENT, or UNGUENT, in pharmacy and ſurgery. See UNGUENT.

OLEA, the olive tree, in botany. See the article OLIVE.

OLEANDER, *nerium*, in botany. See the article NERIUM.

OLFACTORY NERVES, the firſt pair of the head; ſo called from their being the immediate inſtrument of ſmelling.

OLIBANUM, in pharmacy, a gummy-reſin brought from Turkey and the Eaſt-Indies, uſually in drops or tears, like thoſe of maſtich, but larger, of a pale yellowiſh colour, which by age becomes reddiſh. Of the tree which produces it we have no certain account.

This gummy reſin has a moderately ſtrong, not very agreeable ſmell, and a bitteriſh ſomewhat pungent taſte: in chewing, it ſticks to the teeth, becomes white, and renders the ſaliva milky. Laid on a red-hot iron, it readily catches flame, and burns with a ſtrong, diffuſive, not unpleaſant ſmell: it is ſuppoſed to have been the incenſe uſed by the ancients in their religious ceremonies, though it is not the ſubſtance now known by that name in the ſhops. On trituration with water, greateſt part of it diſſolves into a milky liquor, which on ſtanding depoſites a portion of reſinous matter, and, being now gently inſpiſſated, leaves a yellow extract, which retains the greateſt part of the ſmell as well as the taſte of the olibanum; its odorous matter appearing to be of a leſs volatile kind than that of moſt other gummy-reſins. Rectified ſpirit diſſolves leſs than water, but takes up nearly all the active matter: the tranſparent yellowiſh ſolution, inſpiſſated, yields a very tenacious reſin, in which the active parts of the juice are ſo inveloped and locked up, that they are ſcarcely to be diſcovered either by the ſmell or taſte.

Olibanum is recommended in diſorders of the head and breaſt, in hemoptoes, and the alvine and uterine fluxes: the doſe is from a ſcruple to a dram or more.

OLIGARCHY, a form of government, where the adminiſtration is lodged in the hands of a few people.

The word is Greek, ολιγαρχια, which is derived from ολιγος, a few, and αρχη, command, or government.

OLIO, or OGLIO, in cookery, denotes a ſavoury diſh compoſed of a great variety of ingredients, chiefly uſed by the Spaniards.

OLIVE, *Olea*, in botany, a genus of trees, with a monopetalous flower, divided into four ſegments at the limb; the leaves are for the moſt part oblong and evergreen: the ovary, which is fixed to the center of the flower-cup, becomes an oval, ſoft, pulpy fruit, abounding with a fat liquor, incloſing a hard rough ſtone.

There are five ſorts of olive-trees preſerved in the gardens of the curious, where they are planted either in pots or caſes, and removed into the green-houſe in the winter, with oranges, myrtles, &c. but they are moſt of them hardy enough to endure the cold of our ordinary winters in the open air, provided they are planted upon a dry ſoil, and in a warm ſituation, though in ſevere winters they are demoliſhed, or at leaſt loſe their heads, or are killed to the ſurface; but this is what they are liable to in the ſouth parts of France, in which country theſe trees abound; and yet in very ſharp winters are moſt of them deſtroyed. There was a parcel of theſe trees growing in the gardens of Camden-houſe, near Kenſington, a few years ſince, which were ſeven or eight feet high; and in ſome good ſeaſons produced very good fruit: theſe were planted againſt a ſouth wall, but were permitted to grow up rude without pruning, or faſtening to the wall, (which they do by no means care for;) and, during the time they were below the top of the wall, they throve very well; but, after their heads were got above the wall, the north winds uſually greatly prejudiced them every winter; and the hard winter, 1739-40, entirely demoliſhed them.

Theſe plants may be propagated by laying down of their tender branches, in the manner practiſed for other trees, which ſhould remain undiſturbed two years; in which time they will have taken root, and may be taken off from the old plants, and tranſplanted either into pots filled with freſh light earth, or into the open ground in a warm ſituation. The beſt ſeaſon for tranſplanting them is the beginning of April, when you ſhould, if poſſible, take the opportunity of a moiſt ſeaſon; and thoſe which are planted in pots ſhould be placed in a ſhady part of the green-houſe, until they have taken root; but thoſe planted in the ground ſhould have mulch laid about their roots, to prevent the earth from drying too faſt, and be now and then refreſhed with water; but you muſt by no means let them have too much moiſture, which will rot the tender fibres of their roots, and deſtroy the trees.

When the plants have taken freſh root, thoſe in the pots may be expoſed to the open air, with other hardy exotics; with which they ſhould be houſed in winter, and treated as myrtles, and other leſs tender trees and ſhrubs; but thoſe in the open air will require no farther care until the winter following, when you ſhould mulch the ground about their roots, to prevent the froſt from penetrating

netrating deep into them: and, if the froſt ſhould prove very ſevere, you ſhould cover them with mats, which will defend them from being injured thereby; but you muſt be cautious not to let the mats continue over them after the froſt is paſt, leſt, by keeping them too cloſe, their leaves and tender branches ſhould prove mouldy for want of free air, which will be of as bad conſequence to the trees, as if they had been expoſed to the froſt, and many times worſe; for it ſeldom happens, if they have taken much of this mould, or have been long covered, ſo that it has entered the bark, that they are ever recoverable again; whereas it often happens, that the froſt only deſtroys the tender ſhoots; but the body and larger branches, remaining unhurt, put out again the ſucceeding ſpring.

Theſe trees are generally brought over from Italy every ſpring, by the perſons who bring over the oranges, jaſmines, &c. from whom they may be procured pretty reaſonably; which is a better method than to raiſe them from layers in this country, that being too tedious; and thoſe which are thus brought over, have many times very large ſtems, to which ſize young plants in this country would not arrive in ten or twelve years growth. When you firſt procure theſe ſtems, you ſhould, after having ſoaked their roots twenty-four hours in water, and cleaned them from the filth they have contracted in their paſſage, plant them in pots filled with freſh light ſandy earth, and plunge them into a moderate hot-bed; obſerving to ſkreen them from the violence of the ſun in the heat of the day, and alſo to refreſh them with water, as you ſhall find the earth in the pots dry. In this ſituation they will begin to ſhoot in a month or ſix weeks after, when you ſhould let them have air in proportion to the warmth of the ſeaſon; and, after they have made pretty good ſhoots, you ſhould inure them to the open air by degrees; into which they ſhould be removed, placing them in a ſituation where they may be defended from ſtrong winds: in this place they ſhould remain till October following, when they muſt be removed into the green-houſe, as was before directed. Having thus managed theſe plants until they have acquired ſtrong roots, and made tolerable good heads, you may draw them out of the pots, preſerving the earth to their roots, and plant them in the open air in a warm ſituation, where you muſt manage them as was before directed for the young ones, and theſe will in two or three years produce fruit, provided they do well. The Lucca and box-leaved olives are the hardieſt, for which reaſon they ſhould be preferred to plant in the open air; but the firſt ſort will grow to be the largeſt trees.

Olives are very oily and ſmooth, and therefore not good for the ſtomach, being apt to pall and relax it too much. The oil of olives is judiciouſly mixed with cataplaſms of a maturating nature: it is accounted heating, emollient, and vulnerary; and good againſt coſtiveneſs and gripes.

OLIVE-COLOUR, a yellow mingled with black.

OLYMPIAD, in chronology, the ſpace of four years; ſo called from the Olympic games, inſtituted by Hercules, anno mundi 2836, which were celebrated every four years, about the time of the ſummer ſolſtice, upon the banks of the river Alphæus, near the city Piſa, and the temple of Jupiter Olympius, in Elis, a province in Peloponneſus.

Theſe games were reſtored by Iphitus, four hundred and forty-two years after the firſt inſtitution by Hercules, and twenty-two or twenty-three years before the foundation of Rome.

The Greek hiſtorians began a new epocha, the firſt year of the firſt Olympiad. We are to obſerve that, to ſpeak exactly, every Olympiad year belongs to two Julian years; that is to ſay, the firſt ſix months from July to January, to the foregoing; and the ſix laſt months from January to July, to the following year; though moſt authors ſpeak of the Olympiads, as if they had begun the firſt of January, as for example, it is the ſame thing to ſay, ſuch a thing was done in the firſt year of the ſixth Olympiad, as to ſay, it was done in that Julian year in which the ſixth Olympiad began; theſe were every fifth year, or, as the interpreter of Lycophron ſays, every fiftieth month.

The deſign of the inſtitution was to accuſtom young men to running, leaping, and other exerciſes. They held but five days. The conqueror was called Olympionices, and to be crowned there, was as glorious as to triumph at Rome; for the Olympionices was attended home in his coach, the wall of the city broken down, and he drove in at the breach. Theſe were called Olympia magna, to diſtinguiſh them from other plays of this nature that were inſtituted at Macedonia, at Athens, &c. Chorœbus was the firſt who was crowned at theſe games for having obtained the victory by running. The number of Olympic years to the birth of Chriſt is 776, and the years of Rome before that time but 753, becauſe the firſt Olympiad of the chronologers began 23 years before the foundation of Rome.

OLYMPIC GAMES. See the foregoing article.

OMBRE DE SOLEIL, ſhadow of the ſun, in heraldry, is when the ſun is borne in armory, ſo as that the eyes, noſe, and mouth, which at other times are repreſented, do not appear; and the colouring is thin, ſo that the field can appear through it.

OMELET, or AMLET, a kind of pancake or fricaſee of eggs, with other ingredients, very uſual in Spain and France.

OMEN, a ſign, or indication of ſome future event, taken from the mouth of the perſon ſpeaking.

Teſtus derives the word from *oramen, quod fit ore*, as being a preſage by the mouth.

OMENTUM, in anatomy, the cawl, alſo called reticulum, from its ſtructure reſembling that of a net.

When the peritonæum is cut, as is uſual, and the cavity of the abdomen laid open, the omentum or cawl preſents itſelf firſt to view. This membrane, which is like a wide and empty bag, covers the greateſt part of the guts. Its mouth is tied on the right ſide to the hollow of the liver, on the left to the ſpleen, backwards to the back-part of the duodenum, and that part of the colon which lies under the ſtomach, and forwards to the bottom of the ſtomach and pylorus. Its bottom is looſe, and being tied to no part, but floating upon the ſurface of the guts below the navel, was the reaſon why the cawl was by the Greeks called ἐπίπλοον. Sometimes it deſcends as low as the os pubis, within the productions of the peritonæum, cauſing an epiplocele.

The cawl is a moſt delicate and fine double membrane, interlarded for the moſt part with much fat, which lines each ſide of its blood-veſſels. Theſe are veins from the portæ, called gaſtroepiplois dextra and ſiniſtra; arteries from the cæliaca. The intercoſtal nerves and the par vagum ſend it ſeveral twigs of nerves; all theſe veſſels, with ſome ſmall glands, accompanying one another, ſpread their branches very curiouſly upon the cawl, and even to the minuteſt twig; they run between two lines of fat, which are bigger or ſmaller, according to the weight of the cawl. It has been ſometimes found to weigh five pounds, but ordinarily it does not exceeed one half pound. Where there are no veſſels, the membranes of the cawl are very fine and tranſparent; they give ſeveral uſes to the cawl, as to cover the bottom of the ſtomach and the inteſtines, that by cheriſhing their heat, it may promote digeſtion, and help the concoction of the chyle; to ſtrengthen and ſuſtain the veſſels which go from the ſpleen to the ſtomach, inteſtines, pancreas, and liver; to keep a ſtore of the fat, that it may be received by the veins and lymphatics for the uſe we have already ſpoken of; to lubricate the ſuperficies of the inteſtines, and for facilitating their periſtaltic motion.

OMOPHAGIA, an ancient Greek feſtival, in honour of Bacchus, ſurnamed Omophagos, that is, eater of raw fleſh.

OMOPHORIUM, in church hiſtory, a little cloak anciently wore by the biſhops over their ſhoulders.

OMOPLATE, in anatomy, is uſed in general for the ſhoulder, but more particularly for the two bones ſituate on the hinder part of the upper ribs, one on each ſide, called alſo ſcapulæ and ſhoulder blades. See SCAPULÆ and SHOULDER.

Theſe bones are broad, and eſpecially in the middle; thick in their apophyſes, of a triangular form, concave within,

PLATE XCIII.

Facing Oil Mill.

Fig. 1.

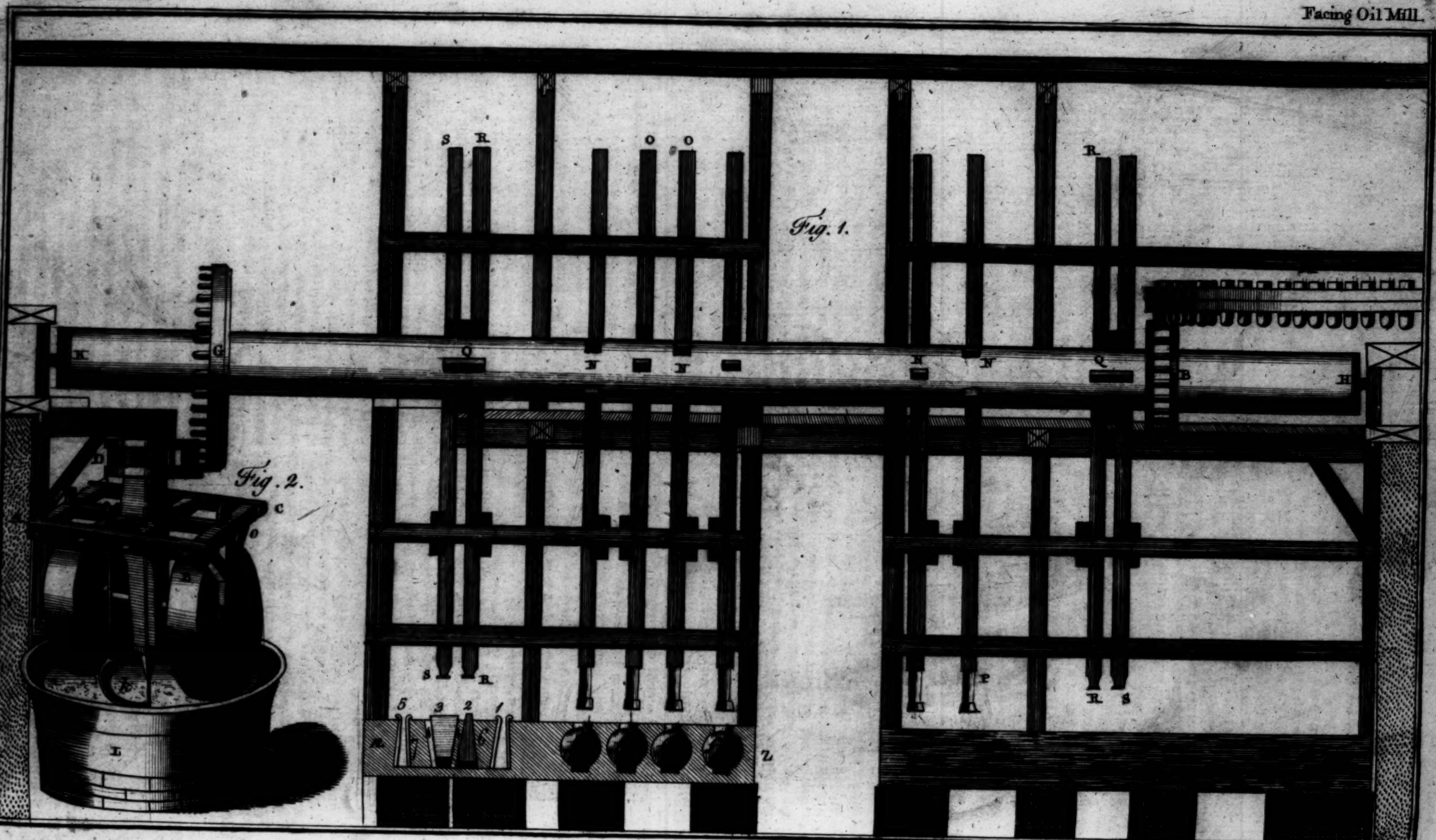
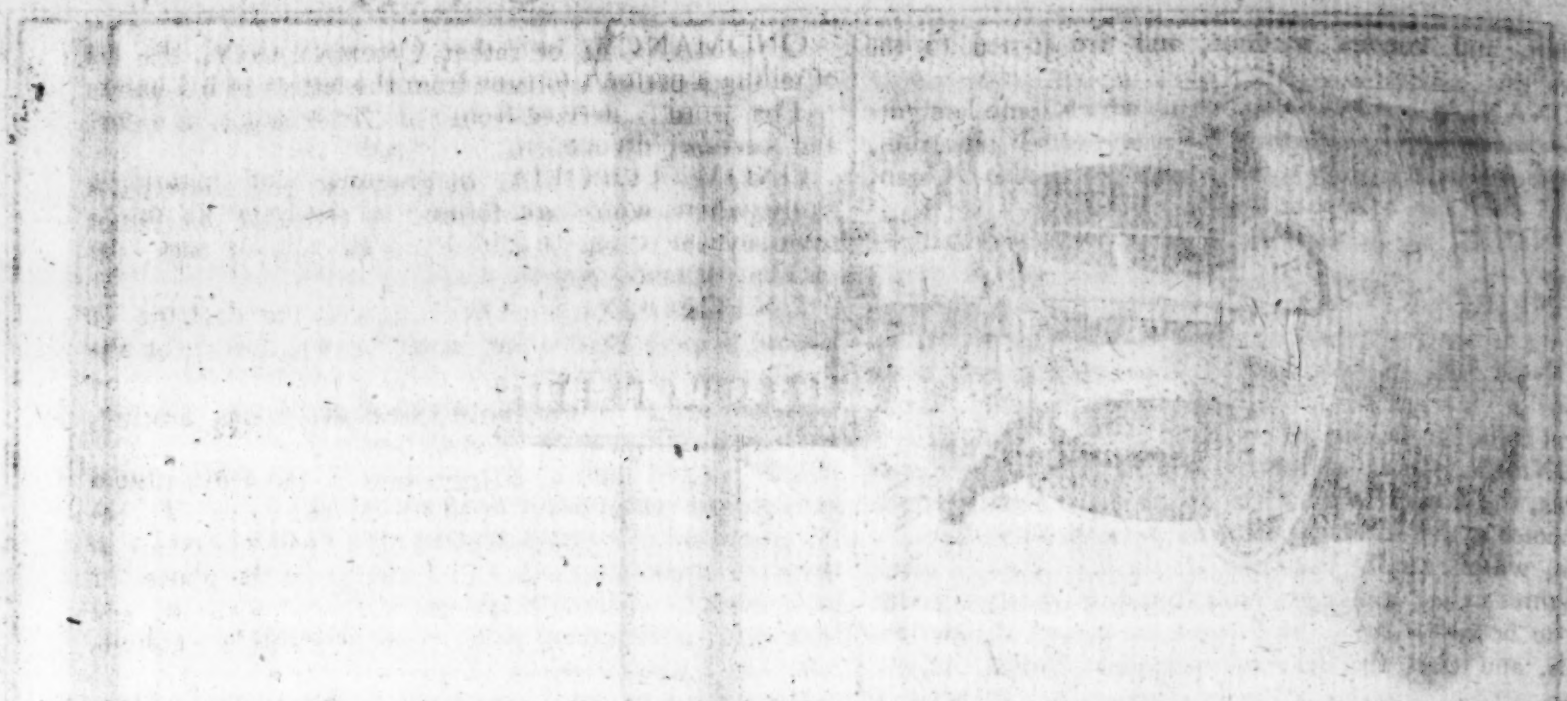


Fig. 2.



5 JA 59

within, and convex without, and are joined to the clavicles.

ONANIA, or ONANISM, terms which ſome late empirics have framed, to denote the crime of ſelf-pollution, mentioned in Scripture to have been practiſed by Onan, and puniſhed in him with death.

ONDEE, in heraldry, the ſame with wavy. See WAVY.

ONEIROCRITICA, ονειροκριτικη, the art of interpreting dreams, or predicting future events from dreams.

ONGLEE, in heraldry, an appellation given to the talons or claws of beaſts or birds, when borne of a different colour from that of the body of the animal.

ONION, *Cepa*, in botany, the name of a genus of plants, the flower of which is of the liliaceous kind, and compoſed of ſix leaves; in the center of it there ſtands a piſtil, which finally becomes a roundiſh fruit, divided into three cells, and containing roundiſh ſeeds. To this it is to be added, that the flowers are placed in ſpherical heads, and that the leaves, as well as ſtalks, are tubular.

Onions are much eaten, and it would be well if they were yet more ſo; they attenuate tough humours, cleanſe the ſtomach, and excite appetite, and in ſome degree promote the menſes; but they are apt to breed flatulencies, and, if eaten too largely, to affect the head and diſturb the ſleep afterwards. An onion, boiled to perfect ſoftneſs, is recommended by many as a cataplaſm for ripening peſtilential buboes. A freſh cut onion, rubbed on the part till it becomes red and itch, is ſaid to be a cure for baldneſs. A mixture of equal parts of juice of onions and ſpirit of wine is eſteemed a cure for deafneſs, a few drops being put at times into the ears: an onion cut in two, and macerated an hour in the ſame ſpirit, is a good application for the head-ach. A cataplaſm of roaſted onions and butter is an excellent application for the piles.

The three ſorts of onions propagated for the ſake of their roots for winter uſe, are the Straſburgh onion, the red Spaniſh onion, and the white. Theſe are to be propagated by ſowing their ſeeds in the latter end of February, in a dry and ſomewhat ſandy ſoil, yet rich; in about a month's time the plants will appear, and, in a fortnight after that, they will be forward enough for hoeing, which muſt be done with a very ſmall hoe, cutting up all the weeds, and leaving the onions two inches aſunder; this ſhould be done in a dry ſeaſon, and the ground will then be clear from weeds for a month: at the end of this time, they muſt be hoed again, and cut to three inches a-part; and a month after this, to four inches; at which diſtance they will thrive well, and grow very large. Toward the latter end of July, the onions will have arrived at their full growth, which is known by their leaves hanging down and ſhrivelling; and they muſt at this time be pulled up, and ſpread on a dry place, and turned every day, to prevent their ſtriking freſh roots; in a fortnight's time they will be dry enough to houſe, and ſhould be wiped clean, and ſpread thin in an upper loft, or garret.

The differences between theſe ſpecies are not eſſential, they often degenerating into one another; and even the large Portugal onion, after a few years, with us, will loſe itſelf ſo far, that no one would imagine it came of that race. *Miller's Gard. Dict.*

Welſh ONIONS, a ſort of onions propagated by gardeners, for the uſe of the table in ſpring; they never make any bulb, and are therefore only to be eaten green with ſallads. They are propagated by ſowing their ſeeds towards the end of July in beds of a dry but rich ſoil; and, in three weeks after ſowing, they will appear above ground: they muſt be kept carefully cleared from weeds. About October all their leaves die away, which has occaſioned ſome to think all the plantation loſt, and to dig up the ground for ſome other uſe; but, if they are ſuffered to ſtand, they will ſhoot up again very ſtrong in January, and from that time will grow very vigorouſly, and reſiſt all weathers, and will be fit to draw for young onions in March, and are extremely green and fine, and more valued at market at that ſeaſon than any other kind; but they are much ſtronger than any other onions, and have very much of the taſte of garlic.

ONOMANCY, or rather ONOMAMANCY, the art of telling a perſon's fortune from the letters of his name. The word is derived from the Greek ονομα, a name, and μαντεια, divination.

ONOMATOPOEIA, in grammar and rhetoric, a figure where words are formed to reſemble the ſound made by the things ſignified; as the buz of bees, the cackling of hens, &c.

ONTOLOGY, or ONTOSOPHY, the doctrine or ſcience *de ente*; that is, of being, in the general, or abſtract.

The word is formed of the Greek ων, οντος, a being, and λογος, a diſcourſe.

ONYX, in natural hiſtory, one of the ſemipellucid gems, with variouſly coloured zones, but none red; being compoſed of cryſtal, debaſed by a ſmall admixture of earth; and made up either of a number of flat plates, or of a ſeries of coats ſurrounding a central nucleus, and ſeparated from each other by veins of a different colour, reſembling zones or belts.

OOST, in huſbandry, a name given by the people who manure hops, for the kiln in which they dry them after they are picked from the ſtalks. This is a ſquare room, built up of brick, or ſtone, ten feet wide, more or leſs, and having a door on one ſide. In the midſt of this room is a fire-place, about thirteen inches wide, and as much high; and in length, reaching from the mouth ſo nearly to the back part of the kiln, that a man has juſt room to go round it. This fire-place is called a herſe, and the fire is let out into the room by ſeveral holes in the ſides, in the ſame manner as in malt kilns. Five feet above this, is laid the floor on which the hops are to be laid to dry, and this muſt have a wall round it, at four feet high, to keep the hops from falling out. At one ſide of the upper bed muſt be made a window by which to puſh out the hops, as they are dried, into a room prepared for them. The beds muſt be made of laths an inch ſquare, placed at a quarter of an inch diſtance from one another, and ſupported by beams underneath. The hops are to be poured on this bed with a baſket, till the whole is covered half a yard thick with them; when this is done, lay them even with a rake, and let a fire be made in the fire-place below. Some recommend a wood fire, but experience ſhews nothing does ſo well as charcoal; let the fire be kept at the mouth of the furnace, for the air will be carried all the way through; and thus let the hops lie, never ſtirring them till they are thoroughly dry; when they rattle under the rake, and the inner ſtalks are brittle, they are ſufficiently dried, and are to be puſhed out, and a freſh parcel laid in the ooſt in their place. Some people dry their hops in a common malt kiln, ſpreading them on a hair cloth about ſix inches thick, and now and then turning them till they are all thoroughly dried, then laying them in a heap, till they are to be put in the bags. But both theſe ways are liable to ſome inconveniences; the ooſt generally over-dries the under ones, by the time the upper ones are dry enough; and the hair cloth, and the turning in the other way, breaks and ſhatters them, and ſpills many of the ſeeds.

OPACITY, in philoſophy, a quality of bodies which renders them impervious tothe rays of light. See LIGHT.

The opacity and tranſparency of bodies in general are occaſioned thus: let A B (plate XCIV. *fig.* 3.) be the ſurface of an opake body A B C D; a ray of light G H falling thereon in the point H, will in part be reflected into the ray H I, and by this reflected ray, the point H becomes viſible to the eye at I; and thus all the points, and conſequently the whole ſurface, is made viſible by that part of the light which it reflects. But the other part of the ray entering into the body, being irregularly refracted and reflected through its internal ſubſtance of particles and pores, becomes divided, diſſipated, abſorbed, and loſt therein; and therefore, as none of the rays can come from the internal parts to the eye, ſo none of thoſe parts can be viſible; and the body in that caſe is ſaid to be opake. In order to this we muſt conſider, that though the whole body be opake, yet the particles of ſuch a body are not ſingly opake, but freely tranſmit the light without reflecting any part between the ſurfaces, and are therefore in themſelves tranſparent; and were theſe particles contiguous to each other, the light would

paſs from one to another, and ſo thro' the whole, without reflection; as we find by experiment it will paſs through ſeveral contiguous pieces of poliſhed glaſs, and thus produce tranſparency. But if the particles do not touch in ſuch a manner as to leave the interſtices or pores exceeding ſmall, there will be a reflection of light at every pore from the air which it there meets with, as being a medium of different denſity. For it is known by experiment, that though a ray of light will paſs from one piece of glaſs to another that is contiguous without reflection, yet will it not paſs from the glaſs thro' the contiguous air without being in part reflected; conſequently, where the pores are large and very numerous, there the reflection of light will be ſo great upon the whole as to cauſe a total diſſipation and loſs of the light that entered the body, and ſo render it opake. This is confirmed by taking ten pieces of clear glaſs, and laying them one upon another over a leaf of print quite dry, and having only air between them; then taking ten other pieces of the ſame glaſs, and putting them into water, ſo that it may fill all their interſtices; and then laying them on the ſame printed paper by the other, a perſon looking through each, will ſee the print, or reading, much more diſtinct, clear and bright, through the latter pieces than through the former, the rays being more regularly tranſmitted through them where the denſity of the parts is not ſo unequal, and alſo with much leſs reflection than through the other, where the light undergoes a conſiderable reflection at every interſtice or place of air between the glaſſes.

It is hence alſo that tranſparent bodies are rendered opake by ſeparating their parts, and rendering them more porous: thus beer, before it is raiſed into froth, is tranſparent; but the froth, by reaſon of its pores, becomes opake: thus dry paper is more opake than that which is wetted with water or oil, becauſe more porous: thus the oculus mundi ſtone is more opake when dry than when ſteeped in water; and glaſs, reduced to powder, is no longer tranſparent. Hence it follows, that the parts of bodies, and their pores, muſt not be leſs than a certain definite bigneſs to render them opake; for the opakeſt bodies, if their parts be ſubtilely divided, become perfectly tranſparent: thus copper, diſſolved in aqua-fortis, has all its particles pellucid; and the whole ſolution is tranſparent: thus a bubble blown off ſoap water, may become ſo thin on the top as to reflect no light, but will tranſmit the whole: thus water, ſalts, glaſs, ſtones, &c though they are as porous as other bodies, yet their parts and interſtices are too ſmall to cauſe reflections in their common ſurfaces.

Therefore, in all tranſparent bodies, as B E F C, (*fig.* 4.) a ray of light, K L, falling on its ſurface, in the point L, will there be in that part reflected, as before, into the ray L M; the other part will go regularly, or in a rectilineal direction from the upper to the lower ſurface at N, where meeting with the air, (a medium of a different denſity) it will be in part reflected again into the ray N O; the other part goes out to the eye at P; by which means all the internal parts from whence that ray comes, will be rendered viſible to the eye: and ſince this may be conceived of every point in the body, it is eaſy to underſtand how the whole becomes tranſparent. See REFLECTION and REFRACTION.

OPAL, in natural hiſtory, a gem of a very peculiar kind, and has been eſteemed by many in all ages of very great value, though at preſent it is of leſs value, in proportion to its ſize, than any of the finer gems. It is ſofter than any other of the fine gems, and is difficult to poliſh to any degree of nicety. It is found of various ſhapes and ſizes; its moſt frequent bigneſs is between that of a pea and a horſe-bean, but it is found as ſmall as the head of a large pin, and has been ſeen of the ſize of a large walnut. Its figure is very various and uncertain, but it is never found in a cryſtalliform or columnar ſtate; its moſt uſual ſhape is an irregularly oblong one, convex above, flatted at bottom, and dented with various ſinuoſities at its ſides. It is often found among the looſe earth of mountains, ſometimes on the ſhores of rivers, and not unfrequently bedded in the coarſer kinds of jaſper. It is found in Egypt, Arabia, ſome parts of the Eaſt-Indies, and in many parts of Europe: thoſe of Europe are principally from Bohemia, and are of a greeniſh or greyiſh colour; the colour of other opals much reſembles the fineſt mother of pearl, its baſis ſeeming a bluiſh or greyiſh white, but with a property of reflecting all the colours of the rainbow, as turned differently to the light.

OPALIA, in antiquity, feaſts celebrated at Rome in honour of the goddeſs Ops.

OPEN *Flank*, in fortification, that part of the flank which is covered by the orillon. See the article FLANK.

OPENING *of Trenches* is the firſt breaking of ground by the beſiegers, in order to carry on their approaches towards a place. See TRENCH.

OPERA, a dramatic compoſition ſet to muſic, and ſung on the ſtage, accompanied with muſical inſtruments, and enriched with magnificent dreſſes, machines, and other decorations.

OPERATION, in general, the act of exerting or exerciſing ſome power or faculty, upon which an effect follows.

OPERATION, in chirurgery and medicine, denotes a methodical action of the hand on the human body, in order to re-eſtabliſh health.

OPERATION, in chemiſtry, implies the proceſſes, or experiments, by means of which the proper changes are produced in bodies.

OPERATOR, a perſon who performs an operation.

OPHIOGLOSSUM, in botany, the plant adder's tongue. See ADDER'S TONGUE.

OPHITES, in natural hiſtory, a ſort of variegated marble, of a duſky-green ground, ſprinkled with ſpots of a lighter green, otherwiſe called ſerpentine.

OPHITES, in church hiſtory, Chriſtian heretics, ſo called both from the veneration they had for the ſerpent that tempted Eve, and the worſhip they paid to a real ſerpent: they pretended that the ſerpent was Jeſus Chriſt, and that he taught men the knowledge of good and evil: they diſtinguiſhed between Jeſus and Chriſt; Jeſus, they ſaid, was born of the virgin, but Chriſt came down from heaven to be united with him: Jeſus was crucified, but Chriſt had left him, to return to heaven. They diſtinguiſhed the God of the Jews, whom they termed Jaldabaoth, from the ſupreme God: to the former they aſcribed the body, to the latter the ſoul of men. They had a live ſerpent which they kept in a kind of cage; at certain times they opened the cage door and called the ſerpent: the animal came out, and mounting upon the table, twined itſelf about ſome loaves of bread; this bread they broke and diſtributed it to the company, who all kiſſed the ſerpent: this they called their Euchariſt.

OPHTHALMIA, in medicine, ſignifies any diſorder or pain in the eye; but it is uſed ſtrictly to expreſs an inflammation of that organ.

The word is Greek, ὀφθαλμια, and derived from ὀφθαλμὸς, an eye.

An ophthalmia, ſays M. de St. Yves, is an inflammation of the conjunctiva, ſometimes attended with violent heat and a flux of tears; ſometimes without either heat or tears. This inflammation ſometimes extends all over the globe of the eye, and even to the adjacent parts. Of all diſorders of the eye, this is the moſt frequent, as it accompanies almoſt every diſeaſe to which the eye is ſubject.

Some of theſe inflammations are without danger, and eaſily cured; others are very dangerous, and difficult to cure. Their cauſe is either external or internal: internally they proceed from the blood, whether from too great a redundancy, or ſome acquired bad quality of it; ſuch are the thickneſs, viſcoſity, acrimony, or too great rarefaction of the blood.

If the quantity of blood be exceſſive, it will be carried too copiouſly into the minute veſſels of the eye, and ſo produce an ophthalmia.

If the blood be too thick, as it is inceſſantly conveyed into the fine veſſels of the eye, its particles being too heavy and large to paſs into theſe veſſels, the circulation in theſe parts muſt be obſtructed, and an inflammation generated. When the blood is too ſharp, the ſeroſity, furniſhed by the lachrymal gland, will partake of the ſame nature; and by irritating the conjunctiva, which it conſtantly moiſtens, will produce an ophthalmia. If the blood be too much rarefied, as the rarefaction affects the

the fine delicate veſſels of the eye, it will occaſion an inflammation.

As to external cauſes, it is evident that whatever can violently irritate the conjunctiva, and the membrane which covers it, or can make a ſeparation in the veſſels of thoſe parts, will neceſſarily cauſe this diſtemper.

An ophthalmia is ſometimes attended with very dangerous accidents; it is often exaſperated by improper remedies applied by the patients when firſt attacked; it is ſometimes ſo violent, that its progreſs can hardly be ſtopped, or the ſight preſerved.

Theſe inflammations are generally divided into the dry and humid.

The dry ſpecies of ophthalmia brings a redneſs on the eye without tears, or any purulent matter. It occaſions no ſwelling of the eye-lid, nor pain in the eye, or in the head. It is cauſed by a thick blood, which ſtagnates only in ſome of the veſſels of the conjunctiva, only part of the white of the eye being red.

The humid ophthalmia is produced by a great quantity of lachrymal lymph, which, as it paſſes continually over the globe of the eye, irritates the ſame by its acrimony, inflames it and the inner part of the eye-lids, which becomes ſwelled; it likewiſe often ulcerates the tranſparent part of the cornea. This diſeaſe is attended with ſhooting pains in the eye, and the patient cannot behold the light without intenſe pain. Children and old people are both ſubject to this diſeaſe, in whom it becomes very obſtinate, by reaſon of the natural moiſture of their temperament. When it runs to a length in children, their lips and noſes ſwell, and are covered with ſcabs and puſtules, that ſometimes overſpread the face.

For cure of the dry ophthalmia waſh the inner part of the eye with collyrium, made of twelve grains of prepared tutty, diſſolved in two ounces of roſe and plantain waters, with the addition of a ſpoonful of ſpirit of wine. Take of Paul's betony, thyme, and red roſes, each a handful; two ſtalks of mullein; boil them in a gallon of wine; and at night apply to the eye a compreſs dipped in this wine.

As this ſpecies of ophthalmia is not dangerous, it requires but few medicines, and is ſometimes cured by bleeding, repeated according to the plethoric conſtitution of the patient.

The cure of the humid ophthalmia is ſometimes very difficult, and requires more medicines than the laſt, beſides ſuch repetitions of the general remedies, as the ſtate of the patient may require.

Bleeding at the neck and foot is often neceſſary. Apply a collyrium, made with the diſtilled waters of fennel, eye-bright, and plantain, of each two ounces, in which diſſolve two grains of ſalt of lead. Sometimes a ſeton, a cautery, and bliſters are obliged to be uſed. If the veſicatories incommode the kidnies or bladder, they muſt be laid aſide, and other means employed. If the firſt collyrium, which is deſigned only as a ſweetener, after ſome days, do not ſucceed, let another be ſubſtituted, which, by conſtringing the pores, will hinder the great afflux of tears to the eye; for which reaſon you may omit the ſalt of lead, and diſſolve, in the ſame waters, half a dram of the white troches of Rhaſis.

OPHTHALMICS, medicines good in diſorders of the eyes.

Ophthalmic Nerves, the fifth pair of the head.

OPHTHALMOGRAPHY, that branch of anatomy which conſiders the ſtructure and compoſition of the eye, the uſe of its ſeveral parts, and the principal effects of viſion.

The word is Greek, οφθαλμογραφια, and derived from οφθαλμος, an eye, and γραφω, to deſcribe.

OPHTHALMOSCOPIA, that branch of phyſiognomy which conſiders a perſon's eyes and looks, in order to know his temperament, humour, and manners.

The word is derived from the Greek, οφθαλμος, an eye, and σκοπεω, to view or conſider.

OPIATES, medicines prepared with opium.

OPINION, the aſſent of the mind to propoſitions not evidently true at firſt; nor deduced, by neceſſary conſequences from others that are ſo; but ſuch as carry the appearance of truth.

OPISTHOTONOS, in medicine, a ſpecies of convulſion, whereby the body is bent downward.

The word is Greek, οπισθοτονος, and derived from οπισθεν, backwards, and τονος, from τεινω, to ſtretch.

OPIUM, in pharmacy, a concrete gummy-reſinous juice; ſomewhat ſoft and tenacious, eſpecially when much handled or warmed; of a dark reddiſh brown colour in the maſs, and when reduced into powder yellow. It is brought from Egypt, Perſia, and ſome other parts of Aſia, in flat cakes or irregular maſſes, from four to about ſixteen ounces in weight, covered with leaves to prevent their ſticking together.

It is extracted from the heads of white poppies, which in thoſe countries are cultivated in fields for this uſe. Kæmpfer reports, that the heads, when almoſt ripe, are wounded with a five-edged inſtrument, by which as many parallel inciſions are made at once from top to bottom; that the juice which exudes is next day ſcraped off, and the other ſides of the heads wounded in like manner; and that the juice is afterwards worked with a little water, till it acquires the conſiſtence, tenacity, and brightneſs of the fineſt pitch. The beſt opium was formerly called Thebaic opium, from its being prepared about Thebes in Egypt: no diſtinction is now made in regard to the places of its production, though the epithet Thebaic ſerves to diſtinguiſh ſome of its officinal preparations.

Opium has a faint diſagreeable ſmell, and a bitteriſh, ſomewhat hot, biting taſte. Watery tinctures of it ſtrike a black colour with chalybeate ſolutions, and thus ſeem to diſcover ſome aſtringency. Mixed with the ſerum of blood, they thicken and render it whitiſh; and on blood itſelf, newly drawn, they have nearly a like effect. Mr. Eller obſerves, that on examining with a microſcope, blood thickened by a vinous tincture of opium, the nature of its globules ſeemed to be deſtroyed. But neither from theſe, nor any of the other known ſenſible properties of this drug, can its ſurpriſing operation in the human body be deduced.

Taken in proper doſes, it commonly procures ſleep, and a temporary reſpite from pain or the action of any ſtimulating power. The cauſe of the pain it in many caſes confirms or augments; and in not a few, it fails even of giving palliative relief. The caſes in which it is proper or improper will be beſt underſtood from a view of its general effects; which, ſo far as experience has hitherto diſcovered them, are the following.

It renders the ſolids, while the operation of the opium continues, leſs ſenſible of every kind of irritation, whether proceeding from an internal cauſe, or from acrimonious medicines, as cantharides and the more active mercurials, of which it is the beſt corrector. It relaxes the nerves; abating or removing cramps or ſpaſms, even thoſe of the more violent kind; and increaſing paralytic diſorders and all debilities of the nervous ſyſtem. It incraſſates thin ſerous humours in the fauces and adjacent parts; by which means it proves frequently a ſpeedy cure for ſimple catarrhs and tickling coughs; but in phthiſical and peripneumonic caſes, dangerouſly obſtructs expectoration, unleſs this effect be provided againſt by ſuitable additions, as ammoniacum and ſquills. It produces a fullneſs and diſtention of the whole habit, and thus exaſperates inflammations both internal and external, and all plethoric ſymptoms. It promotes perſpiration and ſweat; but reſtrains all other evacuations, unleſs when they proceed from a relaxation and inſenſibility of the parts, as the colliquative diarrhœæ in the advanced ſtage of hectic fevers. It promotes labour-pains and delivery more effectually than the medicines of the ſtimulating kind uſually recommended for that purpoſe, partly perhaps by increaſing plenitude, and partly by relaxing the ſolids or taking off ſpaſmodic ſtrictures. And indeed all the preceding effects are perhaps conſequences of one general power; being nearly allied to thoſe which natural ſleep produces.

The operation of opium is generally accompanied with a ſlow but ſtrong and full pulſe, and a ſlight redneſs, heat, and itching of the ſkin: it is followed by a weak languid pulſe, lowneſs of the ſpirits, ſome difficulty of breathing or a ſenſe of tightneſs about the breaſt, a ſlight giddineſs of the head, dryneſs of the mouth and fauces, and

and ſome degree of nauſea. Given on a full ſtomach, it commonly occaſions a nauſea from the beginning, which continues till the opium is rejected along with the contents of the ſtomach. Where the evacuation of acrid humours, accumulated in the firſt paſſages, is ſuppreſſed by it, great ſickneſs and uneaſineſs are generally complained of, till the ſalutary diſcharge either takes place again ſpontaneouſly, or is promoted by art.

An over doſe occaſions either immoderate mirth or ſtupidity, a redneſs of the face, ſwelling of the lips, relaxation of the joints, vertigo, deep ſleep with turbulent dreams and ſtartings, convulſions, and cold ſweats. Geoffroy obſerves, thoſe who recover, are generally relieved by a diarrhœa, or by a profuſe ſweat, which is accompanied with a violent itching. The proper remedies, beſides emetics, bliſters, and bleeding, are acids and neutral mixtures: Dr. Mead ſays he has given, with extraordinary ſucceſs, repeated doſes of a mixture of ſalt of wormwood with lemon juice.

A long continued uſe of opium is productive of great relaxation and debility, ſluggiſhneſs, heavineſs, loſs of appetite, dropſies, tremors, acrimony of the humours, frequent ſtimulus to urine, and propenſity to venery. On leaving it off, after habitual uſe, an extreme lowneſs of the ſpirits, languor, and anxiety, ſucceed; which are relieved by having again recourſe to opium, and in ſome meaſure by ſpirituous or vinous liquors.

With regard to the doſe, one grain is generally a ſufficient, and ſometimes too large a one: maniacal perſons, and thoſe who labour under violent ſpaſms, require oftentimes two, three, or more grains; though even in theſe caſes, it is generally more adviſable to repeat the doſe at proper intervals, than to enlarge it. By frequent uſe, much greater quantities may be borne; the Turks, who habituate themſelves to opium as a ſuccedaneum to ſpirituous liquors, are ſaid to take commonly a dram at a time, and Garcias ſays, that he knew one who every day took ten drams.

Opium appears to conſiſt of about five parts in twelve of gummy matter, four of reſinous matter, and three of earthy or other indiſſoluble impurities. From theſe laſt it is purified, in the ſhops, by ſoftening the opium with boiling water, in the proportion of a pint to a pound, into the conſiſtence of a pulp, with care to prevent its burning; and whilſt it remains quite hot, ſtrongly preſſing it from the fæces through a linen cloth: the ſtrained opium is then inſpiſſated in a water-bath or other gentle heat, to its original conſiſtence. When thus ſoftened with a ſmall quantity of water, the gummy and reſinous parts paſs the ſtrainer together; whereas, if diſſolved by a larger quantity, they would ſeparate from one another.

It has been diſputed, whether it is in the gummy or in the reſinous parts of opium, that its activity reſides. From the experiments of Hoffmann and Neumann, it ſeems to be neither in the direct gum, nor in the direct reſin, but in a certain ſubtile part of the reſinous matter, ſomewhat analogous to eſſential oils, but of a much leſs volatile kind: they report, that on boiling the opium in water there ariſes to the ſurface a frothy, viſcid, unctuous, ſtrong ſcented ſubſtance, to the quantity of two or three drams from ſixteen ounces: that this ſubſtance, in the doſe of a few grains, has killed dogs that could bear above a dram of crude opium; that in diſtillation with water, though it does not riſe itſelf, it gives over, at leaſt in part, the active principle of which it is the matrix; impregnating the diſtilled liquor with its ſcent and its ſoporific power; as eſſential oils exhale their odoriferous principle in the air, without being diſſipated themſelves. What this ſubtile and highly active principle really is, in eſſential oils, in odorous vegetables that yield no oil, and in opium, is equally unknown.

Both water and rectified ſpirit extract, difficultly, by maceration or digeſtion, the active matter of opium, and receive from it a yellow or browniſh tincture. The watery ſolution is found to contain great part of the reſin along with the gum; and the ſpirituous, a ſmaller proportion of the gum along with the reſin. Such part of the gum as is left by ſpirit, and ſuch part of the reſin as is left by water, are equally inert.

Tinctures of opium in water, wine, and proof ſpirit, have the ſame effects as the opium in ſubſtance; with this difference, that they exert themſelves ſooner in the body, and are leſs diſpoſed to leave a nauſea on the ſtomach. Tinctures made in rectified ſpirit are ſaid to act with greater power than the others: Geoffroy relates, from his own obſervation, that while the watery and vinous tinctures occaſioned quiet ſleep, the ſpirituous brought on a phrenzy for a time. It is ſaid likewiſe, that alkaline ſalts diminiſh the ſoporific virtue of the opium; that fixed alkalies render it diuretic, whilſt volatile ones determine its action to the cutaneous pores; and that acids almoſt entirely deſtroy its force.

The officinal tinctures of opium are made in wine or proof ſpirit. The college of London directs two ounces of ſtrained opium to be macerated without heat for a week in a pint of Mountain, with the addition of a dram of cinnamon, and as much cloves to alleviate the ill ſmell of the opium: the college of Edinburgh orders the ſame quantity of crude opium to be digeſted in a ſand heat, in a pint and a quarter of a compound aromatic ſpirituous diſtilled water, or ſpirituous cinnamon water, with or without the addition of an ounce of ſaffron: a mixture of wine and proof ſpirit has been ſometimes made choice of, in order to prevent, in ſome meaſure, an inconvenience which both of them ſeparately, conſidered as officinals, are liable to, being apt to throw off in long ſtanding a part of the opium, which in wine falls to the bottom, and forms a cruſt on the ſurface of ſpirit. Of the firſt of the above tinctures twenty drops, and of the latter twenty-five drops, are reckoned to contain one grain of opium; but as theſe quantities of the menſtrua do not eaſily diſſolve all the active matter of ſo large a proportion of the opium, thoſe doſes are generally obſerved to have ſomewhat leſs effect than a grain of the drug in ſubſtance. As drops alſo, according to different circumſtances, vary in quantity, though in number the ſame, it were to be wiſhed that the ſhops were furniſhed with a ſolution of this drug, made in a quantity of menſtruum large enough not only for the complete extraction of the active parts, but to admit of the doſe being exactly determined by weight or meaſure.

In a ſolid form, independently of ſuch materials as may be ſubſervient to the other indications of cure, it is ſometimes mixed with ſaponaceous or gummy ſubſtances which promote its diſſolution in the ſtomach, and ſometimes with reſinous ones which render its diſſolution and operation more gradual and ſlow: to theſe is commonly ſuperadded ſome aromatic ingredient, to prevent its occaſioning a nauſea. Thirty-two parts of almond ſope, four of ſtrained opium moiſtened with a little wine, and one of eſſence of lemons, beaten together, make an elegant pill of the firſt kind; and ſixteen parts of ſtrained ſtorax, eight of ſaffron, and five of ſtrained opium, of the latter.

Many have endeavoured to correct certain ill qualities which they ſuppoſe opium to be poſſeſſed of, by roaſting it, by fermentation, by long continued digeſtions, by repeated diſſolutions and diſtillations. Theſe kinds of proceſſes, though recommended by ſeveral late writers, do not promiſe any ſingular advantage. That they weaken the opium is indeed very probable; but this intention is anſwered as effectually, and with far greater certainty, by diminiſhing the doſe of the opium.

OPOBALSAMUM, in pharmacy, the ſame with the balſam, or balm of Gilead. See BALSAM.

OPOPANAX, in the materia medica, is a concrete gummy-reſinous juice, obtained from the roots of an umbelliferous plant, which grows ſpontaneouſly in the warmer countries, and bears the cold of our own. The juice is brought from Turkey and the Eaſt-Indies, ſometimes in little round drops or tears, more commonly in irregular lumps, of a reddiſh yellow colour on the out-ſide with ſpecks of white, internally of a paler colour, and frequently variegated with large white pieces.

This gummy-reſin has a ſtrong diſagreeable ſmell, and a bitter acrid, ſomewhat nauſeous taſte. It readily mingles with water, by tincture, into a milky liquor, which on ſtanding depoſites a portion of reſinous matter and becomes yellowiſh: to rectified ſpirit it yields a gold-coloured

loured tincture, which taſtes and ſmells ſtrongly of the opopanax.

Opopanax is an uſeful attenuant and deobſtruent, and in conſiderable doſes looſens the belly. It is given from a ſcruple to a dram, in the ſame intentions as ammoniacum or galbanum: and joined in ſmaller doſes as an auxiliary to thoſe and the other deobſtruent gums.

OPOSSUM, in zoology, a very ſingular animal, about fifteen inches long from the extremity of the noſe to the rump; and its tail is equal in length to the whole body: the legs are robuſt, and the feet armed with ſharp, long, and crooked claws. But what is moſt ſingular in this animal is, that the ſkin of the belly of the female is looſe, forming a kind of pouch or bag, with an aperture in it, at which, in time of danger, it takes in its young.

OPPONENT, a perſon who withſtands or oppoſes another.

OPPOSITES, *Oppoſita*, among logicians, ſimply taken, are ſuch things as differ among themſelves, but ſo as not to differ in like manner from ſome third.

Opposite Angles. See Angle.

Opposite Cones. See Cone.

Opposite Sections are two hyperbolas made by cutting two oppoſite cones by the ſame plane. See Hyperbola and Conic Sections.

OPPOSITION, in logic, the diſagreement between propoſitions, which have the ſame ſubject and the ſame predicate.

Opposition, in aſtronomy, is that aſpect or ſituation of two ſtars or planets, wherein they are diametrically oppoſite to each other, or 180° aſunder.

Opposition, in geometry, the relation of two things, between which a line may be drawn perpendicular to both.

Opposition, in rhetoric, a figure whereby two things are joined, which ſeem incompatible.

OPTATIVE Mood, in grammar, that which ſerves to expreſs an ardent deſire or wiſh for ſomething. See the article Mood.

In moſt languages, except the Greek, the optative is only expreſſed by prefixing to the ſubjunctive an adverb of wiſhing, as *utinam*, in Latin; *plut a Dieu*, in French, and *would to God*, in Engliſh; but in Greek, it is expreſſed by a peculiar inflection, *οιμι*, *οις*, *οι*, &c.

OPTIC, or Optical, ſomething relating to viſion, or the ſenſe of ſight. See Vision.

Optic *Angle*. See *Optic* Angle.

Optic *Axis* is a ray paſſing through the center of the eye, and the middle of the optic pyramid.

Optic *Glaſſes* are glaſſes ground either convex or concave, in order either to collect or diſperſe the rays of light; by means of which viſion is improved, and the eye ſtrengthened and preſerved.

Optic *Inequality*, in aſtronomy, is the apparent irregularity in the motions of far diſtant bodies, but ariſing from the ſituation of the ſpectator's eye: ſo that, were the eye in the center, the motions would always appear uniform.

Optic *Nerves*, the ſecond pair of nerves, ſpringing partly from the extremity of the corpora ſtriata, and partly from the thalami nervorum optici. See the article Nerve.

Optic *Pencil*, or a *Pencil of Rays*, that aſſemblage of rays by means of which any point, or part of an object, is rendered viſible.

Optic *Place*. See Place.

Optic *Pyramid*, in perſpective, is the pyramid ABCO (plate XCIV. *fig.* 5.) whoſe baſe is the viſible object ABC; and its vertex in the eye O, formed by rays drawn from the ſeveral points of the perimeter to the eye.

OPTICS, Optica, is properly the ſcience of direct viſion. See Vision.

Optics is alſo uſed, in a larger ſenſe, for the ſcience of viſion, or viſibles in general; in which ſenſe optics include catoptrics and dioptrics.

The general principle of optics, catoptrics, and dioptrics, is as follows.

In ſimple optics the direct ray comes in the ſhorteſt direct way from the radiant point C (plate XCIV. *fig.* 6.) to the point to be enlightened E; namely, the medium remaining the ſame; that is, in the right line CE.

In catoptrics, the angle of incidence CEA, and of reflexion DEB, are equal: for let C be the radiant, D the point to be enlightened, and AB a plane ſpeculum, the point E of the ſpeculum reflecting the ray to D is ſought; we ſay it is ſuch that CE+ED is the leaſt poſſible, and this will happen when the angle CEA and DEB are equal.

In dioptrics, the ſines of the complements EH and EL of the angles of incidence CEA, and of refraction GEB, have always the ſame ratio, which is reciprocal to the reſiſtance of the mediums. Let IE be air, EK water, glaſs, or any other medium denſer than air, CE the incident ray, and EG the refracted one; put m and n for the reſiſtance, with reſpect to light and air; then the path CEG of the incident and refracted ray will be as the ſum of the rectangles $CE \times m + EG \times n$, and muſt be the leaſt poſſible, or leſs than $CE \times m + FG \times n$, aſſuming any other point F beſides E. In order to find this point, we have the points C and G, as alſo the right-line AB given in poſition; therefore call the right lines perpendicular to the plane CH, c, and GL, g; and HL, which is alſo given, h; put $EH = y$, then EL will be $h - y$, and $CE = \sqrt{cc+yy}$, which put equal to p; and for EG, or $\sqrt{gg+yy-2hy+hh}$, write q; whence we have $n\sqrt{cc+yy} + m\sqrt{gg+yy-2hy+hh}$, or $mp + nq$, for the ſum of the rectangles $CE \times m + EG \times n$; which being put into fluxions, and properly reduced, gives $mqy = np \times \overline{h-y}$, or np to mq as y to $h-y$; or the rectangle $CE \times n$ to the rectangle $EG \times m$, as EH to EL: therefore, ſuppoſing CE and EG equal, n the reſiſtance of the water, in reſpect of light, will be to m the reſiſtance of air, as EH the ſine of the complement of the angle of incidence CEA in air, to EL, the ſine of the complement of the angle of refraction GEB in water; or the ſines of the complements will be in the reciprocal ratio of the reſiſtance of the mediums. If therefore EL, in one inſtance or experiment, be found to be $\frac{3}{4}$ of EH, it will be alſo in all others, wherever C and G are taken, the former in air, the latter in glaſs; if E be in air, and G under water, EL will be $\frac{3}{4}$ of EH nearly.

From this calculation we get the following conſtruction.

Deſcribe the circle CBG from the center E, with the radius EC or EG, and let CE meet its tangent at B produced in V, and EG in T; let the eye be in C, and the object which is ſeen under the water in T, and the point T will appear to be in V; becauſe we ſeem to ſee it along the right line CEV; yet, ſince we really ſee it by the broken line CET, it is plain that EV is the ſecant of the angle of incidence CEA, or its equal VEB; and that ET is the ſecant of the angle of refraction GEB; but, from a known propoſition in trigonometry, the ſecants are reciprocally as the ſines-complement; therefore, directly, EV is to ET as EL to EH; that is, as m to n. The eye at C therefore being in a different medium than the object T, the apparent ray EV in the medium of the object (water) is to the true ray ET in the ſame medium of the object (water) as m the reſiſtance of the air, the medium of the eye, to n, the reſiſtance of water, the medium of the object; which ratio, as it is always the ſame, the mediums remaining the ſame, the ratio therefore, between the true ray ET and the apparent ray EV, will be always the ſame, which agrees with a theorem given for the ſame purpoſe by Snellius.

In the ſame manner, ſeeing the ratio of EL and EH, the coſines of the angles of refraction and incidence, is reciprocal to the reſiſtance of the mediums; it will always be the ſame, which is Des Cartes theorem, deduced from principles very different to thoſe made uſe of by Snellius. This coincidence of concluſions ariſing from ſuch different principles, made Spleſſius, a man very converſant in theſe ſtudies, doubt whether Des Cartes, when in Holland, had not ſeen Snellius's theorem; for he obſerves, that it was a common thing with him to omit the names of authors; and he gives his vortices as an inſtance, at which Jordanus Brunus and Joh. Kepler had hinted in ſuch a manner, that they ſeem to have only

wanted that term: add to this, that Des Cartes ſetting about to demonſtrate this theorem by his own ſkill, fell into great difficulties: for, becauſe he ſaw that the ray C E, carried from air into water, is there refracted in E G, and that towards the perpendicular E K; and therefore rendered more ſimilar to that ray (whoſe action is ſtronger), namely, the perpendicular ray, he ſuſpected that it met with leſs reſiſtance in water, or glaſs, than in air: whereas, ſuppoſing the contrary, which is much more agreeable to reaſon, and employing that general principle, viz. that nature in all its operations takes the neareſt ways; we may arrive at the ſame concluſion. Whence Fermat rightly obſerved, that Des Cartes had not given the true reaſon of his theorem; and likewiſe the compariſon, by which he endeavours to illuſtrate his explication, is but little to the purpoſe. Let the ball A (*fig.* 7.) running on a ſmooth table B C, in the place A, meet in the middle of its courſe part of the table D E, covered with tapeſtry, when it will run ſlower in 2 A. In the ſame manner, therefore, he thinks, that glaſs, or any other ſolid body, leſs hinders the rays of light than air, which is not ſo ſmooth; but (not to mention that the parts of water are ſufficiently yielding, according to Des Cartes himſelf) it is ſufficient to conſider that the ball, when it comes from 2 A, after having paſſed over the tapeſtry D E, again comes to a ſmooth part of the table in 3 A, and cannot there recover its former celerity, which it had in 1 A, before it meets the tapeſtry; yet, ſince the ray of light does again enter from a greater reſiſting medium into a leſs reſiſting medium ſimilar to the firſt, and recovers its former ſtate; and ſuppoſing that the ſurfaces of two ſimilar mediums, to wit, the firſt and the laſt, be parallel planes, it may receive a direction by the latter refraction, parallel to that which it had before the former refraction.

The manner in which Des Cartes explains both reflexion and refraction of light, in imitation of the motion of other bodies, ſeems to be worthy of his genius, and not to be rejected but only amended: for, as to reflexion, he ſhould have in the firſt place explained, why any ball as I (*fig.* 8.) falling along the perpendicular I E on the plane A B is from thence reflected: for we obſerve that ſome bodies, namely ſuch as are ſoft, are not equally reflected, the true cauſe of which reflexion is the elaſticity either of the ball or plane, or both; for an elaſtic plane will yield a ſmall matter, as we obſerve a ſtretched membrane or inflated bladder does to a falling pebble. And indeed, it will yield ſo much the more as the ſtroke is ſtronger; and reſtoring itſelf with ſo much the greater force, it reflects the impinging body towards the ſame parts, and with the celerity it came: for although Des Cartes would not admit of this explication of reflexion, advanced by ſome of his contemporaries, as appears from his letters; yet at this time it is verified, both by reaſon and by experiment. Since therefore the ball comes from C to E in the right line C E, and conſequently with a motion compounded of two others, to wit, the horizontal, as C I or H E, by which it comes from C H to I E, and the perpendicular, as C H or I E, by which it comes from C I to H E, both beginning at C and terminating in E: and as the ſurface A B does not oppoſe, but is parallel to its horizontal conatus, coming into E from C H towards I E in the right line C I or H E; it will therefore retain unchanged both the celerity and direction of its horizontal motion; and the ſame ſpace of time it ſpent in coming from C H to I E, it will likewiſe ſpend in coming from E I to R D, ſuppoſing the intervals between C H and I E, as alſo between I E and R D, to be equal: but the perpendicular motion whereby it came from C I to H E, retaining its velocity, will be changed into the contrary direction, that it may ſpend as much time in which it may return from E R to I D. Since therefore E R is equal to E H, and R D to C H, the triangles C H E and D R E will be ſimilar and equal, and conſequently, the angle D E B will be equal to the angle C E A. All this will be more manifeſt, if we ſuppoſe the ruler C I D parallel to the ſurface A B, and retaining its parallelism through C H and D R to impinge on A B in H R, while in the mean time a ball in the ruler C I is carried from C to I; whence in reality the whole compound motion of the ball will be in the diagonal C E: but the ruler C I D reflected by the ſolid ſurface A B will return with the ſame celerity, and by the ſame way it came, and in an equal time will again come to C I D; while in the mean time the ball continuing its motion in the ruler, has advanced with the ſame celerity: and therefore in the ſame time arrives from I to D through I D = to C I; for the celerity remaining the ſame, equal ſpaces are run over in equal times: the ball, therefore, with a motion compounded of its own motion upon the ruler through I D, and that of the ruler along E I, to wit, returning from H R to C D, will be carried from E to D along the right line E D.

In order to explain refraction, we are to conſider that the greater reſiſting medium to light (yet without opacity) ſeems to be that which more obſtructs the diffuſion or diſtribution of light through more parts of the medium; and it may be called leſs illuminable; for the nature of light endeavours to diffuſe itſelf. On the contrary, by how much more the light equably affects the parts of the medium it illuminates, or communicates its force to a greater number of ſmall particles of the illuminated place, the medium will be the more illuminable, and leſs reſiſt light: whence the more ſolid and ſmall the parts of the medium affected by light are, or the leſs ſpace they leave between them for another heterogeneous matter, not affected by light, the medium will be ſaid to be the more illuminated. But it appears from mechanical principles, that the ſame ſtroke impreſſed on ſeveral bodies at the ſame time, communicates a leſs force than if the ſtroke had been given to one of them: it will, therefore, happen, that in a medium which more reſiſts the diffuſion of light, or which is affected in a leſs number of its parts, each part is ſo much the more ſtrongly affected: in a more illuminable medium more parts are affected, but weaker and with a more languid impreſſed ſtroke. Aſſuming now the motion of the ball inſtead of the ray, and ſuppoſing the ball coming from G to E, there to impinge on a medium, which ſhall retard its celerity or impetus, ſuppoſe in a ſeſquialteral ratio. If, therefore, in a minute of time it comes from G to E in the former medium K E; in the new medium E I the ſmall ball will come from E to C in a minute and a half, ſuppoſing E C and G E to be equal in whatever point C is. But ſince the ſurface A B that ſeparates the mediums ſhall not oppoſe the horizontal celerity in G K, L E, and the parallels thereof upon the ball's firſt entering into the new medium E I, or in the very point E (for the horizontal motion L E H only grazes along the ſeparating ſurface A B) but in the firſt moment of its entering, or in the point E (conſidering the ball as indefinitely ſmall like a point, as rays themſelves are uſually conſidered without breadth) the inclination of the line C E is to be preſently determined. It is, therefore, to be taken at the very firſt; ſo that, in reſpect of the horizontal motion, the velocity may remain the ſame; and ſuch as it was aſſumed at the beginning of its ingreſs into the new medium, ſuch it remains therein: the ball, therefore, while it went in the former medium from G to E, had paſſed over in a minute of time with the horizontal direction the interval G K or L E (between G L and K E); it now in a minute and half of time, in which it ſhould move from E to C, will accompliſh in the ſame horizontal direction the interval E H or I C (comprehended between E I and H C), which ought to be ſeſquialteral of the former L E, becauſe the horizontal velocity remaining the ſame, which is not changed by refraction, the ſpaces are as the times: E H, therefore, is to E L in the direct ratio of the times, or the reciprocal ratio of the celerities or reſiſtances; for we have ſhewn in the caſe of the light, whoſe diffuſion is impeded by the reſiſtance of the medium, that the velocity or impetus increaſes according to the reſiſtance, and languiſhes according to the greater facility of diffuſing itſelf in each part. On the contrary, that the ray recovers its force, and conſequently its direction, when again it comes into a medium where there is a leſs diffuſion, and more rays are employed in impelling a fewer number of parts; and this recovery Des Cartes, as we have mentioned before, could not explain by his compariſon of the tapeſtry, or any rough body.

Euclid has written on the ancient optics and catoptrics: dioptrics were unknown to them. F. Honorat. Fabri

Fabri has an abridgement of optics, catoptrics, and dioptrics. Father Eſchinard has given a century of problems in optics. Vitellio and Alhazen have performed well on the Elements of Optics. Father Kircher has a large volume on the Secrets of Optics, of Light, and Shadow, and their ſurpriſing effects, which paſs on the people for magic. We have alſo *L'Optique & Catoptrique* of father Merſenne, Paris 1641. *Dioptrique Oculaire* of father Cherubin, Paris 1651, fol. Chriſt. Sheineri *Optica*, London 1652. Jacobi Gregorii *Optices*. Barrovii *Lectiones Opticæ*, Lond. 1665. Joh. Bapt. Porta *de Refractione Optices*. Lond. 1669. *Principe generale de l Optique*, by M. Leibnitz, in the Leipſic Acts, 1682. *L'Occhiale all'Occhio*, or *Dioptrica Practica*, Carol. Ant. Mancini, Bologna, 1660, 4°. *Phyſico-matheſis de Lumine Coloribus, & Iride*, per F. Mar. Grimaldi, Bononiæ, 1665, 4°. *Cogitationes Phyſico-mechanicæ de Natura Viſionis*, per Joh. Ott. Scaphuſam, Heidel. 1670, 4°. and, which ought to be named firſt, the great Sir Iſaac Newton's Optics, Latin and Engliſh, 4°. and 8°.

OPULUS, the water-elder, in botany, a genus of plants, with a monopetalous, campanulated flower, quinquifid at the limb: the fruit is a roundiſh unilocular berry, containing a ſingle, oſſeous, and compreſſed cordated ſeed.

OPUNTIA, Indian fig, in botany, a ſpecies of cactus, diſtinguiſhed by being ramoſe and dichotomous.

It is on this plant that the cochineal animal feeds.

OR, in heraldry, denotes yellow, or gold colour. See COLOUR and METAL.

It is repreſented in engraving by ſmall points or dots, ſcattered all over the field or bearing.

ORACLE, among the heathens, was the anſwer which the gods were ſuppoſed to give to thoſe who conſulted them upon any affair of importance; it is alſo uſed for the god who it was thought gave the anſwer, and the place where it was given.

The credit of oracles was ſo great, that in all doubts and diſputes their determinations were held ſacred and inviolable; whence vaſt numbers flocked to them for advice about the management of their affairs; and no buſineſs of any conſequence was undertaken, ſcarce any peace concluded, any war waged, or any new form of government inſtituted, without the advice and approbation of ſome oracle. The anſwers were uſually given by the intervention of the prieſt or prieſteſs of the god who was conſulted, and generally expreſſed in ſuch dark and indeterminate phraſes, as might eaſily be wreſted to prove the truth of the oracle, whatever was the event. It is not, therefore, to be wondered at, that the prieſts who delivered them were in the higheſt credit and eſteem; and that they improved this reputation greatly to their advantage. They accordingly allowed no man to conſult the gods, before he had offered coſtly ſacrifices, and made rich preſents to them. And to keep up the veneration for their oracles, and to prevent their being taken unprepared, they admitted perſons to conſult the gods only at certain ſtated times; and ſometimes they were ſo cautious, that the greateſt perſons could obtain no anſwer at all. Thus Alexander himſelf was peremptorily denied by the pythia, or prieſteſs of Apollo, till ſhe was, by downright force, obliged to aſcend the tripos; when, being unable to reſiſt any longer, ſhe cried out, "Thou art Invincible;" and theſe words were accepted inſtead of a farther oracle. The principal oracles of antiquity were, 1. The oracle of Dodona, where there was a temple conſecrated to Jupiter: the prieſts who delivered theſe oracles were called ſelli; but in latter ages they were pronounced by three old women. Near the temple of Dodona was a ſacred grove of oaks, which were ſaid to be endued with a human voice, and a prophetical ſpirit; the reaſon of which fiction ſeems to have been, that the prieſts often concealed themſelves within the hollow of theſe trees, and from thence delivered oracles. 2. The oracle of Olympian Jupiter at Elis. 3. The oracle of Apollo at Delphi, where it was pretended that an inſpiring vapour aroſe from the mouth of a deep cavern, on which the pythia being placed on a three-legged ſtool, received the divine afflatus, and became inſpired: this oracle was the moſt famous of all others. 4. The oracle of Trophonius, at Lebadea, a city in Bœotia, at which, after a number of ceremonies were performed, the votary deſcended into Trophonius's cave, where future events were revealed to him in a very extraordinary manner. It is remarkable, that all who conſulted this oracle ſeemed to be frighted out of their ſenſes; for ſome time after, they became penſive and melancholy, their tempers were ſowered, and their countenances, however gay and pleaſant before, were rendered dull and heavy. 5. The oracle of Amphiaraus, the anſwers of which were delivered in dreams, while the perſon ſlept on the ſkin of the victim he had ſacrificed. 6. That of Mercury, at Pharæ, a city of Achaia, where thoſe who wanted information, after offering frankincenſe upon the altar, and preſenting a piece of money, placed their ear to the ſtatue, and then ſtopping both ears till they were at ſome diſtance, took away their hands, and received the firſt voice they heard as a divine oracle. 7. The oracle of Hercules at Bura, where was a cave, in which was placed the ſtatue of Hercules: here they who conſulted the god firſt addreſſed themſelves to him by prayer; then taking four dice out of a great heap that lay ready, they threw them upon the table, and as all the dice had particular marks, they were interpreted, and the anſwer given by conſulting a book kept for that purpoſe. 8. At Patræ, a city on the ſea-coaſt of Achaia, was a temple of Ceres, before which was a fountain which delivered oracles only on the event of diſeaſes, by letting down a looking-glaſs ſo low, that the bottom might juſt touch the ſurface of the water; when from the various figures repreſented in it, conjectures were formed concerning the patient. Beſides theſe, there were ſeveral others, as that of Æſculapius at Epidaurus, that of Bacchus at Amphiclea, that of Orpheus's head at Leſbos, &c.

ORACH, *Atriplex*, in botany. See the article ATRIPLEX.

ORAL, ſomething delivered by word of mouth, without being committed to writing; in which ſenſe we ſay, oral law, oral tradition, &c.

ORANGE, a delicious fruit of the apple kind, too well known to need deſcription.

This fine tree not being natural to our climate, we muſt quicken the nature of our ſoil with a compoſition that may cauſe it to correſpond as much as poſſible with the temperament of warmer countries. It delights greatly in a ſoil that is compoſed of an equal quantity of ſheep's dung that has reſted two years; old compoſt, or the ſoil of a ſewer; and fat land taken either from a marſh or hemp-cloſe.

When the proper ſeaſon is arrived for lodging your young ſtems in boxes, theſe latter ſhould always be proportioned to the heads of the plants. The ſtems, even when they are become vigorous, will accommodate themſelves to a box of about fifteen inches diameter; but they muſt be placed more at large in others, when the tree ceaſes to augment its foliage, and informs you, by its languid air, that its ſoil and ſuſtenance are inſufficient. At the end of ſeven or eight years, they may be tranſplanted, with all their earth, into their laſt boxes, whoſe diameters may be about twenty-four inches. All theſe boxes ſhould be made of entire heart of oak, and caſed over with a double coat of green paint liquified with oil, as alſo on the inſide, in order to preſerve the wood from rotting by frequent waterings, as it is on the outſide, to ſecure it from rain and ſun.

The large boxes ſhould have a door with double hinges, and two iron bars to admit the proper renovations of ſoil, and to enable you to clear the box of that liquid ſediment that is collected and thickened at the bottom; and likewiſe to pare off the extreme parts of the mould, that it may afterwards be taken out with eaſe, when it is neceſſary to transfer it into a new box.

In order to place ſome ſhrubs, and more eſpecially orange trees, in boxes, after a proper manner, the firſt proceeding is to cover the bottom of the boxes with large pieces of brick and potſherds, which afford the water an eaſy flow through the cavities that are opened at the bottom. Were it not from this precaution, the humidity collected by the ſediment would rot the box and deſtroy the tree by an immoderate chilneſs. When this proviſion has been made for the ſecurity of the tender plant, the bottom and ſides of the box muſt be lined with good ſoil, prepared

in

in the manner already mentioned: in this ſoil the tree ſhould be inverted in an upright poſition, and the ball of earth at its roots muſt be leſſened, not with an intention to ſtrengthen the tree, but rather to prevent its requiring a large quantity of earth, and to confine it by a moderate vigour to a juſt proportion with the box. A new maſs of earth muſt then be heaped up on every ſide, and preſſed with a due compactneſs, in order to ſecure the ſtem from violent winds, and cauſe the earth to ſettle round the root with as much exactneſs as poſſible.

When the tree is to be placed in the box, care ſhould be taken to raiſe the upper part of the clod of the earth at its roots higher than the rim of the box, becauſe the weight of the tree and the action of the roots will afterwards lower the clod by degrees to a level with the edge of the box. If this precaution be neglected, the tree in proceſs of time will ſink too low. And, that the upper part of the clod may not be expoſed to the air, it ſhould be covered over with earth, and the whole ſuſtained by ſmooth ſtaves diſpoſed round the edges of the box.

When fruit trees are to be pruned, care ſhould be taken to preſerve the ſmall branches in a thriving ſtate, in order to promote their fertility; but they are retrenched in an orange tree, that a vacancy may be opened within. The ſame method is taken with the branches that ſhoot downwards in a perpendicular direction; and alſo with thoſe that are diveſted of their leaves, which only happens, when the tree is weak or diſtempered: but we carefully preſerve all the vigorous branches, whoſe advantageous ſituation contributes to the regularity of the head.

Oranges are brought from ſeveral parts. The beſt and moſt in eſteem for a good taſte are thoſe which grow in hot countries; not only becauſe the ſoil of the places, having ſtore of exalted ſulphur and volatile ſalts in it, communicates a great quantity of the ſame to theſe fruits, and gives them an agreeable ſmell, but becauſe the heat of the ſun there digeſts, and more completely ripens their juice, and gives them a more delicious taſte.

The juice of the orange is ſharp, becauſe this ſalt is but little embarraſſed with the ropy parts; which is the reaſon it communicates almoſt all its acidity to the little nervous fibres of the tongue. As for the juice of the ſweet oranges, as it contains leſs ſalt than that of the four ones, and as this ſalt is kept under by a great quantity of oily parts, it is eaſy to be underſtood that it can make but a ſlight impreſſion on the parts it touches.

They prefer the juice of the four orange in medicinal uſe to the other, as we before obſerved, for cooling, moiſtening, and mitigating fevers; becauſe this juice has more of the acid in it, and can more eaſily thicken the overthinned liquors, allay their violent motions, and keep down thoſe ſharp humours that throw them into an extraordinary fermentation.

ORANGERY, in gardening, a gallery expoſed to the ſouth, but well cloſed with glaſs windows, to preſerve orange trees in winter.

It likewiſe denotes the parterre where the orange trees are expoſed in kindly weather.

ORATION, in rhetoric, a ſpeech or harangue, compoſed according to the rules of oratory, and ſpoke in public.

ORATORIO, in the Italian muſic, a ſort of ſacred drama of dialogues; containing recitativos, duettos, trios, ritornellos, choruſes, &c.

The ſubjects of theſe pieces are uſually taken from the ſcriptures, or from the life of ſome ſaint, &c.

ORATORY, *Oratoria*, the art of ſpeaking well, otherwiſe called rhetoric. See the article RHETORIC.

ORATORY, among the Romaniſts, a cloſet or like apartment near a bed-chamber, furniſhed with an altar, crucifix, &c. for private devotion.

ORB, *Orbis*, in aſtronomy, &c. denotes an hollow globe or ſphere. See GLOBE and SPHERE.

ORBICULARE Os, in anatomy, a little bone of the ear, ſo called from its figure. See the article EAR.

ORBICULARIS, in anatomy, an appellation given to the conſtrictor muſcle of the lips; as alſo to the conſtrictor of the upper eye-lid.

ORBIS MAGNUS, in aſtronomy, denotes the earth's orbit, in its annual revolution round the ſun.

ORBIT, *Orbita*, in aſtronomy, the path deſcribed by a planet about the ſun.

The orbits of all the planets are ellipſes, having the ſun in their common focus; but the elliptic orbit of the earth, by the action of the moon, is ſenſibly diſfigured, as alſo the orbit of Saturn by the action of Jupiter, when they are in conjunction. See PLANET.

ORCHARD, a ſeminary, or plantation of fruit-trees.

It is a rule among gardeners, that thoſe orchards thrive beſt which lie open to the ſouth, ſouth-weſt, and ſouth-eaſt, being ſcreened from the north, and have the ſoil dry and deep.

In planting of an orchard, great care ſhould be had to the nature of the ſoil, that ſuch trees as are adapted to grow upon the ground intended to be planted, may be choſen, otherwiſe there can be little hopes of their ſucceeding; and it is for want of rightly obſerving this method, that we ſee, in many countries, orchards planted which never arrive to any tolerable degree of perfection, their trees ſtarving, and their bodies either covered with moſs, or the bark cracks and divides; both which are evident ſigns of the weakneſs of the trees; whereas, if inſtead of apples the orchard had been planted with pears, cherries, or any other ſort of fruit to which the ſoil had been adapted, the trees might have grown very well, and produced great quantities of fruit.

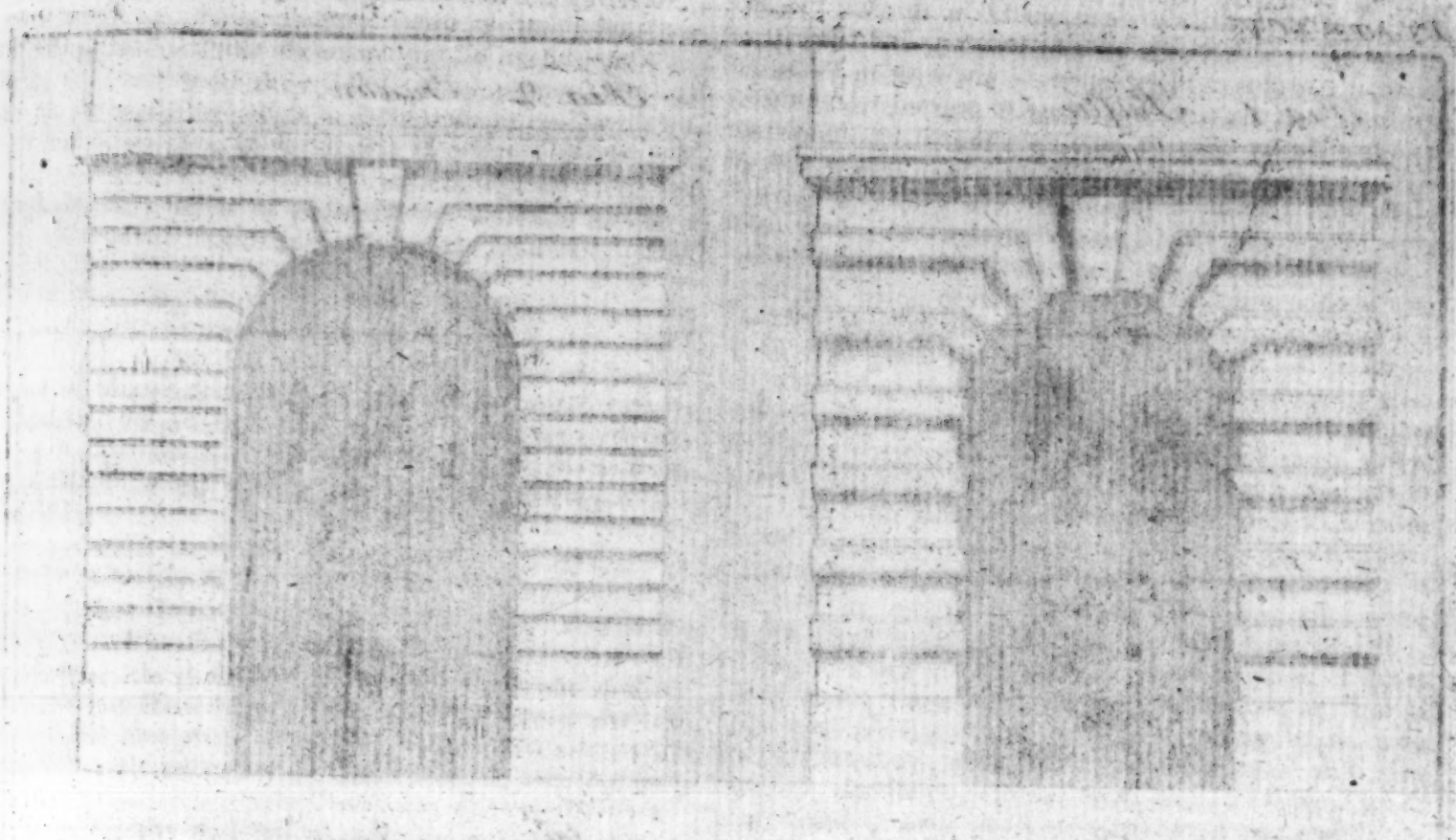
As to the poſition of the orchard, if you are at full liberty to chuſe, a riſing ground, open to the ſouth-eaſt, is to be preferred; but I would by no means adviſe to plant upon the ſide of an hill, where the declivity is very great; for in ſuch places the great rains commonly waſh down the better part of the ground, whereby the trees would be deprived of proper nouriſhment; but where the riſe is gentle, it is of great advantage to the trees, by admitting the ſun and air between them, better than it can upon an entire level; which is an exceeding benefit to the fruit, by diſſipating fogs, and drying up the damps, which, when detained amongſt the trees, mix with the air, and render it rancid: if it be defended from the weſt, north, and eaſt-winds, it will alſo render this ſituation ſtill more advantageous; for it is chiefly from theſe quarters that fruit-trees receive the greateſt injury: therefore, if the place be not naturally defended from theſe by riſing hills, which is always to be preferred, then you ſhould plant large growing timber-trees at ſome diſtance from the orchard, to anſwer this purpoſe.

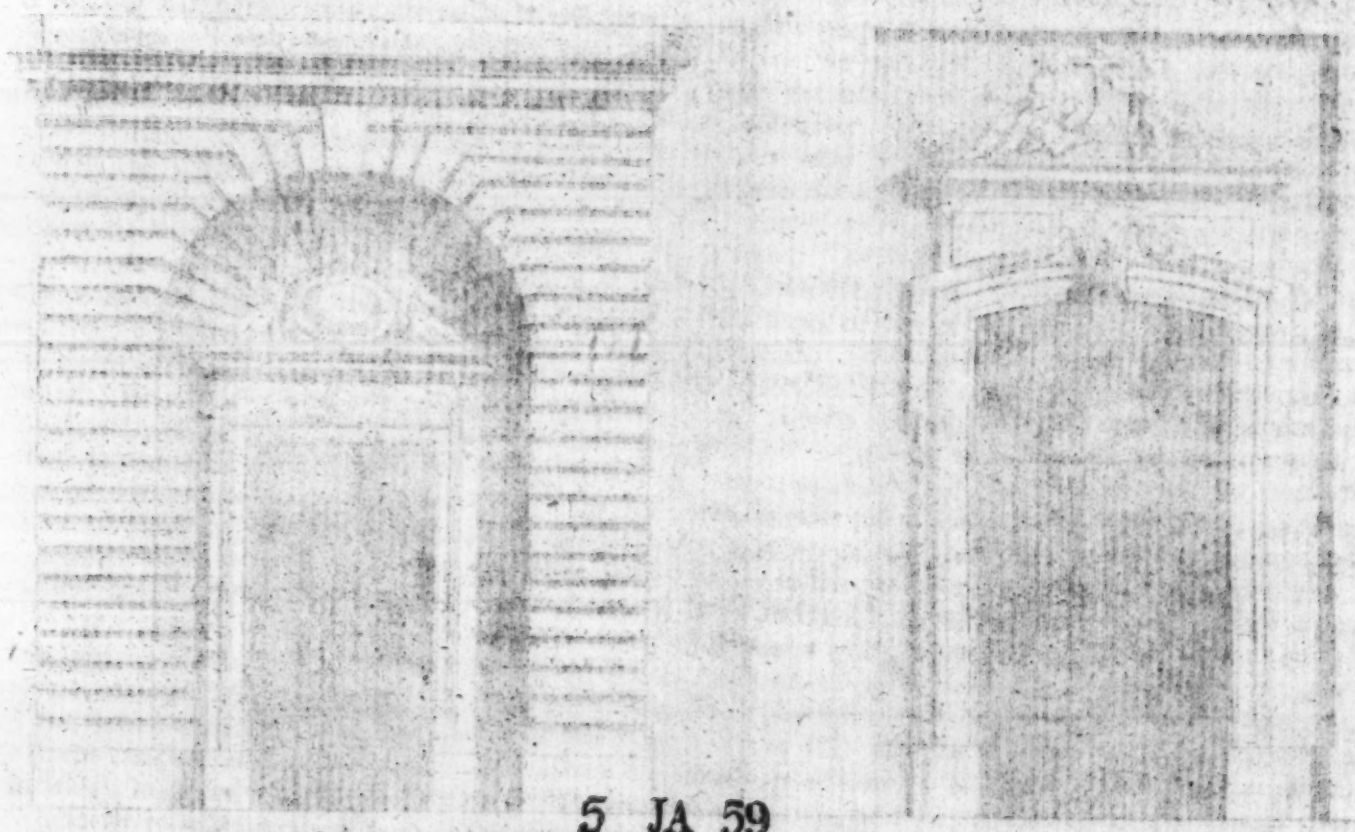
You ſhould alſo have a great regard to the diſtance of planting the trees, which is what few people have rightly conſidered; for if you plant them too cloſe, they will be liable to blights; and the air, being hereby pent in amongſt them, will cauſe the fruit to be ill-taſted, having a great quantity of damp vapours from the perſpiration of the trees, and the exhalations from the earth mixed with it, which will be imbibed by the fruit, and render their juices crude and unwholeſome.

Wherefore I cannot but recommend the method which has been lately practiſed by ſome particular gentlemen with very great ſucceſs; and that is, to plant the trees fourſcore feet aſunder, but not in regular rows. The ground between the trees they plough and ſow with wheat and other crops, in the ſame manner as if it were clear from trees; and they obſerve their crops to be full as good as thoſe quite expoſed, except juſt under each tree, when they are grown large, and afford a great ſhade; and, by thus ploughing and tilling the ground, the trees are rendered more vigorous and healthy, ſcarcely ever having any moſs, or other marks of poverty, and will abide much longer, and produce better fruit.

If the ground in which you intend to plant an orchard has been paſture for ſome years, then you ſhould plough in the green ſward the ſpring before you plant the trees: and, if you will permit it to lie a ſummer fallow, it will greatly mend it, provided you ſtir it two or three times, to rot the ſward of graſs, and prevent weeds growing thereon.

At Michaelmas you ſhould plough it pretty deep, in order to make it looſe for the roots of the trees, which ſhould be planted thereon in October, provided the ſoil be





5 JA 59

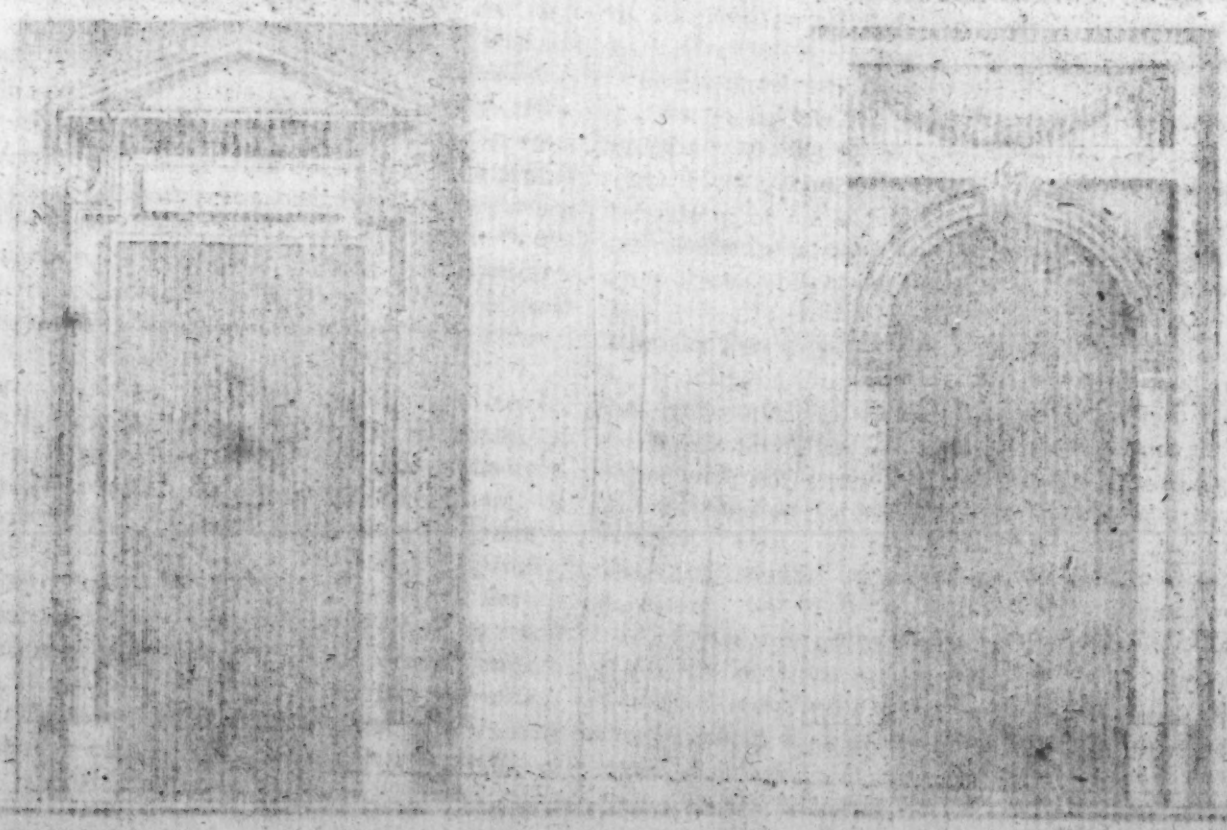


Fig. 1. Ruſtic.

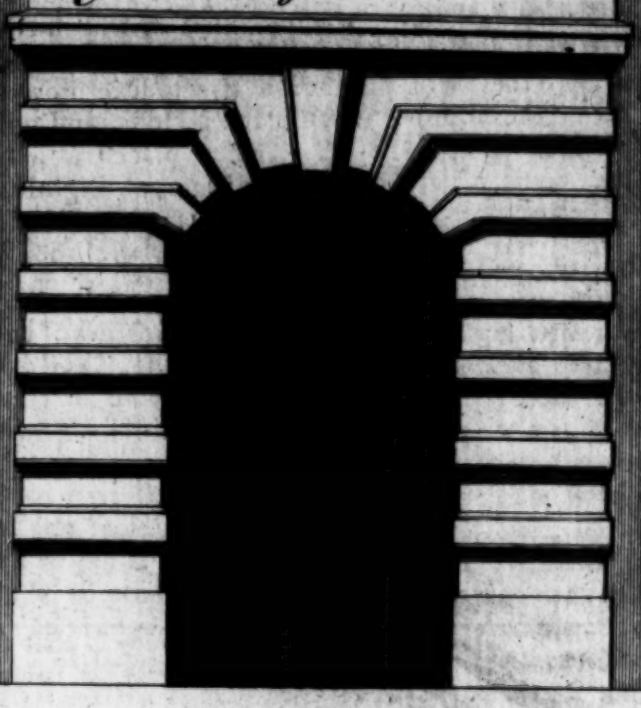


Fig. 2. Tuscan.

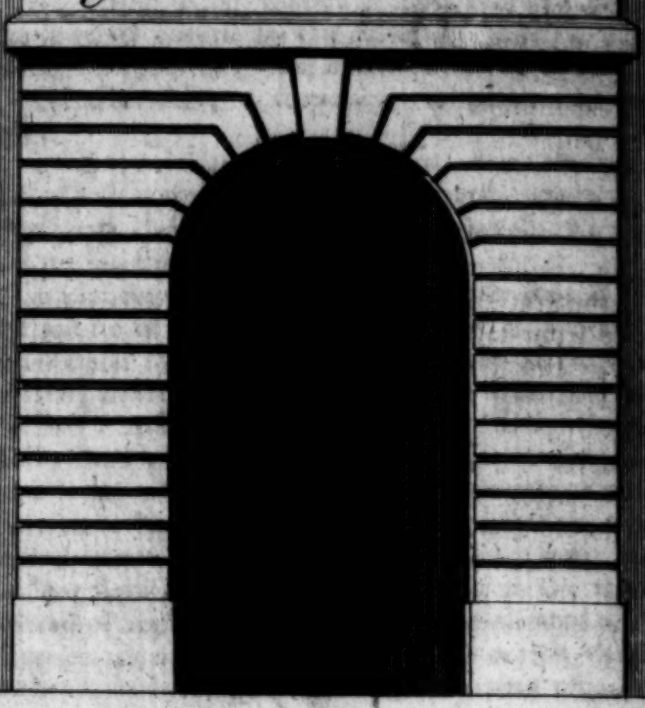


Fig. 3. Doric.

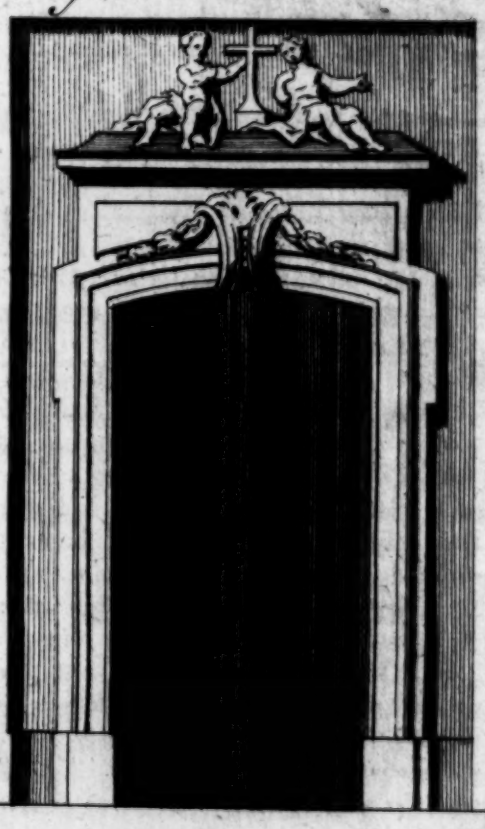


Fig. 4. Ionic.

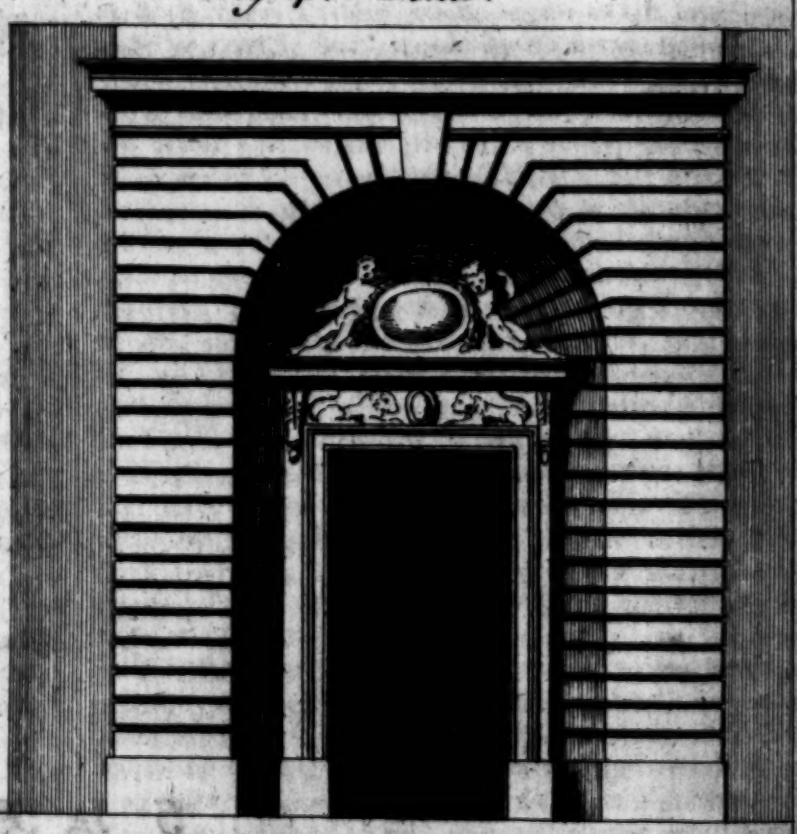


Fig. 5. Corinthian.

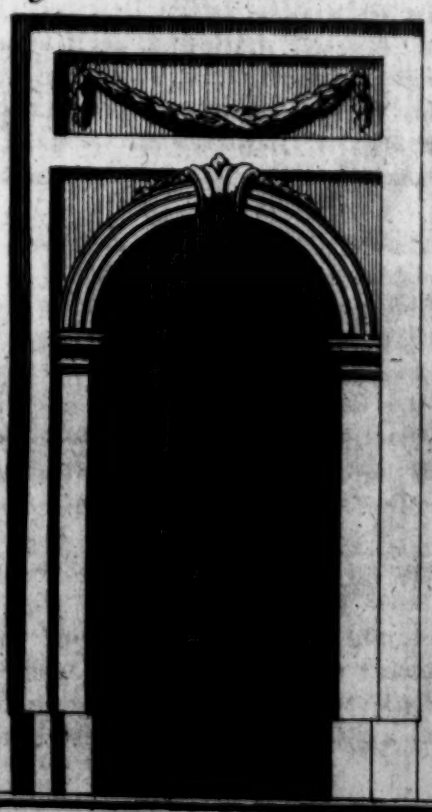
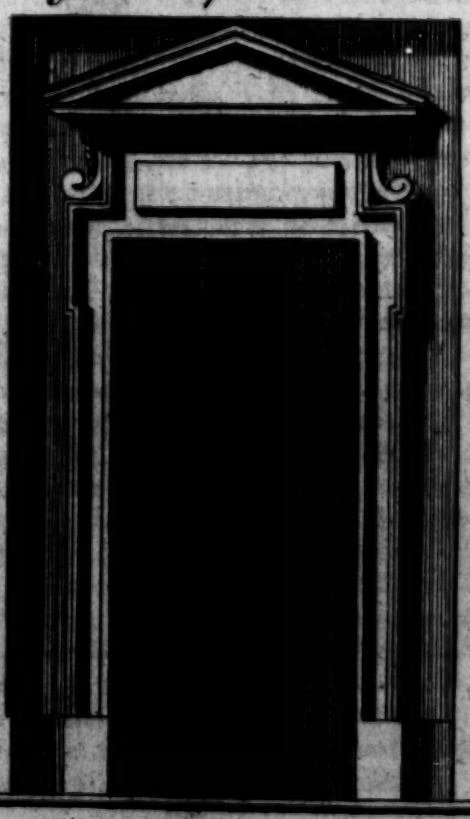


Fig. 6. Composite.



be dry; but, if it be moiſt, the beginning of March will be a better ſeaſon.

When you have finiſhed planting the trees, you ſhould provide ſome ſtakes to ſupport them, otherwiſe the wind will blow them out of the ground; which will do them much injury, eſpecially if they have been planted ſome time; for, the ground at that ſeaſon being warm, and for the moſt part moiſt, the trees will very ſoon puſh out a great number of young fibres; which, if broken off by their being diſplaced, will greatly retard the growth of them.

In the ſpring following, if the ſeaſon ſhould prove dry, you ſhould cut a quantity of green turf, which muſt be laid upon the ſurface of the ground about their roots, turning the graſs downward; which will prevent the ſun and wind from drying the ground, whereby a great expence of watering will be ſaved: and, after the firſt year, they will be out of danger, provided they have taken well.

Whenever you plough the ground between theſe trees, you muſt be careful not to go too deep among their roots, leſt you ſhould cut them off, which would greatly damage the trees: but, if you do it cautiouſly, the ſtirring of the ſurface of the ground will be of great benefit to them; though you ſhould obſerve never to ſow too near the trees, nor ſuffer any great rooting weeds to grow about them, which would exhauſt the goodneſs of the ſoil, and ſtarve them.

If, after the turf which was laid round the trees be rooted, you dig it in gently about the roots, it will greatly encourage them. There are ſome perſons who plant many ſorts of fruit together in the ſame orchard, mixing the trees alternately; but this is a method which ſhould always be avoided; for hereby there will be a very great difference in the growth of the trees, which will not only render them unſightly, but alſo the fruit upon the lower trees ill taſted, by the tall ones overſhadowing them; ſo that, if you are determined to plant ſeveral ſorts of fruit on the ſame ſpot, you ſhould obſerve to place the largeſt-growing trees backwards, and ſo proceed to thoſe of leſs growth, continuing the ſame method quite through the whole plantation; whereby it will appear at a diſtance in a regular ſlope, and the ſun and air will more equally paſs through the whole orchard, that every tree may have an equal benefit therefrom.

The ſoil of your orchard ſhould alſo be mended once in two or three years with dung, or other manure, which will alſo be abſolutely neceſſary for the crops ſown between; ſo that where perſons are not inclinable to help their orchard, where the expence of manure is pretty great; yet, as there is a crop expected from the ground beſides the fruit, they will the more readily be at the charge upon that account.

In making choice of trees for an orchard, you ſhould always obſerve to procure them from a ſoil nearly a-kin to that where they are to be planted, or rather poorer; for, if you have them from a very rich ſoil, and that wherein you plant them is but indifferent, they will not thrive well, eſpecially for four or five years after planting; ſo that it is a very wrong practice to make the nurſery, where young trees are raiſed, very rich, when the trees are deſigned for a middling or poor ſoil. The trees ſhould alſo be young and thriving; for, whatever ſome perſons may adviſe to the contrary, yet it has always been obſerved, that though large trees may grow, and produce fruit, after being removed, they never make ſo good trees, nor are ſo long-lived, as thoſe which are planted while young.

Theſe trees, after they are planted out, will require no other pruning but only to cut out dead branches, or ſuch as croſs each other, ſo as to render their heads confuſed and unſightly: the too often pruning them, or ſhortening their branches, is very injurious; eſpecially to cherries and ſtone fruit, which will gum prodigiouſly, and decay in ſuch places where they are cut: and the apples and pears, which are not of ſo nice a nature, will produce a greater quantity of lateral branches, which will fill the heads of the trees with weak ſhoots, whenever their branches are thus ſhortened; and many times the fruit is hereby cut off, which, on many ſorts of fruit-trees, is firſt produced at the extremity of their ſhoot.

It may, perhaps, ſeem ſtrange to ſome perſons, that I ſhould recommend the allowing ſo much diſtance to the trees in an orchard, becauſe a ſmall piece of ground will admit of very few trees, when planted in this method: but they will pleaſe to obſerve, that, when the trees are grown up, they will produce a great deal more fruit than twice the number when planted cloſe, and will be vaſtly better taſted; the trees, when placed at a large diſtance, being never ſo much in danger of blighting as in cloſe plantations, as hath been obſerved in Herefordſhire, the great county for orchards, where they find that when orchards are ſo planted or ſituated, that the air is pent up amongſt the trees, the vapours which ariſe from the damp of the ground, and the perſpiration of the trees, collect the heat of the ſun, and reflect it in ſteams ſo as to cauſe what they call a fire-blaſt, which is the moſt hurtful to their fruit; and this is moſt frequent where the orchards are open to the ſouth ſun.

But, as orchards ſhould never be planted, unleſs where large quantities of fruit are deſired, ſo it will be the ſame thing to allow twice or three times the quantity of ground; ſince there may be a crop of grain of any ſort upon the ſame place, as was before ſaid, ſo that there is no loſs of ground: and, for a family only, it is hardly worth while to plant an orchard; ſince a kitchen garden well planted with eſpaliers will afford more fruit than can be eaten while good, eſpecially if the kitchen garden be proportioned to the largeneſs of the family: and, if cyder be required, there may be a large avenue of apple-trees extended croſs a neighbouring field, which will render it pleaſant, and produce a great quantity of fruit; or there may be ſome ſingle rows of trees planted to ſurround the fields, &c. which will fully anſwer the ſame purpoſe, and be leſs liable to the fire-blaſts before-mentioned. *Miller's Gard. Dict.*

ORCHESTRA, in the ancient theatres, a place in the form of a ſemi-circle, where the dancing was performed.

ORCHIS, fool's-ſtones, in botany, a genus of plants, the corolla of which is of a coniculated form; and its fruit is an oblong unilocular capſule, containing numerous ſcobiform ſeeds.

Orchis root abounds with a glutinous juice, good for blunting acrid ſerous humours: it is alſo accounted an aphrodiſiac, but on no good foundation.

ORDEAL, a form of trial, or of diſcovering innocence or guilt, formerly practiſed over almoſt all Europe, and which prevailed in England from the time of Edward the Confeſſor, till it was aboliſhed by a declaration of Henry III. It was called *purgatio vulgaris*, or *judicium*, in oppoſition to *bellum* or combat, the other form of purgation, and was of various kinds, as that of fire, that of red-hot iron, that of water, that of judicial pottage, that of hallowed cheeſe, that of the green croſs, and that of dice laid on relics covered with a woollen cloth. To each of which kinds particular maſſes were appointed.

In England, an offender, on being arraigned and pleading not guilty, had it in his choice to put himſelf upon God and his country; that is, upon the verdict of a jury; or upon God alone, on which account it was called the judgement of God, it being preſumed that God would deliver the innocent. The more popular kinds of ordeal were thoſe of red-hot iron and water; the firſt for freemen and people of faſhion, and the laſt for peaſants. That by fire, as practiſed here, was the perſon's walking barefooted and blindfold over nine red-hot plough-ſhares; and if he eſcaped unhurt, he was acquitted, otherwiſe condemned. That of water was of two kinds, viz. either with hot water or cold; the former was where the perſon ſuſpected put his arm or leg into ſcalding water, and brought it out unhurt; and the latter was when his body was not, contrary to the courſe of nature, borne up by the water.

ORDER, in architecture, is a ſyſtem of the ſeveral members, ornaments, and proportions of columns and pilaſters; or a regular arrangement of the projecting parts of a building, eſpecially the column, ſo as to form one beautiful whole.

M. Le Clerc defines an order to be a column charged with an entablature, and ſupported on a pedeſtal.

The origin of orders may be ſaid to be almoſt as ancient as human ſociety. The rigour of the ſeaſons firſt put men upon making little cabbins to retire into: at the firſt they were made half under ground, and half above, and were covered with ſtubble; but, in time growing more expert, they placed trunks of trees on end, and laid others a-croſs, to bear up the covering.

From hence they took the hint of more regular architecture, the trunks of trees upright repreſenting columns; and the girds or bands which ſerved to keep the trunks from burſting, expreſſed baſes and capitals; and the ſummers which lay a-croſs, gave the hint of entablatures; and likewiſe, the coverings, ending in points, gave a notion of pediments. This hypotheſis we have from Vitruvius, and it has been well illuſtrated by M. Blondel. See the article COLUMN, &c.

Others are of opinion that columns take their riſe from the pyramids which were erected by the ancients over tombs; and that the urns wherein their aſhes were incloſed, repreſented the capitals, the abacus of which was a brick laid over to cover the urn: but Vitruvius's account ſeems the moſt natural. See the article ABACUS, &c.

In time, the height of columns was regulated by the Greeks on the foot of the proportion of a human body. The Doric repreſented a man of a ſtrong robuſt make, the Ionic that of a woman, and the Corinthian that of a girl; their baſes and capitals were their ſhoes, head-dreſs, &c.

The three Greek orders repreſent three different manners of building, viz. the ſolid, mean, and delicate; the two Italian ones are imperfect productions of theſe.

The little regard the Romans had for the laſt, appears from this, that we meet not with one inſtance in the antique where they are intermixed.

Daviler obſerves, that the abuſe the moderns have introduced by the mixture of the Greek and Latin orders, ariſes from their want of reflection on the uſe which the ancients made thereof.

To give a general idea of the orders, it will be neceſſary to obſerve that the whole is compoſed of two parts, at leaſt, viz. the column and the entablature; and of four parts, at the moſt, where there is a pedeſtal under the column, and one acroter or little pedeſtal on the top of the entablature.

That the column has three parts, viz. the baſe, the ſhaft, and the capital: the entablature has three likewiſe, viz. the architrave, the frieze, and the corniche; which parts are all different in the ſeveral orders, having each their particular characters and members called by the general names of mouldings or ornaments. See the article BASE, &c.

Theſe orders took their names from the people among whom they were invented. Scamozzi calls the Tuſcan, the gigantic; the Doric, the Herculean; the Ionic, the matronal; the Compoſite, the heroic; and the Corinthian, the virginal.

An order of columns is uſually underſtood of a column bearing its entablature; but the order is ſcarcely complete, except the column be raiſed on a pedeſtal.

The pedeſtal, column, and entablature, are three compound parts, each conſiſting of three others, as has been ſaid before.

The ancients have given us five ſeveral orders of columns, the Tuſcan, Doric, Ionic, Compoſite, and Corinthian.

Under the artiele COLUMN we have given a plate of the five orders, and ſhall here add another of doors adapted to the different orders. See plate XCV. where *fig* 1. is a door according to the Ruſtic taſte. Fig. 2. A door of the Tuſcan order. Fig. 3. A door of the Doric order. Fig. 4. A door of the Ionic order. Fig. 5 A door of the Corinthian order; and *fig*. 6. a door of the Compoſite order.

Diſpoſition of the ORDERS. Theſe ought to be ſo diſpoſed in building, that the moſt ſolid may be placed undermoſt; as being the moſt proper to ſuſtain the weight, and to give the whole edifice a more firm foundation: therefore the Doric muſt always be placed under the Ionic the Ionic under the Corinthian, and the Corinthian under the Compoſite. As to the Tuſcan, being a plain rude order, it is ſeldom uſed above ground except in villas, where one order only is employed. In very large buildings, as amphitheatres, where many orders are required, the Tuſcan may be placed under the Ionic inſtead of the Doric. But if you are deſirous to leave out any of theſe orders, as for inſtance, to place the Corinthian immediately over the Doric, you may, provided you always obſerve to place the moſt ſtrong and ſolid undermoſt, for the reaſons above-mentioned.

ORDER is alſo uſed for a diviſion or claſs of any thing: thus, the tribe of animals called birds, is ſubdivided into ſix orders. See the article ORNITHOLOGY.

Holy ORDERS, a character peculiar to eccleſiaſtics, whereby they are ſet apart for the miniſtry.

Military ORDERS are companies of knights, inſtituted by kings and princes; either for defence of the faith, or to confer marks of honour, and make diſtinctions among their ſubjects.

Religious ORDERS are congregations or ſocieties of monaſtics, living under the ſame ſuperior, in the ſame manner, and wearing the ſame habit.

ORDERS *of Curves*, in geometry. See the article CURVE.

ORIGINAL NUMBERS. See NUMBER.

ORDINANCE, or ORDONNANCE, a law, ſtatute, or command of a ſovereign, or ſuperior.

ORDINARY, in general, ſignifies common, uſual; thus, an ambaſſador or envoy in ordinary, is one ſent to reſide ſtatedly, and for a number of years, in the court of ſome foreign prince or ſtate, in order to keep up a good underſtanding, and watch over the intereſt of his own nation.

This term is alſo applied to ſeveral officers in the king's houſhold, who attend on common occaſions. Thus we ſay, phyſician in ordinary, &c.

ORDINARY, in civil law, is any judge inveſted with authority to take cognizance of cauſes in his own right, and not by deputation.

ORDINARY, in common and canon law, is one who has ordinary or immediate juriſdiction in eccleſiaſtical cauſes in ſuch a place.

ORDINARY, or *Honourable* ORDINARY, in heraldry, a denomination given to certain charges properly belonging to that art. The honourable ordinaries are ten in number; viz. the chief, pale, bend, feſſe, bar, croſs, ſaltier, chevron, bordure, and orle.

ORDINATES, or ORDINATE APPLICATES, in geometry, are parallel lines, terminating in a curve, and biſſected by a diameter. The half of theſe is properly the ſemi-ordinate, though commonly called ordinate. See CURVE, PARABOLA, HYPERBOLA, &c.

ORDINATION, the act of conferring holy orders, or of initiating a perſon into the prieſthood by prayer, and the laying on of hands. Ordination has always been eſteemed the principal prerogative of biſhops, and they ſtill retain the function as a mark of ſpiritual ſovereignty in their dioceſe. Without ordination, no perſon can receive any benefice, parſonage, vicarage, &c. A clerk muſt be twenty-three years of age before he can have any ſhare in the miniſtry; and twenty-four, before he can be ordained, and by that means be permitted to adminiſter the ſacraments. A biſhop, on the ordination of clergymen, is to examine them in the preſence of the miniſters who aſſiſt him at the impoſition of hands; and in caſe any crime, as drunkenneſs, perjury, forgery, &c. be alledged againſt any one that is to be ordained, either prieſt or deacon, the biſhop ought to deſiſt from ordaining him. The perſon to be ordained is to bring a teſtimonial of his life and doctrine to the biſhop, and give an account of his faith in Latin, and both prieſts and deacons are obliged to ſubſcribe the thirty-nine articles.

ORDNANCE, a general name for all ſorts of great guns uſed in war. See CANNON and GUN.

ORDONNANCE, or ORDINANCE, in painting, is uſed for the diſpoſition of the parts of a picture, either with regard to the whole piece, or to the ſeveral parts; as the groups, maſſes, contraſts, aſpects, &c.

In

In the ordonnance there are three things to be regarded, viz. the place or ſcene, the diſtribution, and the contraſt.

1. As to the firſt, regard is to be had to the diſpoſition of things which ſerve as a ground-work; and to the plan and poſition of bodies; under the former of which comes the landſkip, whether an uninhabited place, where there is full liberty of repreſenting all the extravagancies of nature; or inhabited, where the ſigns of cultivation, &c. muſt be exhibited. See LANDSKIP.

As to the plan of bodies, they are either ſolid, which again are either ſo by nature, and muſt be proportioned to their places; or artificial, where regard muſt be had to the rules of geometry, perſpective, architecture, &c. Or the bodies move; which they do either by a voluntary motion, wherein great regard muſt be had to proportion them to their ſituation, and to ſtrengthen them by regarding the equilibrium; or by ſome extraordinary power, as machines, &c. where the cauſes of their motion muſt appear. Or they are things at a diſtance, in all which an even plane muſt ſtill be propoſed, to find their preciſe ſituation, and ſettle their place by ſudden breaks and diſtances agreeably to perſpective.

In placing the figures, regard is to be had, 1. To the group, which connects the ſubject, and ſtays the ſight. In this are to be conſidered the knot or nodus, which binds the group, and the nearneſs of figures, which as it holds them together, may be called the chain; that the group be ſuſtained by ſomething looſe and diſtinct from it, and by the ſame joined and continued to the other groups; and that the lights and ſhadows be ſo diſpoſed, as that the effects of all the parts of a compoſition may be ſeen at once. See GROUP.

2. As to the actions, forced attitudes are to be avoided, and ſimple nature ſhould be ſhewn in her moſt advantageous poſtures.

3. As to the drapery, which is to be adjuſted, ſo as it may appear real garments, and not ſtuff looſely thrown on.

4. In the contraſt, are to be conſidered the actions, which vary infinitely; the aſpects which in actions of the ſame kind, may, by their difference, make a contraſt; the ſituation, according as they meet above, or under the ſight, or are near or at a great diſtance. And laſtly, cuſtom, which indeed extends to all the parts of painting: though this is particularly to be regarded in the ordonnance, it is nevertheleſs to be followed with diſcretion, taking care to avoid all ſtiffneſs and formality.

ORDONNANCE, in architecture, is the compoſition of a building, and the diſpoſition of its parts, both with regard to the whole, and to one another; or, as Mr. Evelyn expreſſes it, determining the meaſure of what is aſſigned to the ſeveral apartments.

ORE, in natural hiſtory, the mineral glebe, earth or ſtone dug out of the mines, to be purified, and have the metalline particles ſeparated from it.

ORGAN, *ὀργανον*, in general, is an inſtrument, or machine deſigned for the production of ſome certain action or operation; in which ſenſe, the mechanic powers, machines, and even the veins, arteries, nerves, muſcles, and bones of the human body, may be called organs.

The organs of ſenſe are thoſe parts of the body, by which we receive the impreſſions or ideas of external objects; being commonly reckoned five, viz. the eye, ear, noſe, palate, and cutis.

ORGAN, in muſic, the largeſt and moſt harmonious wind-inſtrument.

The invention of the organ is very ancient, though it is agreed that it was vey little uſed till the eighth century. It ſeems to have been borrowed from the Greeks. Vitruvius deſcribes an hydraulic one in his tenth book of Architecture.

St. Jerome mentions one with twelve pair of bellows, which might be heard a thouſand paces, or a mile; and another at Jeruſalem, which might be heard at the mount of Olives.

There is one in the cathedral church of Ulm, in Germany, that is ninety-three feet high; and twenty eight broad; the biggeſt pipe is thirteen inches in diameter, and it has ſixteen pair of bellows.

The organ has at leaſt one ſet of keys, when it has only one body, and two or three when it has a poſitive or chair-organ: though large organs have four, and ſometimes five ſets of keys; beſides which, the pedals or largeſt pipes have their keys, the ſtops or touches whereof are played by the feet. The keys of an organ are uſually divided into four octaves, viz. the ſecond ſub-octave, firſt ſub-octave, middle octave, and firſt octave. Each octave is divided into twelve ſtops or frets, whereof the ſeveral black ones mark the natural ſounds, and the five white, the artificial ones, that is, the ſharps and flats; ſo that the keys uſually contain forty eight ſtops, or touches. Some organiſts add to this number one or more ſtops in the third ſub-octave as well as in the ſecond. Note, ſome harpſicords and ſpinnets have their natural ſtops or keys often marked white, and their artificial ones black. The pedals have about two or three octaves, at the pleaſure of the organiſt, ſo that the number of ſtops is indeterminate.

Each key or ſtop preſſed down, opens a valve or plug which correſponds lengthwiſe with as many holes as there are rows of pipes on the ſound-board: the holes of each row are opened and ſhut by a regiſter, or ruler pierced with forty-eight holes; by drawing the regiſter, the holes of one row are opened, becauſe the holes therein correſpond with thoſe of the ſound-board, ſo that by opening a valve, the wind brought into the ſound board, by a large pair of bellows, finds a paſſage into the pipes, which correſpond to the open holes of the ſound-board; but by puſhing the regiſter, the forty-eight holes thereof not anſwering to any of thoſe of the ſound-board, that row of pipes anſwering to the puſhed regiſter are ſhut. Whence it follows, that by drawing ſeveral regiſters, ſeveral rows of pipes are opened; and the ſame thing happens, if the ſame regiſter correſpond to ſeveral rows. Hence the rows of pipes become either ſimple or compound: ſimple, when only one row anſwers to one regiſter; compound, where ſeveral. The organiſts ſay, a row is compound, when ſeveral pipes play upon preſſing one ſtop.

The pipes of the organ are of two kinds; the one with mouths like our flutes; the other with reeds. The firſt, called pipes of mutation, conſiſt, 1. of a foot A A B B (plate XCIV. *fig.* 9.) which is a hollow cone, and which receives the wind that is to ſound the pipe. 2. To this foot is faſtened the body of the pipe B B D D. Between the foot and the body of the pipe is a diaphragm or partition, F E F, which has a long, but narrow aperture to let the wind out. Over this aperture is the mouth B B C; whoſe upper lip C, being level, cuts the wind as it comes out at the aperture.

The pipes are of pewter, of lead mixed with a twelfth part of tin, and of wood. Thoſe of pewter are always open at their extremities: their diameter is very ſmall, and their ſound very clear and ſhrill. Thoſe of lead, mixed with tin, are larger; the ſhorteſt open, the longeſt are quite ſtopped; the mean ones partly ſtopped, and having beſides a little ear on each ſide the mouth, to be drawn cloſer, or ſet farther aſunder, in order to raiſe or lower the ſound. The wooden pipes are made ſquare, and their extremity ſtopped with a valve, or tampion of leather. The ſound of the wooden and leaden pipes is very ſoft; the large ones ſtopped, are uſually of wood; the ſmall ones of lead. The longeſt pipes give the greateſt ſound; and the ſhorteſt, the moſt acute: their lengths and widths are made in the reciprocal ratios of their ſounds; and the diviſions regulated by their rule, which they call diapaſon. But the pipes that are ſhut are of the ſame length as the open ones, which yield the ſame ſound. Uſually, the longeſt pipe is ſixteen feet: though in extraordinary organs it is thirty-two. The pedal tubes are always open, though made of wood, and of lead.

A reed-pipe conſiſts of a foot, A A B B, (*fig.* 10.) which carries the wind into the ſhalot, or reed C D, which is a hollow demi-cylinder, fitted at its extremity D, into a kind of mould, by a wooden tampion G. The ſhalot is covered with a plate of copper, K K I I, fitted at its extremity I I, into the mould by the ſame wooden tampion. Its other extremity K K, is at liberty; ſo that the air entering the ſhalot, makes it tremble or ſhake againſt the reed; and the longer that part of the tongue which is at

liberty

liberty I L, is made, the deeper is the ſound. The mould I I, which ſerves to fix the ſhalot or reed, the tongue, tampion, &c. ſerves alſo to ſtop the foot of the pipe, and to oblige the wind to go out wholly at the reed. Laſtly, in the mould is ſoldered the tube H H, whoſe inward opening is a continuation of that of the reed. The form of this tube is different in the different ranks of pipes. The degree of acuteneſs and gravity in the ſound of a reed-pipe, depends on the length of the tongue, and that of the pipe C K, taken from the extremity of the ſhalot, to the extremity of the tube. The quality of the ſound depends on the width of the reed, the tongue, and the tube; as alſo on the thickneſs of the tongue, the figure of the tube, and the quantity of wind.

To diverſify the ſounds of the pipes, they add a valve to the port-vent, which lets the wind go in fits or ſhakes.

Hydraulic ORGAN denotes a muſical machine that plays by means of water inſtead of wind. Of theſe there are ſeveral in Italy in the grottos of vineyards.

ORGANICAL, in the ancient muſic, was that part performed by inſtruments. See MUSIC.

ORGANICAL *Part* is that part of an animal, or plant, deſtined for the performance of ſome particular function.

ORGANICAL *Diſeaſe*, a diſeaſe in an organical part of the body, whereby its function is impeded, ſuſpended, or deſtroyed.

ORGANICAL *Deſcription of Curves*, the method of deſcribing them on a plane by means of inſtruments.

ORGANO, in muſic, ſignifies the thorough baſs. It is uſually ſcored with figures over the notes for the harpſichord, baſs viol, and lute.

ORGANO PICCIOLO, a chamber or little organ, uſed to play in a ſmall room, being about two or three feet high, that is, its largeſt pipe is that length: it is made in a ſmall buffet, like the poſitive, or little organ of a church.

ORGASM, *Orgaſmus*, an extacy, or impetuous deſire of coition, occaſioned by a turgeſcency of the ſeminal veſſels.

ORGYIA, ὀργια, in antiquity, feaſts and ſacrifices performed in honour of Bacchus, inſtituted by Orpheus, and chiefly celebrated on the mountains, by wild, diſtracted women, called Bacchæ.

ORGUES, in the military art, are thick, long pieces of wood pointed at one end, and ſhod with iron, clear one of another; hanging each by a particular rope, or cord, over the gate-way of a ſtrong place, perpendicularly, to be let fall in caſe of an enemy. Their diſpoſition is ſuch, that they ſtop the paſſage of the gate, and are preferable to herſes or portcullíſes; becauſe theſe may be either broke by a petard, or they may be ſtopped in their falling down; but a petard is uſeleſs againſt an orgue, for if it break one or two of the pieces, they immediately fall down again, and fill up the vacancy; or if they ſtop one or two of the pieces from falling, it is no hindrance to the reſt.

ORGUES is alſo uſed for a machine, compoſed of ſeveral harquebuſs on muſquet-barrels, bound together, by means whereof ſeveral exploſions are made at the ſame time, uſed to defend breaches and other places attacked.

ORGYA, an ancient Grecian meaſure, containing ſix feet.

ORIENT, *Oriens*, in geography and aſtronomy, the eaſt, or eaſt-point of the horizon; thus called, becauſe it is in the point where the ſun riſes. Hence the equinoctial orient is uſed for that point of the horizon wherein the ſun riſes, when he is in the equator, or when he enters the ſigns of Aries and Libra; æſtival orient is the point wherein the ſun riſes in the middle of ſummer, when the days are longeſt; and the hibernal orient, the point where the ſun riſes in the middle of winter, when the days are ſhorteſt.

ORIENTAL, ſomething ſituated towards the eaſt, with regard to us, in oppoſition to occidental.

ORIFICE, the mouth or aperture of a tube, pipe, or other cavity.

In anatomy, this term is particularly applied to the mouths of the ſeveral ducts, veſſels, and other cavities, as of the bladder, uterus, ſtomach, &c.

It is alſo uſed for the aperture of a wound or ulcer.

ORIGANUM, wild marjoram, in botany, a plant with firm round ſtalks, and oval, acuminated, uncut, ſomewhat hairy leaves, ſet in pairs upon ſhort pedicles: on the tops grow ſcaly heads of pale red labiated flowers, whoſe upper lip is entire, and the lower cut into three ſegments, ſet in form of a convex umbel, intermixed with roundiſh purpliſh leaves; each flower is followed by four minute ſeeds incloſed in the cup. It grows wild on dry chalky hills and gravelly grounds, in ſeveral parts of England, and flowers in June. The flowers, or rather flowery tops, of a ſomewhat different ſpecies, *origanum Creticum*, were formerly brought from Candy, but have long given place to thoſe of our own growth, which are nearly of the ſame quality.

The leaves and flowery tops of origanum have an agreeable aromatic ſmell, and a pungent taſte, warmer than that of the garden marjoram, and much reſembling thyme; with which they appear to agree in medicinal virtue. Infuſions of them are ſometimes drank as tea, in weakneſs of the ſtomach, diſorders of the breaſt for promoting perſpiration and the fluid ſecretions in general; they are ſometimes uſed alſo in nervine and antirheumatic baths; and the powder of the dried herb as an errhine. Diſtilled with water, they yield a moderate quantity of a very acrid penetrating eſſential oil, ſmelling ſtrongly of the origanum, but leſs agreeable than the herb itſelf: this oil is applied on a little cotton for eaſing the pains of carious teeth; and ſometimes diluted and rubbed on the noſtrils or ſnuffed up the noſe, for attenuating and evacuating mucous humours.

ORIGENISTS, in church hiſtory, a Chriſtian ſect in the fourth century, ſo called from their drawing their opinions from the writings of Origen. The Origeniſts maintained, that the ſouls of men had a pre-exiſtent ſtate, that they were holy intelligences, and had ſinned in heaven before the body was created: that Chriſt is only the ſon of God by adoption; that he has been ſucceſſively united with all the angelical natures, and has been a cherub, a ſeraph, and all the celeſtial virtues, one after another; that in future ages, he will be crucified for the ſalvation of the devils, as he has already been for that of men; and that their puniſhment, and that of the damned, will continue only for a certain limited time.

ORIGINAL, a firſt draught or deſign of any thing, which ſerves as a model to be imitated or copied.

ORIGINAL SIN, the crime of eating the forbidden fruit, of which it is ſaid, all mankind are guilty at their conception, by the imputation of Adam's tranſgreſſion; which is accounted for by ſuppoſing that Adam, as he was to be the father, was alſo the fœderal head, and repreſentative of the whole human race; and that on his ſinning, all that were to ſpring from him partook of his crime.

ORILLON, in fortification, is a ſmall rounding of earth faced with a wall; raiſed on the ſhoulder of thoſe baſtions that have caſe-mates, to cover the cannon in the retired flank, and prevent their being diſmounted by the enemy.

ORION, in aſtronomy, a conſtellation of the ſouthern hemiſphere; conſiſting of thirty-ſeven ſtars, according to Ptolemy; of ſixty-two, according to Tycho; and of no leſs than eighty, in the Britannic catalogue.

ORION'S RING, in aſtronomy, a conſtellation more uſually called Eridanus. See the article ERIDANUS.

ORLE, ORLET, or ORLO, in architecture, a fillet under the ovolo or quarter round of a capital. When it is at the top or bottom of the ſhaft, it is called cincture. See CINCTURE.

Palladio uſes the word orlo, for the plinth of the baſes of columns.

ORLE, in heraldry, an ordinary in form of a fillet drawn round the ſhield, near the edge or extremity thereof, leaving the field vacant in the middle. Its breadth is but half that of the treſſure or bordure, which contains a ſixth part of the ſhield; and the orle, only a twelfth: beſides that, the orle is its own breadth diſtant

diſtant from the edge of the ſhield, whereas the bordure comes to the edge itſelf.

ORNAMENTS, in architecture, are uſed to ſignify all the ſculpture or carved-work wherewith a piece of architecture is enriched.

Vitruvius and Vignola alſo uſe the word to ſignify the entablature.

ORNITHOLOGY, that branch of zoology which treats of birds. See BIRD.

Linnæus arranges the whole claſs of birds under ſix orders, according to the different figures of their beaks, viz.

1. The accipitres, or birds with uncinated or hooked beaks.

2. The picæ, or birds that have convex and compreſſed beaks.

3. The anſeres, comprehending ſuch birds as have depreſſed, and dentated or ſerrated beaks.

4. The ſcolopaces, or thoſe furniſhed with ſubcylindric and obtuſe beaks.

5. The gallinæ, or birds which have the beak of a conic form, but crooked, and the upper chap imbricated.

6. The paſſeres, or birds with conic and ſharp-pointed beaks.

In the deſcription of birds, the feet, wings, and tail, are chiefly attended to.

In moſt birds the toes are four in number, three ſtanding forwards and one backwards.

In ſome two toes ſtand forward, and two backward. Some feet, again, are palmated, or have the toes connected together by a membrane; and others ſemi-palmated.

With regard to the wings, the long quill-feathers are called by authors remiges, as ſerving to fly with; and the other feathers, placed over the reſt of the body, tectrices. The long feathers of the tail are called rectrices, as ſerving to ſteer the bird's courſe through the air.

As to the other terms made uſe of in the deſcription of birds, they are theſe: cera expreſſes the membrane or naked tunic, which ſurrounds and extends itſelf over more or leſs of the baſe of the beak: urrhopigium is the rump; and as to other terms, they will be found explained under their ſeveral heads.

OROBUS, bitter vetch, in botany, a genus of plants, with a papilionaceous flower, and a rounded bivalve pod for its fruit, containing numerous roundiſh ſeeds.

It agrees in virtues with ervum. See the article ERVUM.

ORPELLO, in the glaſs-trade, calcined bark reduced to a black powder.

ORPHAN, a fatherleſs child, or minor; or one that is deprived both of father and mother.

ORPIMENT, *Auripigmentum*, in natural hiſtory, a beautiful foſſile, ſo called from its being uſed as a gold coloured pigment. It is the *αρσενικον* and *αρρενικον* of the Greeks; the *harnat*, *zarnich*, or *zirnich* of the Arabians; and the *fumus rubeus*, *gummi paradiſi*, &c. of the alchemiſts. It is commonly ſuppoſed to be the ſame with the factitious yellow arſenic, and to be poſſeſſed of a poiſonous quality; but it is neither one nor the other. This error ſeems to have proceeded from Agricola's relation, copied by many writers, that white arſenic is prepared from orpiment and common ſalt ſublimed together. Hoffman made trial of ſuch a compoſition, but obtained from it no white arſenic.

Orpiment is a native foſſile, found chiefly in Turkey and Natolia. Some is met with alſo in Bohemia, Hungary, and Luſatia near Sorau, but inferior in goodneſs to that of Turky. The beſt ſort is of a lively gold-yellow and green colour, here and there intermixed with pieces of a vermilion red; of a ſhattery foliaceous texture, ſomewhat flexible, ſoft to the touch like talc, and ſparkling when broke. The inferior kinds are of a dead yellow, inclining more to greeniſh; and want the ſparkling appearance of the foregoing.

The principal uſe of orpiment is as a colouring drug, among the painters, book-binders, &c. Of itſelf it makes a gold-coloured pigment, as hath been already obſerved; with indigo or other blues, green: it is commonly tempered with yolk of eggs and a little ſaffron, or with fiſh galls. At Rouen it is uſed for ſtaining wood of the colour of box-wood. It is mixed alſo with wax, employed for heightening the colour of gold, for hardening lead in order to the making of ſhot, and for colouring glaſs.

ORPINE, *Anacampſeros*, or *Telephium*, in botany, is a ſpecies of ſedum, with terminatory cluſters of flowers.

ORRERY, a curious machine, or movement, for repreſenting the motions and appearances of the heavenly bodies. See plate XCVI. *fig.* 1.

The orrery, or planetarium, is fixed in a frame of ebony, contained by twelve vertical planes, on which are repreſented the twelve ſigns of the zodiac. The upper-ſurface is flat, of poliſhed braſs, on whoſe outward circumference are ſcrewed in twelve braſs pillars, which ſupport a large flat ſilvered ring marked 12, repreſenting the ecliptic, with ſeveral circles drawn upon it. The three inner-moſt are divided into twelve parts for the ſigns of the zodiac, each of which is divided into thirty degrees, and among theſe degrees are graved in their proper places, the nodes, aphelia, and greateſt north and ſouth latitudes of the planets. Between the next two circles are the cardinal points. The next three circles have the months and the days of the month, according to the new ſtile. Upon the braſs-ſurface of the machine are graduated ſilver-circles, which carry the planets, repreſented by ſilver-balls, upon arbors or ſtems, that raiſe them up to the height of the plane of the ecliptic; and turning about the handle or winch of the orrery, all the planets move at their proportional diſtances from a little gilt ball in the middle, which repreſents the ſun; and perform their revolutions according to their periodical times. There are fixed indices of blued ſteel, which ſhew the longitudes of the planets, by pointing to the diviſions of the ſilvered rings or circles, as they move round. But as theſe circles, being concentric, give only the mean diſtances, the true orbits, according to their excentricities, are graved on the outſide of each circle, with the periodical times taken from the tables, to ſhew what the revolutions are, nearer than can be performed by any machine. The nodes and aphelia, with the places of greateſt north and ſouth latitudes, are alſo marked on thoſe orbits. In the middle of this large circle, deſigned to repreſent the ecliptic, is fixed a globe, 1. to repreſent the ſun. Next the ſun is a ſmall ball, 2, to repreſent Mercury. Next to this is Venus, 3, repreſented by a larger ball. And, at a greater diſtance from the ſun, you ſee the earth, 4, repreſented by an ivory-ball, ſurrounded at ſome diſtance by a ring, which expreſſes the orbit of the moon, making an angle with the circle that repreſents the ecliptic, and thereby ſhewing the inclination they have to each other in the heavens, and alſo the line of the nodes. Within the ſame ring is another ivory-ball, 5, with a black cap or caſe, to repreſent the moon; the cap is contrived always to cover that hemiſphere which is turned from the ſun, and thereby diſtinguiſheth the enlightened part from the dark ſide, and, conſequently, her age. 6 repreſents Mars. 7 is Jupiter attended with his ſatellites, or four moons. And 8, the outmoſt of all the planets, is Saturn with his ring or belt, and five ſatellites, or moons. All theſe are fixed upon ſmall ſtems, which ſeverally repreſent their axes, each of which hath its peculiar and proper inclination to the plane of that circle which repreſents the ecliptic. 9 is a dial-plate; 10, 10, 10, meridians; 11, the equator; 12, the ecliptic with its circles, already deſcribed; 13, 13, two keys for locking and unlocking the diurnal and annual motions; and as to the arctic circle, tropic of Cancer, and moveable horizon, they are named in the figure.

By means of the orrery, a great many perſons, who have not time to apply themſelves to the ſtudy of aſtronomy, and yet are deſirous to be acquainted with the celeſtial appearances, in a few days may get a competent knowledge of ſeveral phænomena, and eſpecially, be cured of the common prejudices againſt the motion of the earth, and the Copernican ſyſtem. See the article COPERNICAN.

But the principal uſe of the orrery is to render the theory of the earth and the moon eaſy and intelligible; and to evidence to our ſenſes how all thoſe appearances happen, which depend on the annual or diurnal rotation

tion of the earth, and the monthly revolutions of the moon: as the variety of ſeaſons, the viciſſitudes and various lengths of days and nights, the manner of ſolar and lunar eclipſes, the various phaſes of the moon, &c. There have been various forms invented for this noble inſtrument, two of which have principally obtained, viz. the hemiſpherical orrery, and the whole ſphere: though the orrery at firſt was made without any ſphere, with only the ſun, the earth and moon revolving about it; but as this was too imperfect a ſtate, they ſoon began to inveſt it, ſome with half a ſphere, and others with a whole ſphere, to be an adequate repreſentation of the ſolar ſyſtem.

The hemiſpherical orrery, as that above deſcribed, has been made in greater numbers than any other, on account of their being made much cheaper and eaſier than thoſe in a ſphere of the ſame ſize; there being a vaſt difference between placing an hemiſphere on the box of an orrery, and diſpoſing an orrery in a large moveable ſphere. But the idea given us by the former, is very imperfect and unnatural in compariſon of the latter; and it is ſurpriſing to think how they ſhould have had ſo great a run. An orrery, therefore, adapted to an armillary ſphere, is the only machine that can exhibit a juſt idea of the true ſyſtem of the world, with the diurnal and annual motions of the heavenly bodies; for it is likewiſe capable of exhibiting the third motion of the earth, viz. that motion of the earth by which the poles of the world revolve about the poles of the ecliptic, and occaſions what is commonly called the preceſſions of the equinoxes, or more properly the retrogreſſion of the earth's nodes.

As the diſtances are in their true proportions to each other, ſo likewiſe are the bodies of the planets in their juſt proportions to one another. But it cannot be expected, that the diameters of the planets ſhould be in proportion to the diameters of the orbits; becauſe taking Jupiter under three inches diameter, and the earth a little more than a quarter of an inch, it would require the ſyſtem to be of the bigneſs of a mile and $\frac{3}{4}$, the orbit of Saturn 9000 feet in diameter; and ſo on of the reſt; which would make the machine 3000 times bigger than it is. And if the bodies were ſuited to the dimenſions given, the bodies muſt be 3000 times leſs, which would render them all inviſible, but the ſun; and that would be leſs than $\frac{1}{1000}$th part of an inch. For this reaſon, as a ball big enough to repreſent the ſun cannot be put on, we are to ſuppoſe the ſun, in reſpect of them, as big as the inner circle of the ſilver ring, which repreſents the ecliptic.

As the orbit of the moon, and the orbits of the ſatellites of Jupiter and Saturn, are quite loſt in this proportion of the orbits of the primary planets, much more are the ſatellites themſelves; therefore the ſatellites are uſually not put on in this poſition of the machine. But Saturn's ring is joined to Saturn's body, according to its proportion, and the inclination of its plane to the plane of Saturn's orbit: and as the planet is carried round, the ring always moves parallel to itſelf, as it does in the heavens. Thereby we ſee why the inhabitants of the earth, in one revolution of Saturn, ſee the ring twice in the moſt open ſituation of the anſæ, as at 8, and twice, as if it had no ring, that is, when the edge of the ring is towards the earth, the plane of the ring going through the obſerver's eye, and the ſucceſſive increaſing and decreaſing of the viſible bigneſs of the anſæ.

Jupiter, with his moons, is repreſented at 7, and the ſpots whereby his revolution has been obſerved.

When you have a compleat idea of the proportional bigneſs of the planets, Jupiter and Saturn are taken off, and others put on three times leſs than the former, in order to put ſatellites about them, and at the ſame time the moon is joined to the earth, to ſhew how the ſatellites accompany their primary planet in its courſe round the ſun. Theſe ſatellites, which are pearls upon crooked ſtems, do not turn by clock-work round their primaries, as has been done in ſome large orreries, but are only ſet by the hand; becauſe, to do it, would be only a needleſs expence, to give a falſe notion of their bigneſs, diſtances, and inclination of their orbits, in reſpect of their primaries. But to give a right notion of Jupiter and his ſatellites, and of Saturn and his ſatellites, there is ſhewn for each of theſe planets a ſyſtem apart, where the diſtances from the primary, and the bigneſs of the ſatellites, are expreſſed: and in this ſyſtem, though Jupiter is but of about an inch diameter, the outermoſt ſatellite is as far diſtant from Jupiter's center, as Saturn is from the ſun in the machine; which ſhews the inconſiſtency and diſproportion of making the ſatellites to move round Jupiter in an orrery. Saturn's ſatellites are ſtill more improperly put in; becauſe four of them move in orbits very much inclined to Saturn's ecliptic, viz. in an angle of above thirty degrees, and the fifth has its orbit almoſt in the ſame plane as Saturn's ecliptic, with a diameter greater than the diameter of the whole orrery, even when Saturn is three times leſs than the Saturn of the orrery.

The next thing which is put on, is a contrivance to ſhew, that all the confuſion of the planets motions in the Ptolemaic hypotheſis, called their ſtations and retrogradations, is not really, but apparently ſo, in the Copernican or true ſyſtem of the world. And this is done by two ſteel indices, one of which being always applied to the ſun, and ſucceſſively to the top of the ſtem of the planet to be examined, whilſt the other is applied to the earth, as a center, and the ſaid planet; by turning the handle of the machine, the heliocentric and geocentric places of the planet are ſeen on the ecliptic at the ſame time; ſhewing why the planets ſeem to go backwards and forwards when viewed from the earth; though they go all the while regularly from weſt to eaſt, as they would be ſeen from the ſun.

When the machine is put in motion, all theſe bodies move round that which repreſents the ſun, and, at the ſame time, both that, and all thoſe which repreſent ſuch of the planets as have been obſerved to have a rotation about their axis, turn round upon the ſaid ſtems, and in their proper times. The ſatellites, or moons, alſo revolve about their primaries at the ſame time; and the ring that repreſents the orbit of the moon has likewiſe its proper motion, whereby that of its nodes is alſo expreſſed. The whole machine is put into motion by turning a ſmall winch, 14, like the key of a clock, with very little ſtrength. And, above this winch, is a cylindrical pin, which may be drawn a little out, or puſhed in at pleaſure: when it is puſhed in, all the planets, both primary and ſecondary, will move according to their reſpective periods, by turning the handle or winch: when it is drawn out, the motions of the ſatellites of Jupiter and Saturn will be ſtopped, while all the reſt move freely. In the place of the ſun, you may fix a braſs lamp, with two convex glaſſes, made on purpoſe; which, being placed with the glaſs directly to the earth, and turning round in the ſame time with the earth, throws a continual ſtrong light upon it and the moon, in whatever part of its orbit it is; and ſo not only the times in which the eclipſes of the ſun and moon will happen, are ſhewn, but the phænomena themſelves are truly repreſented.

When you propoſe to uſe this machine, place a ſmall black patch, or a bit of wafer, upon the middle of the ſun, right againſt the firſt degree of ♈: you may alſo place patches upon Venus, Mars, and Jupiter, right againſt ſome noted point in the ecliptic; put on the handle, and puſh in the pin which is juſt above it. One turn of this handle anſwers to a revolution of the ball, which repreſents the earth, about its axis; and, conſequently, to 24 hours of time, as may be ſeen by the motion of the hour-index, 9, which is marked, and placed at the foot of the wire, on which the ball of the earth is fixed: again, when the index has moved the ſpace of ten hours, Jupiter makes one complete revolution round its axis; and ſo of the reſt.

By theſe means the revolutions of the planets, and their motions round their own axes, will be repreſented to the eye. And it is worth obſervation, that the diurnal motion of the planets are diſcovered, by obſerving the motions of the ſpots upon the ſurface of the ſun, and of the planets in the heavens, after the ſame manner as we here obſerve the motions of their repreſentatives, by that of the marks placed upon them in this machine.

This machine is ſo contrived, that the winch may be turned either way; ſo that the ſame number of revolu-

tions

tions being made backwards, they will bring all the planets to their former aſpects or ſituations in reſpect to each other.

It would be too great an undertaking here to give an account of the mechaniſm of the larger ſort of orreries, which repreſent the movements of all the heavenly bodies; nor, indeed, can it be done either by diagram or deſcription, to render it intelligible to the moſt diſcerning reader; but, inſtead of that, we ſhall exhibit an idea of the theory and ſtructure of an uſeful, conciſe, and portable planetarium, which any gentleman may have made for a ſmall expence, and will exhibit, very juſtly, the motions of all the primary planets about the ſun, by wheel-work; and thoſe that have ſecondaries, or moons, may have them placed about their primaries moveable by the hand, ſo that the whole ſhall be a juſt repreſentation of the ſolar ſyſtem, or true ſtate of the heavens, for any given time of the year.

In order to this we muſt compare, and find out the proportion, which the periodical times, or revolutions of the primary planets, bear to that of the earth; and they are ſuch as are expreſſed in the table below, where the firſt column is the time of the earth's period in days and decimal parts; the ſecond, that of the planets; the third and fourth are numbers in the ſame proportion to each other: as,

365,25 : 88	☿	:: 83 : 20, for Mercury.
365,25 : 224,7	♀	:: 52 : 32, for Venus.
365,25 : 686,9	♂	:: 40 : 75, for Mars.
365,25 : 4332,5	♃	:: 7 : 83, for Jupiter.
365,25 : 10759,3	♄	:: 5 : 148, for Saturn.

If we now ſuppoſe a ſpindle or arbor with ſix wheels fixed upon it in an horizontal poſition, having the number of teeth in each, correſponding to the numbers in the third column, viz. the wheel A M (*fig.* 2.) of 83 teeth, B L of 52, C K of 50, for the earth, D I of 40, E H of 7, and F G of 5; and another ſet of wheels moving freely about an arbor, having the number of teeth in the fourth column, viz. A N of 20, B O of 32, C P of 50, for the earth, D Q of 75, E R of 83, and F S of 148; then, if thoſe two arbors of fixed and moveable wheels are made of the ſize, and fixed at the diſtance from each other, as here repreſented in the ſcheme, the teeth of the former will take thoſe of the latter, and turn them very freely, when the machine is in motion.

Theſe arbors, with their wheels, are to be placed in a box, of an adequate ſize, in a perpendicular poſition: the arbor of fixed wheels to move in pivots at the top and bottom of the box; and the arbor of moveable wheels to go through the top of the box, to a proper height, on the top of which is to be placed a round ball, gilt with gold, to repreſent the ſun. On each of the moveable wheels is to be fixed a ſocket, or tube, aſcending above the top of the box, and having on the top a wire fixed, and bent at a proper diſtance into a right angle upwards, bearing on the top a ſmall round ball, repreſenting its proper planets.

If then on the lower part of the arbor of fixed wheels be placed a pinion of ſcrew-teeth, a winch turning a ſpindle with an endleſs ſcrew, playing in the teeth of the arbor, will turn it with all its wheels; and theſe wheels will move the others about with their planets, in their proper and reſpective periods of time, very exactly. For while the fixed wheel C K moves its equal C P once round, the wheel A M will move A N a little more than four times round, and ſo will nicely exhibit the motion of Mercury; and the wheel F G will turn the wheel F S about $\frac{1}{2}\frac{1}{0}\frac{1}{3}$ round, and ſo will truly repreſent the motion of Saturn: and the ſame is to be obſerved of all the reſt.

ORRICE, the common name of the iris-root. See the article IRIS.

ORTEIL, in fortification, the ſame with berme. See BERME.

ORTHODOX, in church hiſtory, an appellation given to thoſe who are ſound in all the articles of Chriſtian faith.

ORTHOGONIAL, in geometry, the ſame with rectangular.

ORTHOGRAPHIC *Projection of the Sphere*, that wherein the eye is ſuppoſed at an infinite diſtance; ſo called, becauſe the perpendiculars from any point of the ſphere will all fall in the common interſection of the ſphere with the plane of the projection. See the article PROJECTION.

ORTHOGRAPHY, that part of grammar which teaches the nature and affections of letters, and the juſt method of ſpelling or writing words with all the proper and neceſſary letters, making one of the four greateſt diviſions or branches of grammar.

ORTHOGRAPHY, in geometry, the art of drawing or delineating the front plan of any object, and of expreſſing the heights or elevations of each part. It is called orthography, from its determining things by perpendicular lines falling on the geometrical plane.

ORTHOGRAPHY, in architecture, the elevation of a building. This orthography is either external or internal. The external orthography is taken for the delineation of an external face or front of a building; or, as it is by others defined, the model, platform, and delineation of the front of a houſe, that is contrived, and to be built, by the rules of geometry, according to which pattern the whole fabric is erected and finiſhed. This delineation or platform exhibits the principal wall, with its apertures, roof, ornaments, and every thing viſible to an eye placed before the building.

Internal orthography, which is alſo called a ſection, is a delineation, or draught of a building, ſuch as it would appear, were the external wall removed. To lay down the orthography of a building, draw a right line for a baſe or ground line A B (pl. XCVI. *fig.* 3.) and at one end erect a perpendicular A D upon A B; ſet off the width and diſtances of the gates or doors, windows, &c. On the right line A D, ſet off the heights of the ſeveral parts viſible in the face of the building, *v. g.* of the doors, windows, the roofs, chimnies, &c. and apply a ruler to each point of diviſion.

The common interſections of the right lines, drawn from three points, parallel to the lines A B and A D, determine the external orthography of the building; and after the ſame manner is the internal orthography to be laid down.

ORTHOGRAPHY, in perſpective, is the front or fore view of any plane; that is, the ſide or plane that lies parallel to a ſtraight line, which may be imagined to paſs through the outward convex point of the eye, continued to a convenient length.

ORTHOGRAPHY, in fortification, is the profile or repreſentation of a work; or a draught ſo conducted, as that the length, breadth, height, and thickneſs of the ſeveral parts are expreſſed, ſuch as they would appear if perpendicularly cut from top to bottom.

ORTHOPNOEA, in medicine, a ſpecies or degree of aſthma, where there is ſuch a difficulty of reſpiration, that the patient is obliged to ſit or ſtand upright, to be able to breathe. See ASTHMA.

ORTIVE, in aſtronomy, the ſame with eaſtern: the ortive or eaſtern amplitude, is an arch of the horizon intercepted between where a ſtar riſes, and the eaſt point of the horizon, or point where the horizon and equator interſect.

ORVIETANUM, in pharmacy, the name of a celebrated antidote, ſo called, according to Lemery, from Orvieto, a city of Italy, where it was firſt uſed; but, according to others, from Hieronymus Ferrantes Orvietanus, a famous mountebank, who invented it.

The method of preparing this medicine may be ſeen in Lemery's Pharmacopoeia.

ORYZA, rice, in botany, a genus of plants, the corolla of which is formed of two obtuſe, large, nearly equal, and permanent valves: the nectarium is compoſed of two leaves, plane, very ſmall, and ſituated on the ſides of the germen; the leaves of it are narrow at the baſe, truncated, and deciduous; there is no pericarpium; the corolla grows to the ſeed, and becomes of an oblong oval figure, compreſſed, thin at the edges, and marked each way with two lines on the ſides; the ſeed is ſingle, large, obtuſe, oblong, and compreſſed.

This plant is cultivated in vaſt abundance in the Eaſt,

as alſo in Carolina, for food. It is ſaid to be good in dyſenteries, diarrhœas, &c.

OSCHEOCELE, in ſurgery, a hernia of the ſcrotum. See HERNIA.

Of this rupture, ſometimes called hernia ſcrotalis, there are two kinds; a true one, proceeding from a prolapſion of the inteſtine, or omentum; and a ſpurious one, or only apparent, ariſing from a tumour of the teſticles, or ſpermatic veſſels, or a diſtention with air, water, or ſome offending humour: the oſcheocele is therefore diſtinguiſhed into various kinds, according to the different ſubſtances with which the ſcrotum is diſtended, by which it is alſo differently denominated: when the inteſtine is prolapſed through the proceſs of the peritonæum into the ſcrotum, the tumour is then called enterocele; if from the omentum, epiplocele: if from a diſtention with water, hydrocele; if from wind or flatus, pneumatocele; when from blood, hæmatocele; if the teſticle is enlarged beyond its proper dimenſions, it is termed ſarcocele; and when the ſpermatic veins are too much diſtended, it is termed varicocele, cirſocele, or hernia varicoſa; and when an abſceſs is formed in the ſcrotum, it is by ſome termed hernia humoralis; ſometimes two or more of theſe ſubſtances concur together to form the tumour, which is then named conjunctly from them entero-epiplocele, hydro-enterocele, &c. Each of theſe may be ſeen ſeparately treated of, under their ſeveral heads. See ENTEROCELE, EPIPLOCELE, &c.

OSCILLA, in antiquity, ſmall images of wax or clay, which were made in the ſhape of men and women, and conſecrated to Saturn, in order to render him propitious.

OSCILLATION, in mechanics, vibration, or the reciprocal aſcent or deſcent of a pendulum.

The word is Latin, *oſcillatio*, and derived from *oſcillo*, to vibrate, or ſwing to and fro.

1. If a ſingle pendulum be ſuſpended between two ſemi-cycloids B C, C D (plate XCVI. *fig.* 4.) that have the diameter C F of the generating circle equal to half the length of the ſtring, which, as it oſcillates, folds about them; all the oſcillations, however unequal, will be iſochronal in a non-reſiſting medium.

2. The time of a whole oſcillation through any arch of a cycloid, is to the time of the perpendicular deſcent through the diameter of the generating circle, as the periphery of the circle to the diameter.

3. If two pendulums deſcribe ſimilar arches of circles, the times of the oſcillations are in the ſubduplicate ratio of their lengths.

4. The number of iſochronal oſcillations, made in the ſame time by two pendulums, are reciprocally as the times wherein each of the oſcillations are made. The times of the oſcillations, in different cycloids, are in the ſubduplicate ratio of the length of the pendulums.

5. The length of a pendulum that will perform its oſcillations in a ſecond, is 3.125 inches, or three feet 3.125.

6. The ſhorter the oſcillations in the arch of a circle are, the truer will the pendulum meaſure time, or the more iſochronal will the oſcillations be. See the article PENDULUM.

Center of OSCILLATION, in a ſuſpended body, is a certain point therein, each vibration whereof is performed in the ſame manner, as if that point or part alone were ſuſpended at that diſtance from the point of ſuſpenſion. Or it is a point, wherein, if the whole length of a compound pendulum be collected, the ſeveral oſcillations will be performed in the ſame time as before. Its diſtance, therefore, from the point of ſuſpenſion, is equal to the length of a ſingle pendulum whoſe oſcillations are iſochronal with thoſe of the compound one.

In order to determine the place of the center of oſcillation in a compound pendulum, let the bodies C, A, and B, be ſuppoſed fixed to the axis at their reſpective diſtances CI, AK, and BL (p. XCVII. *fig.* 1.) and to gravitate in parallel lines CD, A*a*, and B*b*; let theſe lines be equal to each other, and repreſent the accelerating force of gravity; let C*g*, A*f*, and B*h*, repreſent the forces by which their motions are actually accelerated with their reſpective directions perpendicular to IC, K A, and L B, while the figure moves upon its axis KL. Let DQ, *am*, and *bk*, be perpendicular to thoſe directions in Q, *m*, and *k*, and *gd*, *fn*, *hr*, be perpendicular to CD, A*a*, and B*b*, in *d*, *n*, and *r*. If CQ be greater than C*g*, but A*a* leſs than A*n*, and B*b* leſs than B*r*, then the body C loſes by its action on the lever IC a force C×*g*Q, and thereby the bodies A and B acquire the forces A×*mf* and B×*kb* reſpectively. Hence regard being had to the lengths of the ſeveral levers CI, K A, and B L, according to the known principles of mechanics, C×*g*Q×IC will be equal to A×*mf*×KA+B×*kb*×LB, or (becauſe the velocities C*g*, A*f*, and B*h*, are as the diſtances from the axis IC, AK, and BL) C×C*g*×*g*Q=A×A*f*×*mf*+B×B*b*×*kb*, that is, C×CQ×C*g*−C×C*g*^{2}=A×$\overline{Af}$^{2}−A×A*f*×A*m*+B×$\overline{Bb}$^{2}−B×B*b*×B*k*. But CQ×C*g* is equal to CD×C*d*, A*f*×A*m* to A*a*×A*n*, and B*b*×B*k* to B*b*×B*r*. Therefore C×C*g*^{2}+A×$\overline{Af}$^{2}+B×$\overline{Bb}$^{2} is equal to C×CD×C*d*+A×CD×A*n*+B×CD×B*r*; from which it follows, that when all the bodies deſcend while the axis moves, the ſum of the products of the bodies multiplied by the ſquares of the reſpective velocities acquired by them at any time, is the ſame as if they had fallen freely along the perpendicular altitudes from which they have deſcended. But if any body as B (for example) had been on the other ſide of the axis KL, ſo as to have aſcended while the common center of gravity of the bodies deſcended, *bk* had been equal to B*k*+B*b*. In this caſe the term B×CD×B*r* muſt be ſubducted in the latter part of the laſt equation; and in general the ſum of the products of the bodies multiplied by the ſquares of their reſpective velocities, is equal to the difference of the ſum of the products of thoſe that deſcend, multiplied by the ſquares of the velocities that would have been acquired by the ſame deſcents if they had fallen freely, and of the ſum of the products of thoſe that aſcend, multiplied by the ſquares of the reſpective velocities that would be acquired by falling freely along the reſpective altitudes to which they have ariſen. In either caſe it follows, that if the bodies be ſuppoſed to aſcend from their reſpective places at any time, and to be retarded by their gravity only, their common center of gravity will always aſcend to the ſame level from which it deſcended.

Suppoſe therefore OV (*fig.* 2.) to be equal to the length of a ſimple pendulum, that in a vacuum performs its vibrations in ſimilar arcs, in the ſame time with the compound pendulum above deſcribed; or let OV be the diſtance of a point in this latter pendulum that moves in it, with the ſame velocity as if OV was a ſimple pendulum ſuſpended at O. Let S repreſent the ſum of the bodies C, A, and B, and OG be the diſtance of their center of gravity from the axis. While the pendulum moves, let the points C, B, A, G, and V, deſcend to *c*, *b*, *a*, *g*, and *v*, reſpectively; let GM be the perpendicular deſcent of the center of gravity, and VR the perpendicular deſcent of the point V; then becauſe the velocities of the points C, B, A, G, and V, are as their diſtances from the axis of oſcillation, and the velocity acquired at *v* is ſuch as would cauſe a body to aſcend from R to V (by the ſuppoſition) and the altitudes to which bodies would aſcend by the velocities acquired at *c*, *b*, *a*, and *v*, are in the duplicate ratio of theſe velocities, it follows that C, B, and A, would aſcend by their reſpective velocities, at thoſe points to the altitudes $VR\times\frac{IC^2}{OV^2}$, $VR\times\frac{LB^2}{OV^2}$, and $VR\times\frac{KA^2}{OV^2}$. And ſince their common center of gravity would aſcend to the ſame altitude from which it deſcended, as has been ſhewn above, it follows that $C\times VR\times\frac{IC^2}{OV^2}+B\times VR\times\frac{LB^2}{OV^2}+A\times VR\times\frac{KA^2}{OV^2}$ is equal to S×GM. But the arcs deſcribed by G and V being ſimilar, GM is to VR as OG to OV; conſequently S×OG×OV is equal to C×IC^2+R×LB^2+A×AK^2; and OV is found by multiplying each body by the ſquare of its diſtance from the axis of oſcillation, and dividing the ſum of the products by S×OG, which is the product of the ſum of the bodies multiplied by the diſtance of their common center of gravity from the ſame axis. The

Fig. 4. Oscillation.

Fig. 1. Orrery.

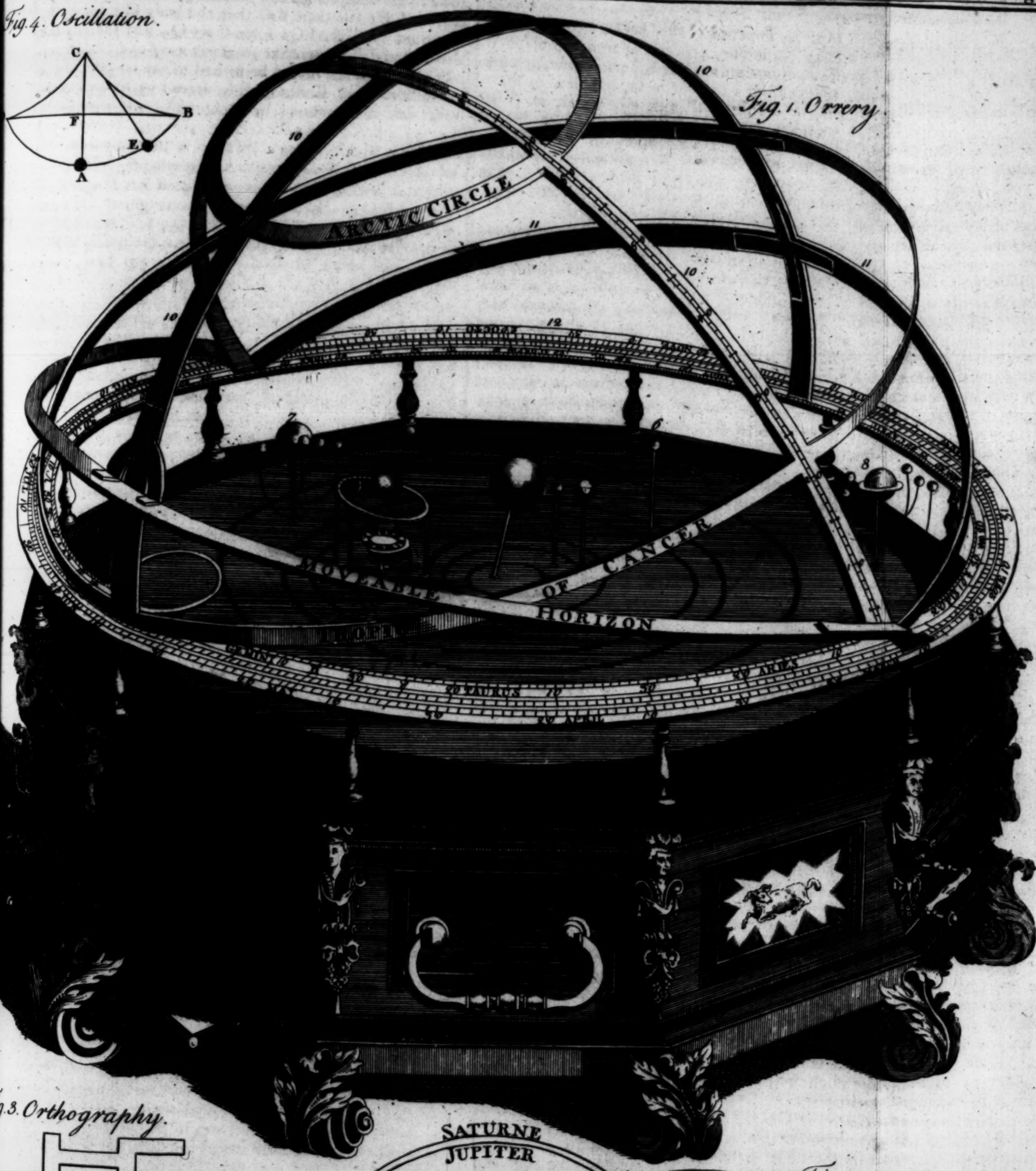


Fig. 3. Orthography.

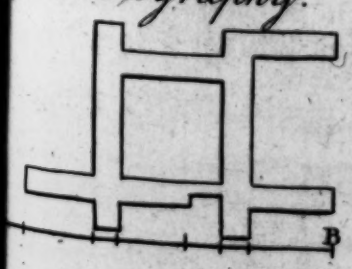


Fig. 5. Osculum.

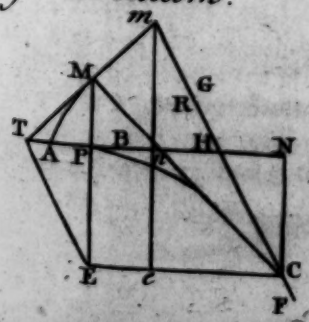
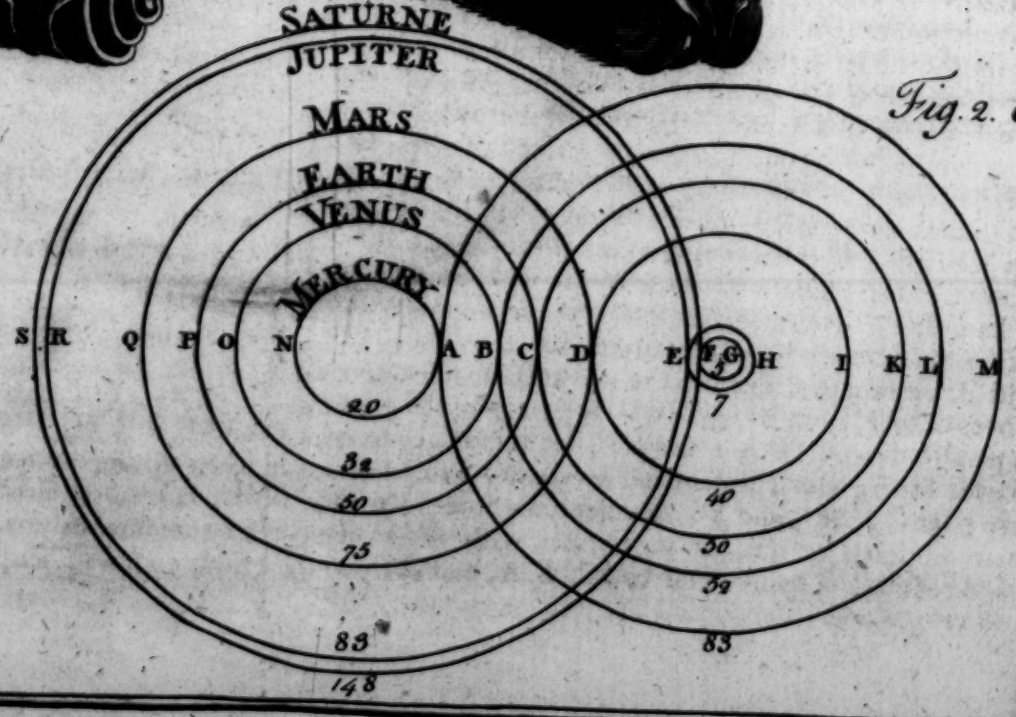


Fig. 2. Orrery.



5 JA 59

ſame demonſtration being applicable to any number of bodies, we may conclude, that when any body moves about a given axis, the diſtance of its center of oſcillation from this axis (or the length of a ſimple pendulum that vibrates in a void in the ſame time with the body in ſimilar arks) is found by computing the fluent when each particle or element of the body is ſuppoſed to be multiplied by the ſquare of its diſtance from the axis, and dividing this fluent by the product of the body multiplied by the diſtance of its center of gravity from the ſame axis.

If the points C, A, and B, *(fig.* 3.) be in one plane that is perpendicular to the axis of oſcillation in O, let C*c*, B*l*, and A*k* be perpendicular to OG in *i*, *l*, and *k*; then OC^2 being equal to OG^2+CG^2-2OGi. OB^2 to OG^2+BG^2+2OGl, and OA^2 to OG^2+2AG^2+2OGk (Elem. 12 and 13.2) the point *i* being betwixt O and G, and the points *l* and *k* on the other ſide of G; and $C\times iG$, being equal to $B\times lG+A\times kG$, it follows, that the ſum of the products of the bodies multiplied by the ſquares of their diſtances from O, or $S\times OG\times OV$, is equal to $S\times OG^2+C\times CG^2+B\times BG^2+A\times AG^2$; conſequently $S\times OG+GV$ is equal to the ſum of the products, when each body is multiplied by the ſquare of its diſtance from the center of gravity; and GV, the diſtance of the center of oſcillation from the center of gravity, is found by dividing this ſum by $S\times OG$; whence the computation of the diſtance of the center of oſcillation from the axis in ſolids is in ſome caſes abridged.

To give an example, let D E *d* *(fig.* 4.) be the ſection of a ſphere through its center G by a plane perpendicular to the axis of oſcillation, D*d* the diameter of this circle perpendicular to the axis, G E the radius perpendicular to D*d*, and P F *p* any concentric circle; let MP, an ordinate perpendicular to D*d* at P, meet D E *d* in M, MN be perpendicular to GE in N, and the ratio of *n* to 1 expreſs that of the circumference of a circle to its radius. Let a cylindric ſurface be imagined to ſtand on the circumference P F *p* perpendicular to the plane D E *d*, and terminated by the ſurface of the ſphere, and its altitude being 2PM, it may be expreſſed by $2n\times GP\times GN$, which being multiplied by the ſquare of GP (which is the diſtance of the particles in each ſection of this ſurface, perpendicular to the axis of oſcillation from the center of gravity of the ſection), and the product $2n\times GN\times GP^3$, being multiplied by the fluxion of GP, or (becauſe GP^2 is equal to GD^2-GN^2, and the fluxion of GP is to the fluxion of GN, as GN to GP) the product of $2n\times GN^2$, and GE^2-GN^2, being multiplied by the fluxion of PM, and the fluent found will give $2n\times GN^3$ into $\frac{1}{3}GE^2-\frac{1}{5}GN^2$. But this fluent becomes equal to $\frac{4}{15}\times n\times GE^5$, when P has deſcribed the whole radius DG, and GN becomes equal to GE; and this being divided by $\frac{2}{3}n\times GE^3\times OG$ (which expreſſes the ſolid content of the ſphere multiplied by OG) gives GV the diſtance of the center of oſcillation from the center of gravity in the ſphere equal to $\frac{2}{5}\times\frac{GE^2}{OG}$ or two fifths of a third proportional to OG and GE.

The general method of determining the center of oſcillation in any plane figure, as F*f*m M, *(fig.* 5.) is thus. Let G be the center of gravity, and O the center of oſcillation of the propoſed figure when it revolves about the axis F*f*, OGA perpendicular to F*f* in A, and to M*m* in P, $AP=x$, $Mm=y$, $GA=z$, $OA=u$; then $z=\frac{\text{Flu. } yx\dot{x}}{\text{Flu. } y\dot{x}}$ and $u=\frac{\text{Flu. } yx^2\dot{x}}{\text{Flu. } yx\dot{x}}$. Suppoſe $\frac{1}{2}y=x^m$, then $z=\frac{\text{Flu. } x^{m+1}\dot{x}}{\text{Flu. } x^m\dot{x}}=\frac{m+1}{m+2}\times x$, or $GA:PA::m+1:m+2$; and $u=\frac{\text{Flu. } x^{m+2}\dot{x}}{\text{Flu. } x^{m+1}\dot{x}}=\frac{m+2}{m+3}\times x$, or $OA:PA::m+2:m+3$.

The center of oſcillation of a ſphere was juſt now determined from the fluent of $2ny^2\dot{y}\times\overline{aa-yy}$ (ſuppoſing in the laſt *fig.* but one) the radius $GE=a$, $GN=PM=y$, $OG=z$, and *n* to 1, as the circumference of the circle to its radius) which is $2ny^3\times\overline{\frac{aa}{3}-\frac{yy}{5}}$; and this fluent becomes equal to $\frac{4na^5}{15}$, when $PM=GE$, or $y=a$, which being divided by $\frac{2n}{3}\times a^3\times z$ (the ſolid content of the ſphere multiplied by the diſtance of its center of gravity from the axis of oſcillation) gives $\frac{2}{5}\times\frac{aa}{z}=u$. The center of percuſſion is in a right line perpendicular to AO at the point O.

OSSICLE, *Officulum*, a little bone, a diminutive of bone, in which ſenſe it is frequently uſed by anatomiſts.

Botaniſts alſo uſe officulum for the ſtone of a plumb.

OSSIFICATION, the formation of bones, but more particularly the converſion of parts naturally ſoft, to the hardneſs and conſiſtence of bones.

OSTEOCOLLA, in natural hiſtory, though ſuppoſed by many to be an earth, is truly a cruſtated kind of ſpar, debaſed by earth, and therefore not tranſparent. See the article SPAR.

It is uſually found coating over vegetable, or other bodies, in form of incruſtations; ſo that the true oſteocolla is a tubular cruſtaceous ſpar, of a very foul and coarſe texture, and carries with it much more of the appearance of a marl, than of a ſpecies of ſpar.

The maſſes of oſteocolla, though regularly of the ſame figure, are very different in ſize; ſome of them being not thicker than a crow-quill, and others of five and ſix inches diameter: it is always, however, of a tubular figure, and wrinkled and rough ſurface.

Oſteocolla is frequent in Germany, where it is found buried near the ſurface of the earth, ſometimes in ſtrata of ſand, but more frequently among marls: it ſhould be choſen for uſe, the pureſt that can be had, of a pale brown colour, and of a tolerably cloſe and firm texture.

It has long been famous for bringing on a callus in fractured bones; its name oſteocolla ſignifing the bone-glue, or bone-binder. It is alſo recommended as a diuretic, and as good in the fluor albus; but, at preſent, little regard is paid to it; ſince, if it has any virtues, they muſt be wholly owing to ſpar, which may be given to greater advantage in a purer form.

OSTEOCOPOS, in medicine, any pain in the bones, whether ariſing from wearineſs, a ſharp ſcorbutic humour, or a venereal taint.

OSTEOLOGY, that branch of anatomy which treats of the bones. See BONE.

The objects of eſteology are the bones, whether they be recent or dried, whether they have belonged to an infant or an adult; and with the bones are to be conſidered their perioſteum, medulla or marrow, the ligaments, and the cartilages.

The ſtudy of the bones is to be conſidered in two lights, as theoretical, or as practical. In the firſt ſenſe, oſteology only extends to the external conformation and uſe of the bones; whereas, in the latter or practical ſenſe, it comprehends the more intimate knowledge of their interior ſtructure and connections. 1. If their internal parts are the ſubjects of enquiry, they are to be cut or broken. 2. If the articulations are to be examined, the ligaments and cartilages, as wellas the articulations themſelves, muſt be diſſected and carefully obſerved. 3. If the making a ſkeleton be the intent, then their preparation and preſervation come into this branch. See the articles BONE, ARTICULATION, LIGAMENT, SKELETON, &c.

OSTIA, in anatomy, an apellation given to the orifices or apertures of the veſſels of the body.

OSTRACISM, ὀστρακισμὸς, in Grecian antiquity, denotes the baniſhment of ſuch perſons whoſe merit and influence gave umbrage to the people of Athens, leſt they ſhould attempt any thing againſt the public liberty. It was ſo called, becauſe the people voted a perſon's baniſhment, by writing his name on ſhells, called in Greek ὄστρακον, and caſting them into an urn.

OSTRACITES, in natural hiſtory, the name by which authors call the foſſile oyſter-ſhells. See the article OYSTER.

Oſtracites has the ſame medicinal virtues with the belemnites, and lapis-judaicus, only in a higher degree;

being accounted, by Dr. Liſter, one of the greateſt known medicines in nephritic caſes: the doſe, in powder, is from half a dram to a dram, in white wine; and to prevent a ſickneſs at the ſtomach, that ſometimes attends the taking it, one third part of the quantity of powdered calomile flowers may be mixed with it.

OSTRICH, *Struthio*, in ornithology, a diſtinct genus of birds, having only two toes to each foot, and theſe are both placed foreward; and its head is ſimple, or not ornamented with the appendages which are common to moſt birds of this order.

The oſtrich is the talleſt of all the bird kind, meaſuring ſeven or eight feet when it ſtands erect: its legs are very long and naked; and the ſtructure of the foot, having only two toes, is particular.

OSYRIS, poets roſemary, in botany, a genus of plants, without any flower-petals: the fruit is a globoſe unilocular berry, containing a ſingle oſſeous ſeed.

This whole ſhrub is aſtringent, and conſequently good in fluxes.

Oſyris is alſo a name ſometimes uſed for the linaria, or toad-flax.

OTHONNA, baſtard jacobæa, in botany, a genus of plants, the compound flower of which is radiated, with a great number of tubuloſe and quinquedentated hermaphrodite ones on the diſc: the ſtamina are five very ſhort capillary filaments; and the ſeed, which is ſingle after each flower, is contained in the cup, and is either naked or crowned with down.

OTIS, the buſtard, in ornithology, makes a diſtinct genus of birds, the characters of which are theſe: there are three toes on each foot, all turned forewards; and the head is naked, or has no comb.

The buſtard has been confounded with the turkey: it is about the ſize of the common peacock, and runs at a prodigious rate, being frequently taken with greyhounds in a fair courſe, in the manner of hunting the hare: its fleſh is well taſted.

OTTER, *Lutra*, in zoology, a genus of quadrupeds, the characters of which are theſe: the fore-teeth in the upper jaw are ſtraight, diſtinct, and acute; thoſe of the under jaw are obtuſe, and ſtand cloſe together: the ears are ſituated lower than the eyes, and the feet are furniſhed each with five toes, and are palmated or formed for ſwimming.

Of this genus there are two ſpecies: 1. The common otter, with all the toes of an equal length: this is a very fierce animal, three feet in length, including the tail. 2. The Braſilian otter, with the inner toe ſhorter than the reſt. This is ſomewhat larger than the former ſpecies.

OVAL, an oblong curvilinear figure, with two unequal diameters, interſecting each other at right angles in the center; or a figure bounded by a ſingle curve line, imperfectly round its length, being greater than its breadth, like an egg; whence its name.

The proper oval, or egg-ſhape, is an irregular figure, being narrower at one end than the other; in which it differs from the ellipſis, which is the mathematical oval, and equal in breadth at each end.

Theſe two are confounded together by the common people, and even geometricians call the oval a falſe ellipſis.

The method commonly uſed by workmen, in deſcribing an oval, is by a cord or ſtring, as *f h m* (plate XCIV. *fig.* 11.) whoſe length is equal to the greater diameter of the oval, and which is faſtened by its extremes to two points or nails, *f*, *h*, planted in its longeſt diameter, by which means the oval is made as much longer as the two points or nails are farther apart.

OVARY, *Ovarium*, in anatomy, that part of a female animal wherein the ova or eggs are formed and lodged. See GENERATION.

OVATION, in the Roman antiquity, a leſſer triumph, allowed to commanders for victories won without the effuſion of much blood; or, for defeating a mean and inconſiderable enemy. The ſhow generally began at the Albanian mountain, whence the general, with his retinue, made his entry into the city on foot, with many flutes or pipes ſounding in concert as he paſſed along, and wearing a garland of myrtle as a token of peace. The term ovation, according to Servius, is derived from *ovis*, ſheep, becauſe on this occaſion the conqueror ſacrificed a ſheep, as in a triumph he ſacrificed a bull.

OVEN, a kind of domeſtic furnace, uſed for baking bread, pies, tarts, &c. of a circular ſtructure, with a very low roof, well lined, both on the top, bottom, and ſides, with ſtone; it has a ſmall entrance in the front, which is exactly fitted by a kind of door, which being clapped to the mouth of the oven confines the heat, while bread, pies, or puddings, are baking. Over this paſtry-cooks, &c. have another oven built much in the ſame manner, which is uſed for ſuch things as require a leſs degree of heat. Ovens are heated by burning dry wood, faggots, &c. in them, till all the parts are equally hot.

Aſſaying-OVEN, in metallurgy, a particular kind of furnace, uſed by aſſayers in their operations upon metals. See the article ASSAY *Oven*.

OVER, in general, ſignifies one thing being above another; through, or from, one end to another; beyond, croſs, or overthwart: it alſo denotes exceſs, &c.

OVER-FLOWING *of Lands*, in huſbandry. See the article LAND.

OVER-REACH, in the manege, is when a horſe ſtrikes his hind-feet againſt his fore. The word is alſo uſed for a ſtrain, or painful ſwelling of the maſter-ſinew of an horſe, occaſioned by ſuch over-reach.

OVER-RULING *an Objection*, in law, is the rejecting or ſetting it aſide by the court.

OVERSEERS *of the Poor*, are public officers appointed by ſtatute in every pariſh, to provide for the poor therein; and ſometimes they are two, three, or four, according to the largeneſs of pariſhes.

OVERT, the ſame with open: thus an overt-act ſignifies an act which, in law, muſt be clearly proved; and ſuch is to be alledged in every indictment for high treaſon.

OVERTURE, or OUVERTURE, opening or preluding; a term uſed for the ſolemnities at the beginning of a public act or ceremony; an opera, tragedy, concert of muſic, &c.

The overture of the theatre, or ſcene, is a piece of muſic uſually ending with a fugue; the overture of a jubilee is a general proceſſion, &c.

OVILIA, or SEPTA, in ancient Rome, a place in the *campus martius*, at firſt railed in like a ſheep-pen; whence its name. Afterwards it was mounted with marble, and beautified with walks and galleries, as alſo with a tribunal, or ſeat of juſtice. Within this precinct, or encloſure, the people were called in to give their ſuffrages for the election of magiſtrates. The aſcent into the ovilia was not by ſtairs, but by pontes, or narrow boards, laid there for the occaſion; on which account *de ponte dejici* was to be denied the privilege of voting; and perſons thus dealt with were called depontani.

OVIPAROUS, a term applied to ſuch animals as bring forth their young, *ab ovo*, from eggs; as birds, inſects, &c. See EGG.

The oviparous kind ſtand in oppoſition to thoſe which bring forth their young alive, called viviparous animals, as man, quadrupeds, &c. Oviparous animals may be ſaid to be ſuch as conceive eggs which they afterwards bring forth, and from which, by the incubation of the parent, or ſome other principle of warmth and fermentation, at length ariſe animals; which, after they have ſpent the moiſture or humour they have been ſurrounded withal, and are grown to a ſufficient bulk, firmneſs and ſtrength, break their ſhell and come forth. The oviparous kind, beſides birds, include divers other ſpecies of terreſtrial animals.

OVIS, the SHEEP, in zoology. See SHEEP.

OUNCE, *Uncia*, a little weight, the ſixteenth part of a pound-avoirdupois, and the twelfth part of a pound-troy: the ounce-avoirdupois is divided into eight drams, and the ounce-troy into twenty penny-weights. See WEIGHT.

OUNCE, *Lynx*, in zoology. See the article LYNX.

OUNDLE, a market-town of Northamptonſhire, ſituated on the river Nen, twenty-two miles north-eaſt of Northampton.

OVOLO, or OVUM, in architecture, a round moulding,

ing, whoſe profile, or ſweep, in the Ionic and Compoſite capitals, is uſually a quadrant of a circle: whence it is alſo commonly called the quarter round. It was uſually enriched with ſculpture by the ancients, in the form of cheſnut-ſhells; whence Vitruvius, and others, called it echinus, i. e. cheſnut-ſhell. See the article MOULDING.

OURAN, the name of an imaginary ſect of magicians, in the iſland of Gromboccanore, in the Eaſt-Indies; where they are ſuppoſed to have the art of rendering themſelves inviſible, and paſſing where they pleaſe, and by theſe means doing infinite miſchief.

OUROLOGY, in medicine, a name given by authors to a treatiſe or diſcourſe on the ſubject of urine. See URINE.

OUSTER LE MER, in law ſignifies a cauſe of excuſe given to the court on a defendant's not appearing upon ſummons, by alleging that he was then beyond the ſeas.

OUT-HOUSES are ſuch as belong and are adjoining to dwelling-houſes.

OUT-LAW ſignifies one that is deprived of the benefit of the law, and therefore held to be out of the king's protection.

OUT-LAWRY is where a perſon is out-lawed, and on that account loſes the benefit of a ſubject.

OUTWARD *Flanking Angle*, or *The Angle of the Tenaille*, in fortification, is comprehended by the two flanking lines of defence. See the article TENAILLE.

OUTWORKS, in fortification, all thoſe works made without-ſide the ditch of a fortified place, to cover and defend it.

Outworks, called alſo advanced and detached works, are thoſe which not only ſerve to cover the body of the place, but alſo to keep the enemy at a diſtance, and prevent his taking advantage of the cavities and elevations uſually found in the places about the counterſcarp, which might ſerve them either as lodgments, or as rideaux, to facilitate the carrying on the trenches, and planting their batteries againſt the place: ſuch are ravelines, tenailles, hornworks, queve d'arondes, envelopes, crown-works, &c. See the articles RAVELINE, TENAILE, &c.

It is a general rule in all outworks, that if there be ſeveral of them, one before another, to cover one and the ſame tenaille of a place, the nearer ones muſt gradually, one after another, command thoſe that are farther advanced out into the champaign, that is, muſt have higher ramparts, that ſo they may overlook and fire upon the beſiegers, when they are maſters of the more outward works.

OVUM PHILOSOPHICUM, or CHYMICUM, a glaſs-body, of an oval form, reſembling an egg, uſed for the ſublimation of mercury.

OWELTY, or OVELTY *of Services*, in our law-books, denotes an equality of ſervices; as in the caſe of a lord-meſne, and a tenant who holds the meſne, as he holds of the ſuperior lord.

OWLER, any perſon who conveys wool, &c. to the ſea-ſide in the night-time, there to be ſhipped, contrary to law.

OWSE, among tanners, oaken bark beaten or ground ſmall, to ſerve in the preparation of leather.

OX, *Bos*, in zoology makes a genus of quadrupeds.

Oxen, like other domeſtic animals, vary in colour, though the dun ſeems the moſt common; and the redder it is, the more it is eſteemed. A black coat is alſo valued; and bay oxen are ſaid to be vigorous and long lived; whereas the brown ſoon decay. The grey, the dappled, and the white, are proper only for the ſlaughter; no care can render them fit for labour; but whatever be the colour of an ox's coat, it ſhould be gloſſy, thick, and ſmooth to the touch; for if it be harſh, rough, or thin, there is reaſon to ſuppoſe that the animal is out of order, or at leaſt not of a ſtrong conſtitution. A good ox for the plough muſt be neither too fat nor too lean; the head ſhort and thick; the ears large and ſhaggy; the horns ſtrong, gloſſy, and of a middling ſize; the forehead wide, the eyes full and black; his muzzle large and flat; the noſtrils wide and open; the teeth white and even; the lips black; a fleſhy neck, large and heavy ſhoulders; the breaſt broad; the dew-lap hanging down to the knees; the reins very broad; a ſpacious deſcending belly; the flanks firm; the haunches large, and the rump thick; large and nervous thighs and legs; the back ſtraight and full; the tail reaching to the ground, and well covered with thick and fine hair; the feet firm; the hide thick and pliable; the muſcles raiſed; the hoof ſhort and broad: he muſt alſo anſwer to the goad, be obedient to the voice, and well trained; but it is only gradually, and by beginning early, that the ox can be brought willingly to bear the yoke, and be eaſily governed. At the age of two years and a half, or three at the lateſt, you muſt begin to tame him, and bring him under ſubjection; if delayed longer, he becomes froward, and often ungovernable. The only method of ſucceeding is, by patience, mildneſs, and even careſſes; for compulſion and ill-treatment will only diſguſt him irreclaimably; ſtroaking him gently along the back, clapping him, giving him occaſionally boiled barley, ground beans, and ſuch other aliments as pleaſe him beſt, all of them mingled with ſalt, of which he is very fond, will prove of the greateſt uſe. At the ſame time his horns ſhould be often tied, and ſome days after the yoke is to be put on his neck, and faſtened to a plough, with another ox of the ſame ſize ready trained; theſe are to be tied together at the manger, and in the ſame manner led to the paſture, that they may become acquainted, and accuſtomed to have one common motion. The goad is never to be made uſe of in the beginning, as that would only render him more untractable; he muſt alſo be indulged, and labour only at ſhort intervals; for till he is thoroughly trained, he tires himſelf very much; and for the ſame reaſon he is to be fed more plentifully than at other times.

An ox is to draw the plough only from his third to his tenth year, when it will be adviſeable to fatten and ſell him, as being then of a better fleſh than if he was kept longer. The age of this creature is known by his teeth and horns. The firſt fore-teeth, which he ſheds at the end of ten months, are re-placed by others; larger, but not ſo white; at ſix months the teeth next to thoſe in the middle fall out, and are alſo re-placed by others; and in three years all the inciſive teeth are renewed. They are then equal, long, and pretty white; but as the ox advances in years, they wear, become unequal and black. It is the ſame in the bull and cow; ſo that the growth and ſhedding of the teeth are not affected by caſtration, or the difference of ſexes. Nor is the ſhedding of the horns affected by either; as both bull, ox, and cow, loſe them alike at the end of three years; and theſe alſo are replaced by other horns, which, like the ſecond teeth, remain; only thoſe of the ox and cow are larger and longer than thoſe of the bull. The manner of the growth of theſe ſecond horns is not uniform, nor the ſhooting of them equal. The firſt year, that is the fourth year of the ox's age, two ſmall pointed horns make their appearance, nearly formed, ſmooth, and towards the head terminated by a kind of button. The following year this button moves from the head, being impelled by a corneous cylinder, which alſo lengthening, is terminated by another button, and ſo on; for the horns continue growing as long as the creature lives. Theſe buttons become annular joints, which are eaſily diſtinguiſhed in the horn, and by which the age of the creature may be readily known; counting three years for the point of the horn to the firſt joint, and one year for each of the other intervals.

OXFIELD, in our old writers, is ſaid to be a reſtitution made by a county, &c. for any wrong done in the ſame. See HUE AND CRY.

OXGANG, or OXGATE, is generally taken, in our old law-books, for fifteen acres, or as much ground as a ſingle ox can plough in a year.

OXYCRATE, *Oxycratum*, in pharmacy, &c. a mixture of vinegar and water, proper to aſſuage, cool, and refreſh: they make fomentations of oxycrate, clyſters of oxycrate, &c. The uſual proportion is one ſpoonful of vinegar to five or ſix ſpoonfuls of water.

OXYCROCEUM, in pharmacy, &c. a preparation much uſed in plaſters for fractures, &c. made as follows;

take

take yellow wax, one pound; pitch and galbanum, each half a pound; melt them over a gentle fire; and then add of venice-turpentine, myrrh, and olibanum, each three ounces; saffron, two ounces: make them into a plaſter.

OXYGLYCU, a ſpecies of drink prepared of the ſweeteſt honey-combs, macerated and boiled.

OXYMEL, in pharmacy, a compoſition of honey and vinegar, boiled to the conſiſtence of a ſyrup.

The word is derived from the Greek, ὀξὺς, vinegar, and μέλι, honey.

OXYSACCHARUM, a liquid medicine, prepared of ſugar and vinegar.

OYER, in law-books, ſeems to have been anciently uſed for what is now called aſſiſes.

OYER AND TERMINER, a commiſſion directed to the judge of aſſiſe, and other gentlemen, impowering them to hear and determine all criminal cauſes, and to try all offenders, whether for treaſon, felony, or treſpaſs.

OYER *of a Deed*, a petition to hear and peruſe any deed, upon which an action is brought. This is always granted the defendant, who may alſo take a copy of it, that he may conſider what to plead to the action.

OYES, or OYEZ, ſignifies *hear ye*; and is frequently uſed by the cryers in our courts, on making proclamation, or to enjoin ſilence.

OYSTER, or OISTER, *Oſtrea*, in zoology, a genus of bivalve ſhell-fiſh, the lower valve of which is hollowed on the inſide, and gibboſe without; the upper one is more flat; and both are compoſed of a multitude of laminæ or cruſts, and uſually ſcabrous or rough on the outer ſurface: ſome oyſter-ſhells are alſo furniſhed with tubercles, or ſpines, and others are deeply furrowed and plicated: the figure of moſt is roundiſh, but in ſome it is quite irregular.

Oyſter-ſhells are accounted drying and abſtergent, and given internally, ſudorific.

OZENA, a foul malignant ulcer of the noſe, which is ſometimes ſo exulcerated as to diſcharge a fœtid odor, with pieces of corrupted bones.

An ozena is generally more violent and foul, when attended with a caries of the bones; for, at firſt, the internal coat of the noſe only is ulcerated, but it extends itſelf inſenſibly into the ſlender bones, and often into the ſinuſes of the cranium, and the oſſa maxillaria, and excites a malignant caries.

It generally ariſes from an obſtinate catarrh or ſome other diſorder of the noſe, eſpecially when the blood is affected with the ſcurvy, or venereal diſeaſe; but ſometimes from acrid ſubſtances drawn into the noſe with the air, and corroding its membrane, as ſtrong ſternutatory powders, and ſometimes it proceeds from, or is joined by a polypus.

The ſigns of an ozena are diſcoverable from what has been already mentioned; but, for the event, the cure is certainly difficult, becauſe the bones, eſpecially the oſſa ſpongioſa, are ſurpriſingly tender, and not ſufficiently expoſed to view; in conſequence of which, the part affected cannot be properly cleanſed. For this reaſon the diſorder ſpreads, and at length corrodes the ſeptum, and other bones of the noſe in ſuch a manner, that the external part is deformed, and the faculties of ſpeech and reſpiration injured. Some have thought an ozena a ſufficient plea for a divorce.

The external cure ſhould be taken by external, but more particularly ſuch internal medicines as correct the blood, as antivenereals, of which mercurials and decoctions of the woods are the principal. The patient likewiſe muſt be ordered to uſe a diet moderate and light, neither ſtrong nor light ſeaſoned. When the caſe is venereal, the beſt remedy is ſalivation.

P.

PAD

P, A conſonant, and the fifteenth letter in the Engliſh alphabet; and when followed by an *h* in the ſame word, it ſounds like an *f*, as in *Philemon*, *Filemon*, &c.

In the ancient Latin alphabet it was thus written Γ, and ſo in the oldeſt Greek; but in time, the angular point being rounded off, it became as in its preſent figure.

The ſound is made by expreſſing the breath ſomewhat more ſuddenly than in forming that of B, otherwiſe nearly the ſame. The P is not ſounded in *pſalms*, *Ptolemy*, &c. nor the *ph* in *phthiſic*.

P, in the Italian muſic, denotes *piano*, ſoft; that is, the force of the voice or inſtrument is to be diminiſhed, ſo as to make a kind of echo. *p p*, *piu piano*, that is, more ſoft; and *p p p*, *pianiſſimo*, ſofteſt of all, or a third echo, the voice being almoſt loſt in the air.

P. M. in aſtronomy, denotes *poſt meridiem*, or afternoon; ſometimes *poſt mane*, after morning, that is, after midnight.

P, in antiquity, was a numeral letter, denoting the ſame with G, namely, an hundred, and when a daſh was put at the top thus $\bar{P}$, it ſtood for 400,000.

P, in medicine, denotes *pugil*, or the eighth part of a handful.

P. Æ, in medicine, *partes æquales*, equal parts, the ſame with *ā* or *ana*.

P P. in medicine, *pulvis patrum*, the Jeſuit's bark in powder, ſo called, as theſe fathers were the firſt who brought it into Europe.

PACE, *Paſſus*, a meaſure taken from the ſpace between the two feet of a man, in walking; uſually reckoned two feet and a half, and in ſome men a yard or three feet.

The geometrical pace is five feet; and 60,000 ſuch paces make one degree of the equator.

PACE in the manage, is of three kinds, viz. walk, trot, and gallop; to which may be added an amble, becauſe ſome horſes have it naturally.

PACK, in commerce, denotes a quantity of goods, made up in loads, or bales, for carriage.

A pack of wool is ſeventeen ſtone and two pounds, or a horſe's load.

PACOS, in zoology, a ſpecies of Peruvian camel, without any gibboſity, erroneouſly reckoned by ſome a ſheep: it is only three feet and a half high, from the ground to the top of the back; but the neck is very long, ſo that when the head is carried erect it is pretty tall.

PACK, or PACTION, *Pactum*, in law, denotes a contract, or agreement, between two or more parties.

PACTA CONVENTA, in Poland, are the articles agreed on between the king and the republic, which they mutually oblige each other to obſerve.

PADDLE, in glaſs-making, an inſtrument with which the work-men ſtir about the ſand and aſhes in the calcar.

PADDOC, or PADDOC COURSE, a piece of ground encompaſſed with pales or a wall, and taken out of a park for exhibiting races with grey-hounds, for plates, wagers, or the like.

PADUS, the laurel, or birds cherry in botany, a genus of plants, the corolla whereof conſiſts of five large, roundiſh, patent petals, inſerted by their ungues into the

PAG

edge of the calyx: the fruit is a roundiſh drupe, and the ſeeds is an oval, acuminated nut, with a furrow: the receptacle of the flower, which inveſts the inner ſurface of the cup, is hairy in this genus.

PÆAN, among the ancient pagans, was a ſong of rejoicing ſung in honour of Apollo, chiefly uſed on occaſions of victory and triumph.

PÆAN, in the ancient poetry, a foot conſiſting of four ſyllables.

PÆDARTHROCACES, in ſurgery, is a diſeaſe of the bones, raiſing them into tumors near the joints, and differing from the ſpina ventoſa, in that it is not attended either with violent pains, or eroſions of the bone and adjacent parts. The word is derived from the Greek παις, a child, αρθρον a joint, and κακον, an evil, ſignifying, that it is a diſorder of the joints, to which children are principally ſubject; which is the caſe, becauſe the bones of children, being ſofter than thoſe of adults, are therefore the more eaſily diſtended by humours, and more frequently raiſed into tumors: theſe are hard in this caſe, and the adjacent ſoft parts are not inflated, and are free from redneſs, inflammation, and pain. It is, however, to be obſerved, that this diſorder, though at firſt very different from the ſpina ventoſa, is ſometimes known to degenerate into that diſorder. *Heiſter's Surgery.*

PÆDO-BAPTISM, infant-baptiſm, or that conferred on children. See the article BAPTISM.

PEONIA, male and female peony, or piony, in botany, a plant with large leaves, divided deeply into oblong ſegments, or rather compoſed of a number of theſe ſegments ſet on divided pedicles: on the tops of the branches grow large roſe-like flowers, followed each by two or more horned pods, internally of a deep red colour, containing roundiſh ſhining red or black ſeeds. The male ſort has dark green leaves, pale red ſingle flowers, long thick roots, and the ſtalks and pedicles ſtreaked with red: the female has longer, narrower and paler leaves, deep red double flowers, and irregular roots, compoſed of ſeveral tuberous pieces hanging by tough filaments from one head. They are both found wild in ſome parts of Europe, and cultivated with us in gardens: they are perennial, produce their flowers in May, and very ſoon ſhed them.

The male peony has been generally preferred for medicinal uſe; but the female, which is the largeſt and moſt elegant, and for this reaſon the moſt common, is the ſpecies which the ſhops have been principally ſupplied with. In quality, there does not appear to be any material difference betwixt the two; and hence the college allow both ſorts to be taken indiſcriminately.

The roots, flowers, and ſeeds, are looked upon as lightly anodyne and corroborant; to the latter, at leaſt, of which virtues, they appear from experience to have ſome claim. They have been principally recommended in ſpaſmodic and epileptic complaints; in which, we are afraid, their effects are not very conſiderable.

PAGAN, *Pagamus*, a heathen, gentile, or idolater; one who adores falſe gods.

PAGANALIA, certain feſtivals obſerved by the ancient Romans in the month of January. They were inſtituted by Servius Tullius, who appointed a certain number of villages (pagi) in each of which an altar was to be raiſed for annual ſacrifices to their tutelar gods; at

which all the inhabitants were to aſſiſt, and give preſents in money, according to their ſex and age, by which means the number of country-people was known. The ſervants upon this occaſion offered cakes to Ceres and Tellus, to obtain plentiful harveſts.

PAGANISM, the religious worſhip and diſcipline of pagans; or, the adoration of idols and falſe gods. See IDOLATRY.

The gods of paganiſm were either men, as Jupiter, Hercules, Bacchus, &c. or fictitious perſons, as Victory, Fame, Fever, &c. or beaſts, as Egypt, Crocodiles, Cats, &c. or finally, inanimate things, as Onions, Fire, Water, &c.

PAGE, a youth of ſtate retained in the family of a prince or great perſonage, as an honourable ſervant, to attend in viſits of ceremony, do meſſages, bear up trains, robes, &c. and at the ſame time to have a genteel education, and learn his exerciſes. The pages in the king's houſhold are various, and have various offices aſſigned them, as pages of honour, pages of the preſence-chamber, pages of the back ſtairs, &c.

PAGEANT, a triumphal car, chariot, arch, or other like pompous decoration, variouſly adorned with colours, flags, &c. carried about in public ſhews, proceſſions, &c.

PAGOD, or PAGODA, a name whereby the Eaſt-Indies call the temple in which they worſhip their gods.

The pagod uſually conſiſts of three parts, the firſt is a vaulted roof ſupported on ſtone or marble-columns. It is adorned with images, and, being open, all perſons without diſtinction are allowed to enter it: the ſecond part is filled with groteſque and monſtrous figures, and no body is allowed to enter it but the bramins themſelves: the third is a kind of chancel, in which the ſtatue of the deity is placed: it is ſhut up with a very ſtrong gate. This word is ſometimes uſed for the idol, as well as for the temple.

PAGOD, or PAGODA, is alſo the name of a gold and ſilver-coin, current in ſeveral parts of the Eaſt-Indies.

PAIN, *Dolor*, is defined to be an uneaſy ſenſation ariſing from a ſudden and violent ſolution of the continuity, or ſome other accident in the nerves, membranes, veſſels, muſcles, &c. of the body; or, according to ſome, it conſiſts in a motion of the organs of ſenſe; and, according to others, it is an emotion of the ſoul occaſioned by theſe organs.

There are various kinds of pain, one is attended with pulſation, another with a ſenſe of incumbent weight, another with a tenſion; there is a pain which attends eroſion, inciſion, punction, and perforation, comprehended with theſe and the like differences under the name acute; and, laſtly, there is a pain attended with a torpor and numbneſs.

Beſides the above-mentioned, there are other diſtinctions of pain: thus ſome pains are fixed, others moveable and wandering, as it often happens in a redundance of humours; ſome pains are continual, and others intermittent; ſome intenſe, others remiſs; ſome again afflict the patient in the beginning of the diſeaſe, others afterwards; and ſometimes they ariſe on the critical day, ſometimes not; and to mention no more, ſome pains are ſeated in the external parts, others in the internal; ſome in the noble, others in the ignoble parts.

All pain proceeds from ſome injury done to the parts affected; and, according to Galen, it proceeds either from a ſudden alteration of the part, or a new temperament ſuddenly induced, or elſe from a ſolution of continuity. The internal parts ſuffer pain from the violence of a fever, by which the nervous parts are dried and vellicated, or from a inflammation, an eryſipelas, ſome great obſtruction or abſceſs in the viſcera, or, laſtly, from a flatus. Now ſince theſe pains owe their riſe to ſuch cauſes, they are juſtly denominated bad, as well when alone, as when attendant on other diſtempers: for all pain exhauſts the ſtrength, promotes crudities, and impedes the concoction of the humours. The worſt pains are thoſe excited in the viſcera and noble parts; and of theſe the moſt pernicious on all accounts are pains affecting the viſcera in a violent manner, and of a long and conſtant duration, by which the natural heat of the viſcera is deſtroyed, or reſolved, and no room left to hope for a happy event.

Pain is mitigated or aſſwaged divers ways; as, 1. By diluting and ſoftening acrimonies with warm water mixed with flour applied by way of drink, fomentation, clyſter, or bath. 2. By reſolving and waſhing away obſtructions by the ſame means, and reſolvents. 3. By relaxing the nervous veſſels with drinks, fomentations, baths, relaxants, anodynes, and aperients. 4. By correcting the acrimony itſelf with proper remedies. 5. By freeing the obſtruent, obſtructed, and acrimonious parts from the too great preſſure of the vital humours, and by ſoftening, ſuppurating, and depurating them. 6. By rebating or deadening the ſenſe by narcotics, either internally or externally.

PAIN FORT ET DURE, in law, ſignifies a particular puniſhment inflicted on a perſon who being arraigned for felony, refuſes to put himſelf upon the common trial of God and his country, but inſtead thereof obſtinately ſtands mute: this puniſhment is vulgarly called preſſing to death.

PAINTING, *Pictura*, the art of repreſenting figures, countries, towns, and other things in colours. It is not to be doubted, but that painting is ancient as well as ſculpture, but it is hard to know the real time and place where they began to appear. The Egyptians and Greeks who pretend to be the inventors of thoſe arts which are moſt for the ſplendor of life, pretend that they were the firſt carvers and painters; however it is certain that painting, after having ſome weak beginnings, appeared in its perfection among the Greeks, and that the principal ſchools, where this art was taught, were at Sicyone, a town of Peloponneſus, at Rhodes, and Athens: from Greece it paſſed into Italy, where it was in great eſteem about the end of the republic, and under the firſt emperors, until at laſt, war and luxury having diſmembered the Roman empire, it became extinct, as well as other ſciences and arts, and did not begin to revive again, till the famous Cimabue laboured at it, and recovered from the hands of certain Greeks, ſome ſlender remains of this art. Some Florentines, having ſeconded him, were thoſe that gained moſt reputation, yet it was long before any conſiderable painting was produced. Le Ghirlandais, Michael Angelo's maſter, acquired the moſt credit; but Michael Angelo, his ſcholar, in the time of pope Julius II, at the beginning of the fifteen century, eclipſed the glory of all that went before him, and erected a ſchool at Florence. Peter Perugin and Raphael de Urbin, who excelled him very much, and even Michael Angelo himſelf, formed a ſchool at Rome, conſiſting of ſeveral excellent painters; at the ſame time the ſchool of Lombardy was ſet up, and was famous under Georgion and Titian, who had Julian Bellino for his maſter; beſides which, there were alſo in Italy ſome other particular ſchools, under different maſters; amongſt the reſt, that of Leonardo da Vinci at Milan, but the three firſt are eſteemed the moſt famous, the reſt having proceeded from them; but, over and above theſe, there were on this ſide the mountains ſome painters who had nothing to do with thoſe of Italy, as Albert Durer in Germany, Holbens in Swiſſerland, Lucas in Holland, and ſeveral others that wrought in France and Flanders in a different manner; but Italy, and Rome eſpecially, was the place where this art was practiſed in its greateſt perfection, and where from time to time were brought up excellent painters. The ſchool of Raphael was ſucceeded by that of Caracchio, which hath almoſt laſted till now in its height and perfection; but at preſent there is little of it in Italy, this art ſeeming to have paſſed into France, ſince Lewis XIV. hath ſet up academies for thoſe that practiſe it. We have ſaid before, that the firſt invention of this art of painting is not certainly known; but it is agreed, that he who firſt attempted drawing, made his firſt eſſay upon a wall, by drawing the ſhadow of a man, which the light diſcovered; and, to give the greater beauty to this ſtory, ſome write that it was a girl who thus deſigned the face of her lover. Some allege that it was one Philocles, of Egypt, who firſt reduced this invention into practice; others name Cleanthes of Corinth, and others again ſay, that Ardices, a Corinthian, and Telephanes of Clarentia in Peloponneſus, began to draw without

without colours, with a coal only; and that the firſt who made uſe of one colour in painting, was one Cleophantes of Corinth, and for that reaſon called Monochromatos: after him, it is ſaid that Higienontes, Dinias, and Charmas were the firſt that drew pictures in one colour only. Eumarus of Athens, at laſt, painted both men and women in a different manner; his diſciple, Simon, the Cleonian, began to paint the body in various poſtures, and to repreſent the joints and limbs, the veins, and the foldings of the drapery; however, it is certain, that in the time of Romulus, and about the fifteenth Olympiad, that is, 715 years before Chriſt's incarnation, Candaules, ſirnamed Myrſilus, king of Lydia, bought, for its weight in gold, a picture of Bularchus's painting, in which was repreſented the battle of the Magneſians. Panæus, the brother of Phidias, was in eſteem in the eighty-third Olympiad, 448 years before our Saviour. Polygnotus, the Thaſian, was the firſt that put thought and paſſion in the face, and gave force and beauty to the colours; he did ſeveral things at Delphos and Athens. At the ſame time Mycon made himſelf famous, alſo, in Greece. About the ninetieth Olympiad appeared Aglaophon, Cephiſſodones, Phrillus, and Evener, the father of Parrhaſius; all theſe painters were excellent in the art, but Apollodorus exceeded them all; he lived in the ninety-third Olympiad, 408 years before the birth of our Lord; his manner was imitated by Zeuxis, Parrhaſius, the great Apelles, and ſeveral others, till the reign of Auguſtus. It is not known what painters have wrought in Italy ſince the reign of this emperor. When the Conſtantines and Theodoſian took upon them the protection of the church, theſe Chriſtian emperors cauſed ſome carving and painting works to be made for the ornaments of the churches, but we have almoſt nothing conſiderable of the remains of thoſe pieces. It is probable, one reaſon of the decay of painting was occaſioned by the ſecond council of Nice's decreeing religious worſhip to be paid to the images of our Saviour and the ſaints: this practice being looked on by a great part of the church as a dangerous and unwarrantable innovation, ſeveral of the Greek emperors made a vigorous oppoſition againſt it; and the better to ſuppreſs theſe exceſſes, ordered the images, &c. to be taken out of the churches and defaced; and by this means the art itſelf fell under a great diſcouragement. But, after the year 1270, the famous Cimabue reſtored the art of painting, which was perfected by the painters of the ſucceeding age. About the beginning of the fifteenth century, there were famous painters in the Low-Countries, and in Germany. *Rollin.*

Cleaning Pictures and PAINTINGS.—The art of cleaning pictures and paintings is of great conſequence to the preſerving valuable works of that kind: but has been very little underſtood even by thoſe who profeſs to practiſe it; on which account many valuable pictures have been damaged: and indeed few eſcape without damage, in a greater or leſs degree, which come under the hands of thoſe who pretend to make it their buſineſs; and yet moſt generally know no other than one ſingle way of treating all the ſubjects they are to operate upon, however different may be the condition or circumſtances of them.

As a painting may be, however, fouled with a variety of different kinds of matter, many of which will not be diſſolved, or ſuffer their texture to be deſtroyed by the ſame ſubſtances, it is neceſſary to know what will diſſolve or corrode each ſuch kind; for there is no other means of removing, or taking off any foulneſs, than by diſſolving or corroding by ſome proper menſtruum, the matter which conſtitutes it, except by actual violence, which the tender nature of oil paintings by no means ſuffer them to bear. Of theſe ſubſtances, which will remove, by diſſolving or corroding it, the matter which may foul paintings, ſome are very apt likewiſe to act upon and diſſolve the oil in the painting itſelf; and conſequently to diſorder or bring off the colours; while others are, on the contrary, paſſive and innocent, with reſpect to the painting; and may be uſed freely, or indeed in any quantity whatever, without the leaſt inconvenience of this kind.

As paintings to be cleaned are likewiſe varniſhed with a variety of ſubſtances of different natures, which ſometimes require to be taken off, and at other times are much better left remaining, it is very neceſſary to be able to judge what is beſt to be done in this point; as likewiſe to know the means by which each ſort of varniſh may be taken off without injury to the painting: for in fact, without this, there is no way of cleaning pictures, in ſome circumſtances, but by ſcouring till, as well the ſurface of the picture as the foulneſs be cleared away. We ſhall therefore firſt give ſome account of the nature of the ſubſtances which are, or may be, uſed for cleaning paintings in oil, as it regards this application of them; and then ſhew how they may be uſed, as well for the taking off the varniſh, as the removing any foulneſs that may be either upon or under it.

The firſt and moſt general ſubſtance uſed for cleaning pictures is water. This will remove many kinds of glutinous bodies, and foulneſs ariſing from them; ſuch as ſugar, honey, glue, and many others, and alſo take off any varniſh of gum-arabic, glair of eggs, and iſinglaſs; and is therefore the greateſt inſtrument in this work. It may be uſed without any caution, with regard to the colours, as it will not in the leaſt affect the oil which holds them together.

Olive oil, or butter, though not applied to this purpoſe, through an ignorance of their efficacy, will remove many of thoſe ſpots or foulneſs which reſiſt even ſoap; as they will diſſolve or corrode pitch, roſin, and other bodies of a like kind, that otherwiſe require ſpirit of wine, and oil of turpentine, which endanger the painting: and they may be uſed very freely, not having the leaſt effect on the oil of the painting.

Wood-aſhes, or what will better anſwer the purpoſe, when uſed in a proper proportion, pearl aſhes, being melted in water, make a proper diſſolvent for moſt kinds of matter which foul paintings; but they muſt be uſed with great diſcretion, as they will touch or corrode the oil of the painting, if there be no varniſh of the gum-reſins over it, ſo as to render the colours liable to be injured by very little rubbing. The uſe of them, or ſoap, is, however, in many caſes unavoidable, and in general they are the only ſubſtances employed for this purpoſe.

Soap is much of the ſame nature with the laſt-mentioned ſubſtances; being indeed only oil incorporated with ſalts of the ſame kinds, rendered more powerfully diſſolvent by means of quick-lime: for which reaſon it is ſomething more efficacious; but conſequently more hazardous, as it will the ſooner get hold of the oil of the paintings. It ſhould, therefore, not be uſed but on particular ſpots, that elude all other methods, and there with great caution.

Spirit of wine, as it will diſſolve all the gums, and gum-reſins, except gum-arabic, is very neceſſary for the taking off from pictures varniſhes compoſed of ſuch ſubſtances; but it corrodes alſo the oils of the paintings, and ſoftens them in ſuch a manner, as makes all rubbing dangerous while they are under its influence.

Oil of turpentine will likewiſe diſſolve ſome of the gums uſed for varniſh; but ſpirit of wine will in general much better anſwer that purpoſe. There are, however, ſometimes ſpots of foulneſs, which will give way to ſpirit of turpentine, that reſiſt moſt other ſubſtances uſed in this intention; and it may, therefore, be tried where they apper to fail, but very ſparingly, and with great caution, as it will very ſoon act even on the dry oil of the painting.

Eſſence of lemons has the ſame powers as oil of turpentine; but is, moreover, a much ſtronger diſſolvent, and ſhould therefore only be uſed in deſperate caſes, where ſpots ſeem indelible with regard to all other methods. Spirit of lavender and roſe-mary, and other eſſential oils, have the ſame diſſolving qualities as eſſence of lemons; but they are in general dearer, and ſome of them too powerful to be truſted near the colours.

Whenever paintings are varniſhed with gum arabic, glair of eggs, or iſinglaſs, the varniſh ſhould be taken off when they are to be cleaned. This may be eaſily diſtinguiſhed by wetting any part of the painting, which will feel clammy, if varniſhed with any ſubſtance diſſolvible in water. In ſuch caſes, the taking off the varniſh will frequently alone render the painting entirely clean; for if it have been laid on thick, and covered the ſurface every where, the foulneſs muſt neceſſarily lie upon it. The manner of taking off this kind of varniſh muſt be done

done by means of hot-water and a ſponge, the picture, or painting, being laid horizontally. The water may be nearly boiling hot, and may be uſed copiouſly at firſt with the ſponge; but when the varniſh appears to be ſoftened, and the painting more naked, it ſhould be uſed cooler; and, if the varniſh adhere, ſo as not to be eaſily brought off by a ſponge, a gentle rubbing with a linen cloth may be uſed; the cloth being frequently wrung, and wet again with freſh water a little warmiſh.

Where paintings appear, by the above trial, to be varniſhed with the gum-reſins, or ſuch ſubſtances as cannot be diſſolved in water, it is proper, nevertheleſs, to waſh them well with water pretty warm, by means of a ſponge, which will ſometimes be alone ſufficient to clean them, even in this caſe: but if there yet appear any foulneſs, rub the painting over with olive-oil made warm, or butter; and if any parts appear ſmeary, or any foulneſs ſeem to mix with the oil or butter, purſue the rubbing gently, taking off the foul oil, and adding freſh till all ſuch foulneſs be wholly removed. Let the oil be then wiped off with a woollen cloth, and if the picture require further cleaning, the wood-aſhes, or pearl-aſhes, muſt be uſed in the following manner; which, indeed, as to the firſt part, is not widely different from the method commonly uſed.

"Take an ounce of pearl-aſhes, and diſſolve them in a pint of water; or take two pounds of wood-aſhes, and add to them three quarts of water, and ſtir them well in the water once or twice in an hour, for half a day; and then, when the earthy part of the aſhes has ſubſided, pour off the clear fluid, and evaporate it to a quart; or if it appear acrid to the taſte at that time, three pints may be left. Waſh, by means of a ſponge, the painting well with either of theſe ſolutions, or lyes, which are in fact the ſame thing, made warm; and rub any particular ſpots of foulneſs gently with a linen cloth till they diſappear: but if they appear to remain unchanged by the lye, do not endeavour to take them off by mere force of rubbing; for that would infallibly damage the colours under the ſpots, before they could be removed: but in this caſe they ſhould be left to be tried by the ſpirit of wine, or the eſſential oils of turpentine and lemons. Where thick ſpots ſeem to give way in part, but yet reſiſt in a degree to this lye, a little ſtrong ſoap ſuds may, in ſome caſes, be uſed, with great caution; but it ſhould be prevented as much as poſſible, from touching any part of the painting, except the ſpot itſelf; and as that diſappears, the ſoap-ſuds ſhould be diluted with water, that it may not reach the oil of the colours in its full ſtrength. If, however, all this be done upon a ſtrong coat of varniſh, there will be leſs hazard; and, in ſuch caſes, the waſhing freely with the wood aſh lye, or weak ſoap-ſuds, will frequently do the buſineſs effectually, without any material damage: but it requires ſome judgment to know where paintings may be freely treated; and, with reſpect to thoſe of great value, it is always beſt to proceed by more circumſpect methods, and to try the more ſecure means we have above directed, before theſe rougher be uſed."

Some uſe the wood-aſhes, with the addition of water only, without ſeparating the ſolution of the ſalts from the earth; which, when ſo uſed, aſſiſts in ſcrubbing the foulneſs from the painting; but all ſuch practices are to be condemned; as the finer touches of the painting are always damaged in a greater or leſs degree, where any abrading force is employed in cleaning it.

Where ſpots appear, after the uſe of all the above-mentioned methods, ſpirit of wine, or if that fail, oil of turpentine, and in the further caſe of its default, eſſence of lemons muſt be applied. The ſpots ſhould be lightly moiſtened with them; avoiding to ſuffer them to touch any more of the ſurface than what is covered with the foulneſs; and the part ſhould be immediately rubbed with a linen cloth, but very gently; obſerving at the ſame time to deſiſt, if the colours appear the leaſt affected. After a little olive oil ſhould be put on the ſpot, where oil of turpentine and eſſence of lemons are uſed, and water where ſpirit of wine is applied; which being taken off by a woollen cloth, if the foulneſs be not wholly removed, but appears to give way, the operation muſt be repeated till it be entirely obliterated.

Where paintings appear to have been varniſhed with thoſe ſubſtances that will not diſſolve in water, and after the careful uſe of the above means the foulneſs ſtill continues, or where, as is very often found, the turbidneſs, or want of tranſparency, or the yellow colour of the varniſh, deprave the painting ſo as to deſtroy its value, ſuch varniſh muſt be taken off; the doing of which, though attended with the greateſt difficulty to thoſe who proceed by the methods now in uſe, and which indeed is ſeldom done by them at all, but with the deſtruction of the more delicate teints and touches of the painting, is yet very eaſily and ſafely practicable by the following method.

"Place the picture or painting in an horizontal ſituation, and moiſten, or rather flood, by means of a ſponge, the ſurface with very ſtrong rectified ſpirit of wine; but all rubbing, more than what is neceſſary to ſpread the ſpirit over the whole ſurface, muſt be avoided. Keep the painting thus moiſtened, by adding freſh quantities of the ſpirit for ſome minutes; then flood the whole ſurface copiouſly with cold water; with which, likewiſe, the ſpirit, and ſuch part of the varniſh as it has diſſolved, may be waſhed off. But in this ſtate of it, all rubbing, and the ſlighteſt violence on the ſurface of the painting, would be very detrimental. When the painting is dry, this operation muſt be repeated at diſcretion, till the whole of the varniſh be taken off."

In pictures and paintings which have been long varniſhed, it will be found ſometimes that the varniſh has been a compoſition of linſeed-oil, or ſome other ſuſtantial oil, with gums and reſins. If ſuch paintings cannot be brought to a tolerable ſtate by any of the above-mentioned means, which may in this caſe be freely uſed, the miſchief may be deemed to be without remedy. For it is abſolutely impracticable to take off ſuch varniſh, as it is more compact and indiſſoluble than the oil of the painting itſelf; and could only be wrought upon by thoſe menſtrua and diſſolvents, which would act more forcibly on the paintings: ſuch pictures muſt, therefore, be left in the ſtate they are found, except by being freed from any foulneſs that may be upon this varniſh, and may be cleaned away by the methods we haue before directed. The coat of this varniſh may indeed be ſometimes made thinner, by anointing the ſurface of the painting with eſſence of lemons; and then putting on olive-oil, which, when rubbed off by a ſoft woollen-cloth, will carry away the eſſence with ſuch part of the varniſh as it may have diſſolved; but this requires great nicety, and can never be practiſed without ſome hazard of diſordering the colours of the painting.

Method of taking off PAINTINGS *in Oil, from the Cloths or Wood on which they were originally done; and transferring them entire, and without Damage, to new Pieces.*—The art of removing paintings in oil from the cloth or wood on which they are originally done, and transferring them to new grounds of either kind of ſubſtance, is of very great uſe; as not only pictures may be preſerved, where the canvas is ſo decayed and damaged, that they would otherwiſe fall to pieces; but paintings on cielings or wainſcot, which, when taken away from the places where they were originally placed, would have little value, may be conveyed to cloths; and, by being thus brought to the ſtate of other pictures, become of equal worth with thoſe painted originally on canvas. The manner in which this is done is, by cementing the face of the picture to a new cloth, by means of ſuch a ſubſtance as can afterwards be diſſolved, and conſequently taken off by water; deſtroying the texture of the old cloth, by means of a proper corroding fluid; and then ſeparating the corroded parts of it entirely from the painting: after which, a new cloth being cemented to the reverſe of the painting in its place, the cloth cemented to the front is in like manner to be corroded, and ſeparated; and the cemented matter cleanſed away by diſſolving it with water, and rubbing it off from the face of the picture. The particular method of doing this, with moſt convenience, is as follows.

Let the decayed picture be cleanſed from all greaſe that may be on its ſurface; which may be done by rubbing it very gently with crumbs of ſtale bread; and then wiping it with a very fine ſoft linen cloth. It muſt then be laid, with the face downwards, on a ſmooth table covered with fan paper, or the India paper; and the cloth

cloth on the reverſe muſt be well ſoaked with boiling water, ſpread upon it by means of a ſponge, till it appear perfectly ſoft and pliable. The picture is then to be turned with the face upwards; and, being ſtretched in the moſt even and flat manner on the table, muſt be pinned down to it in that ſtate, by nails driven in through the edge, at proper diſtances from each other. A quantity of glue ſhould be then melted, and ſtrained through a flannel cloth, to prevent any gravel or other impurities from lurking in it; and when it is a little ſtiffened, a part of it ſhould be ſpread on a linen cloth, of the ſize of the painting, where it ſhould be ſuffered to ſet and dry; and then another coat put over it: when this is become ſtiff alſo, the glue ſhould be again heated; and while it remains of ſuch heat as to be eaſily ſpread, it ſhould be laid over the face of the picture, and a linen cloth immediately put over it in the moſt even manner, and nailed down to the picture and table at the edge likewiſe. The glue ſhould not be uſed boiling hot, as that would hazard ſome of the more delicate colours of the painting; and the linen cloth ſhould be fine and half worn, that it may be the ſofter, and lie the flatter on the ſurface of the picture: in order to which, it is proper to heat it till the glue be ſoft and pliable before it be laid on, and to compreſs each part gently with a ball formed of a linen rag tied round with thread. The table, with the picture, cloth, &c. nailed down to it in this ſtate, ſhould be then expoſed to the heat of the ſun, in a place where it may be ſecured from rain; and there continued till the glue be perfectly dry and hard; at which time the nails ſhould be drawn, and the picture and linen cloth taken off from the table. The picture muſt now be again turned with the face downwards, and ſtretched and nailed to the table as before; and a border of wax muſt be raiſed round the edge, forming as it were a ſhallow trough with the ſurface of the picture, into which trough ſhould be poured a proper corroding fluid, to eat and deſtroy the threads of the original canvas or cloth of the picture. The corroding fluid uſed for this purpoſe may be either oil of vitriol, aquafortis, or ſpirit of ſalt; but the laſt is preferable, as it will more effectually deſtroy the thread, when it is ſo weakened by the admixture of water, as not to have any effect on the oil of the painting; which ever is uſed, it is neceſſary they ſhould be properly diluted with water: to find the due proportion of which, it is expedient to make ſome previous trials; and when they are found to be of ſuch ſtrength as to deſtroy the texture of thread without diſcolouring it, they are in the due ſtate. When the corroding fluid has done its office, a paſſage muſt be made through the border of wax at one end of it; and the fluid muſt be poured off, by inclining the table in the requiſite manner; and the remaining part muſt be waſhed away, by putting repeated quantities of freſh water upon the cloth. The threads of the cloth muſt then be carefully picked out till the whole be taken away; but if any part be found to adhere, all kind of violence, even in the leaſt degree, muſt be avoided in removing them; inſtead of which, they ſhould be again touched, by means of a pencil, with the corroſive fluid leſs diluted than before, till they will readily come off from the paint. The reverſe ſurface of the painting being thus wholly freed from the old cloth, muſt be then well waſhed with water, by means of a ſponge, till the corroding fluid employed be thoroughly cleanſed away; when being wiped with a ſoft ſponge, till all the moiſture that may be collected by that means be taken off, it muſt be left till it be perfectly dry. In the mean time a new painting, which now remains cemented to the linen cloth, put on the ſurface of it; and the reverſe of the painting being dry, and ſpread over by ſome hot glue, purified as before, and melted with a little brandy or ſpirit of wine, the new canvas muſt be laid on it, in the moſt even manner, while the glue yet remains hot, and ſettled to it by compreſſion; which may be performed by thick plates of lead or flat pieces of poliſhed marble. Great care ſhould however be taken in the laying them on, to prevent the edge from cutting or bruiſing the paint; as alſo, during the ſetting of the glue to take them off; and wipe them at proper intervals, to prevent their adhering to the cloth by means of the glue, which may be preſſed through it. The lead or marble, by which the compreſſure is made, being removed when the glue is ſet, the cloth muſt be kept in the ſame ſtate till the glue be perfectly dry and hard; and then the whole muſt be again turned with the other ſide upwards, and the border of wax being replaced, the linen cloth on the face of the painting muſt be deſtroyed by means of the corroding fluid, in the ſame manner as the canvas was before; but greater care muſt be taken with reſpect to the ſtrength of the corroding matter, and in the picking out the threads of the cloth; becauſe the face of the painting is defended only by the coat of glue which cemented the linen cloth to it. The painting muſt then be freed from the glue, by waſhing it with hot water, ſpread and rubbed on the ſurface by a ſponge; which ſhould be cleanſed frequently during the operation, by dipping and ſqueezing it in clean water. The painting may afterwards be varniſhed as a new picture; and if the operation be well conducted, it will be transferred to the new cloth in a perfect ſtate.

When the painting is originally on wood, it muſt be firſt detached from the cieling or wainſcot, where it was fixed; and the ſurface of it covered with a linen cloth, cemented to it by means of glue, in the manner before directed for the paintings on canvas. A proper table being then provided, and overſpread with a blanket, or thinner woollen cloth, if laid ſeveral doubles, the painting muſt be laid upon it with the face downwards, and fixed ſteady; and the boards or wood on which it was done muſt be planed away, till the ſhell remain as thin as it can be made, without damaging the paint under it. The proceedings muſt afterwards be the ſame as was before practiſed in the caſe of the paintings on canvas, till that on the wood be in like manner transferred to a cloth or canvas.

The whole of the above operation muſt be managed with the greateſt care, otherwiſe the painting will receive ſome damage; and ſo much nicety is required in the corroſion, and taking off the threads of the cloth, that it can ſcarcely be performed rightly, but by ſuch as have had ſome experience in the matter. It is proper, therefore, for any perſon who would practiſe it in the caſe of valuable paintings, to try it firſt with ſome old pictures of little value, till they find they have the right method of proceeding: and even then, in ſome inſtances, where the coats of paint lie very thin on the cloth, it is ſcarcely practicable without miſcarriage. But, as in the caſe of pictuers greatly decayed, or paintings on wood taken from buildings that do not admit of being commodiouſly replaced elſewhere, there can be no great loſs, if a failure ſhould happen; and a conſiderable advantage may accrue, if the experiment ſucceed; for which there is good chance, if the operation be properly conducted, and the ſubject favourable; it is very well worth while to make the trial.

PAIR, *Par*, denotes two equal and ſimilar things joined together either collectively, as a pair of gloves, or two ſimilar parts that compoſe one whole, or a ſet of things joined to make another complete, &c.

PAIR, in anatomy, an aſſemblage of two nerves, having their origin in the brain or ſpinal marrow, and thence diſtributed into the ſeveral parts of the body; one on one ſide, and the other on the other.

PALACE, *Palatium*, a name generally given to the dwelling houſes of kings, princes, and other great perſonages; and taking different epithets, according to the quality of the inhabitants, as imperial palace, royal palace, pontifical palace, cardinal palace, ducal palace, epiſcopal palace, &c.

PALÆSTRA, in Grecian antiquity, a public building, where the youth exerciſed themſelves in wreſtling, running, playing at quoits, &c.

PALANQUIN, a kind of chaiſe, or chair, borne by men on their ſhoulders, much uſed by the people of China, and the Eaſt, as a vehicle for their eaſy conveyance from place to place.

PALATE, *Palatum*, in anatomy, the fleſh that compoſes the roof, or the upper and inner part, of the mouth. See the article MOUTH.

The palate has much the ſame ſtructure with the gums, but it has alſo a great number of glands, diſcovered ſo early as the time of Fallopius: theſe are principally ſituated in the hinder part near the uvula, where it is pendulous,

in the manner of a curtain, which part is called the velum, or clauſtrum, of the palate. The glands ſituated particularly in this part, ſecrete a mucous fluid, ſerving to lubricate the mouth and throat, and to facilitate deglutition: they have a great number of apertures there for the diſcharge of this humour into the mouth.

The great uſes of this membrane are to defend the bones of the palate from corrupting, and for preventing by its clauſtrum or velum, the things to be ſwallowed from getting up into the noſtrils.

Wounds of the palate and other parts of the mouth, are only to be healed by being anointed with honey of roſes, either alone, or mixed with balſam of Peru, or with oil of myrrh per deliquium.

PALATO SALPINGÆUS, called alſo muſculus tubæ novus Valſalvæ, and pterygoſtaphylinus externus, a muſcle ariſing broad and tendinous from the edge of the lunated part of the os palati; ſeveral of its fibres being ſpread on the membrane that covers the foramen narium, whence growing into a ſmall thin tendon, it is reflected about the hook-like proceſs of the inner wing of the proceſſus pterygoidæus internus, and is inſerted carnous into all the membranous, fleſhy, and cartilaginous parts of the tube, which leads from the palate to the ear. Its uſe is to dilate and keep open this tube.

PALATO-STAPYLINUS, in anatomy, a muſcle ariſing on each ſide from the junction of the bones of the palate. It is broad at its beginning, but afterwards joins its aſſociate, and becomes then narrower, ſo as to reſemble a triangle, which deſcends from the place of its origin to the uvula, and is inſerted into its upper part: it draws it upward and forward.

PALE, *Palus*, a little pointed ſtake or piece of wood, uſed in making incloſures, ſeparations, &c.

PALE, in heraldry, one of the honourable ordinaries of an eſcutcheon; being the repreſentation of a pale or ſtake placed upright, and comprehending the whole height of the coat from the top of the chief to the point.

PALED FLOWERS, in botany, are thoſe which have their leaves ſet about, or ſurrounding, an head, or thrum, as in marigolds, &c.

PALESTINE, a part of Aſiatic Turky, ſituated between thirty-ſix and thirty eight degrees of eaſt-longitude, and between thirty-one and thirty-four degrees of north latitude: it is bounded by Mount Libanus, which divides it from Syria on the north; by Mount Herman, which ſeparates it from Arabia Deſerta on the eaſt; by the mountains of Seir, and the deſarts of Arabia Petræa, on the ſouth; and by the Mediterranean ſea on the weſt.

It was called Paleſtine from the Philiſtines, who inhabited the ſea-coaſts. It was alſo called Judea, from the patriarch Juda; and the Holy Land from our Saviour's reſidence and ſufferings in it; and it is called Canaan, and the Promiſed Land in the Scriptures.

It is one hundred and fifty miles in length, and eighty in breadth; and in the time of Solomon it ſeems to have extended from the Mediterranean ſea to the river Euphrates.

PALILIA, a feaſt among the ancient Romans, in honour of the goddeſs Pales.

The palilia were celebrated with great feſtivity by the ſhepherds on the firſt of May, to beſeech that goddeſs to take care of their flocks, and preſerve them from wolves and diſeaſes. Part of the ceremony conſiſted in burning heaps of ſtraw, and jumping over them.

PALILICIUM, in aſtronomy, the ſtar called the bull's-eye, or aldebaran. See ALDEBARAN.

PALINDROMUS, παλινδρομος, a verſe or ſentence which runs the ſame when read either backwards or forwards; ſuch is the verſe,

Roma tibi ſubito motibus ibit amor.

PALING, a ſort of fencing for fruit-trees planted in fields, wherein three ſmall poſts are erected at a foot and a-half diſtance one from another, and near the top nailed to each other with croſs-bars. In fixing the pales in form of a triangle, room is to be left for the tree to play and bow by the high winds, without galling: the trees are to be bound to a ſtake for a year or two, after which, fern or ſtraw may be ſtuffed in betwixt the tree and upper-moſt rails, to keep it upright. If the place be open to deer, rabbits, or the like, a poſt is to be nailed to the bar between every two pales.

PALISADE, or PALISADO, in fortification, an incloſure of ſtakes or piles driven to the ground, each ſix or ſeven inches ſquare, and eight feet long, three whereof are hid under-ground.

Paliſadoes are generally uſed to fortify the avenues of open forts, gorges, half-moons, the bottoms of ditches, the parapets of covert-ways, and in general all poſts liable to ſurprize, and to which the acceſs is eaſy. Paliſadoes are uſually planted perpendicularly, though ſome make an angle inclining towards the ground next the enemy, that the ropes caſt over to tear them up may ſlip.

Turning PALISADES are an invention of M. Coehorn, in order to preſerve the paliſades of the parapet of the covert-way from the beſiegers ſhot.

He orders them ſo, that as many of them as ſtand in the length of a rod, or in about ten feet, turn up and down like traps, ſo as not to be in ſight of the enemy, till they juſt bring on their attack, and yet are always ready to do the proper ſervice of paliſades.

PALISADE, in gardening, denotes a ſort of ornament; being a row of trees which bear branches and leaves from the bottom, cut and ſpread in manner of a wall along the ſide of an alley, or the like, ſo as to appear like a wall covered with leaves.

PALISSE, in heraldry, a bearing like a range of paliſades before a fortification, repreſented on a feſſe, riſing up a conſiderable height, and pointed a-top, with a field appearing between them.

PALL, in heraldry, denotes a kind of croſs repreſenting the pallium, or archiepiſcopal ornament ſent from Rome to the metropolitans.

PALLADIUM, in antiquity, a ſtatue of the goddeſs Pallas, ſuppoſed to have dropped down from heaven, preſerved in Troy, whereon the fate of that city is ſaid to have depended.

PALLET, among painters, a little oval piece of wood, &c. very thin and ſmooth; on which they place the colours they have occaſion for, ready for the pencil; it has a hole at one end to put the thumb through, to hold it.

PALLET, among potters, crucible makers, &c. a wooden inſtrument, almoſt the only one they uſe, for forming, heating, and rounding their works: they have ſeveral kinds, the largeſt are oval, with a handle; others are round, or hollowed triangularly; others, in fine, are in manner of large knives, ſerving to cut off whatever is ſuperfluous on the moulds of their work.

PALLET, in gilding, an inſtrument made of a ſquirrel's tail, to take up the gold leaves from the pillow, and to apply and extend them on the matter to be gilt.

PALLET, in heraldry, is nothing but a ſmall pale, conſiſting of one half of it in breadth; and therefore there are ſometimes ſeveral of them upon one ſhield.

PALLET is alſo a part belonging to the ballance of a watch or movement. See WATCH.

PALLIATION, or a PALLIATIVE CURE, in medicine, is when, in deſperate and incurable diſeaſes, after predicting the fatal event, the phyſician preſcribes ſome remedies for mitigating the pain, or ſome other urgent ſymptoms, as in ulcerated cancers, or cancerous fiſtulas, and the like.

PALLIER, or PAILLIER, in building, denotes a landing-place in a ſtair caſe.

PALLIUM, or PALL, an archiopiſcopal veſtment, of white woollen cloth, about the breadth of a border, made round, and thrown over the ſhoulders. Upon this border there are two others of the ſame matter and form, one of which falls down upon the breaſt, and the other upon the back, each having a red croſs upon it: ſeveral croſſes of the ſame colour being likewiſe upon the upper part of it, about the ſhoulders.

PALM, *Palma*, in anatomy, the inſide of the hand, called alſo vola. See the article HAND.

PALM is alſo a meaſure of length. See the article MEASURE.

PALM-SUNDAY, in the Chriſtian church, the Sunday next before before Eaſter; being ſo called in memory of our

our Saviour's triumphal entry into Jeruſalem, when the multitude that attended him ſtrewed palm branches in his way.

PALMARIS Musculus, one of the flexor muſcles of the hand, ſo called as being inſerted into the palm of the hand by a broad expanded tendon: its office ſeems to be the conſtriction of the palm. There is alſo another muſcle of the hand called palmaris brevis, and quadratus, in form of a ſmall maſs of fleſh, which adheres to the aponeuroſis of the former muſcle, above the abductor muſcle of the little finger; it is ſaid to aſſiſt in drawing together the hand; but Heiſter obſerves, that both theſe muſcles are found wanting in diſſections.

PALPABLE, ſomething perceivable by the ſenſes, particularly that of feeling.

PALPEBRÆ, the eye-lids, in anatomy. See the article Eye.

PALPITATION, in medicine, a ſpaſtic contraction of the heart, when it leaps and beats violently.

PALSY, παραλυσις, in medicine, a diſeaſe wherein the body, or ſome of its members, loſe their motion, and ſometimes their ſenſation or feeling.

The apoplexy, ſays Dr. Mead, when not mortal, frequently terminates in a palſy, which is the criſis of the diſeaſe: this palſy generally ſeizes but one ſide of the body; and what Morgagni obſerves, after Valſalva, that, on diſſection of the bodies of apoplectics, who had been ſeized with a hemiplegia, he always found the cauſe of the diſeaſe in the oppoſite ſide of the brain, the doctor ſays he has formerly found true more than once in St. Thomas's hoſpital. There is now no longer any room for blood-letting, or draſtic purges; it will be ſufficient to give warm and moderate cathartics now and then, ſuch as the tinctura ſacra. And as the diſeaſe is now become chronical, inſtead of bliſters, it will be requiſite to make iſſues in proper places, eſpecially in the nape of the neck, and above the ſcapulæ, either with the actual cautery, or with cauſtic medicines. Hippocrates adviſes to apply the actual cautery in eight places, at leaſt, and ſpecifies them.

The cure is to be chiefly proſecuted with aromatic ſtrengtheners and ſteel; and beſides, it is of ſervice to ſtimulate the ſkin of the paralytic part; which is extremely well effected by the green ointment, mixed with the ſeventh or eighth part of the ſtrong ſpirit of vitriol; and when the part begins to be rubified, the liniment is to be removed, and the part anointed with ointment of elder. Cold bathing is very beneficial in perſons not too far advanced in years, but hot bathing is prejudicial to all paralytics; ſome of whom the doctor has known ſent to Bath by a miſtaken notion of their phyſicians, who, upon coming out of the bath, were ſeized with a return of the apoplexy, which carried them off.

Wherefore the doctor makes the following remarks on theſe waters. Their chief virtue ſeems to conſiſt in a certain mineral heat, whereby they warm and cheriſh the ſtomach and inteſtines; and, therefore, they are chiefly ſerviceable to thoſe who have ruined their appetite and digeſtive faculty by drinking wine or other ſpirituous liquors, which is well known to be the cauſe of a number of evils: but they are very prejudicial to all whoſe inward parts, as the brain, lungs, liver, or kidnies, are too hot. And, for the ſame reaſon, though they may be agreeable to, and mend, the ſtomach, yet, if the uſe of them be continued too long, they more frequently hurt this organ: that very warmth which was beneficial at firſt, by immoderate perſeverance, becoming prejudicial, by over-relaxing the fibres. A circumſtance which the doctor ſeveral times obſerved, more particularly in patients whoſe diſeaſes were owing to a fault in the nervous fluid.

This diſeaſe never is acute, is often tedious, and in old people almoſt incurable; and the patient for the moſt part drags a miſerable life. For the vigour of his mind, together with his memory are loſt, or vaſtly impaired; he totters and ſhakes, and becomes a diſmal ſight; as if no longer a man, but an animal half dead.

PALUMBUS, the ring-dove, a beautiful ſpecies of pigeon, with the neck white on each ſide, and a brown ſpot behind. See Columba.

PALY, or Pale, in heraldry, is when the ſhield is divided into four or more equal parts, by perpendicular lines falling from the top to the bottom.

Paly-bendy is when the eſcutcheon is divided by perpendicular lines, which is paly; and alſo by diagonals, which is called bendy.

PAMPINIFORME Corpus, in anatomy, a plexus, or knot, formed by the ſpermatic veins and arteries, and included in a common coat, within the teſticle. See the article Testicle.

PANACEA, among phyſicians, denotes an univerſal medicine, or a remedy for all diſeaſes; a thing impoſſible to be obtained, according to no leſs an author than Boerhaave.

PANADA, a diet conſiſting of bread boiled in water to the conſiſtence of a pulp, and ſweetened with a little ſugar. It is given to young children, and to ſick perſons, whoſe digeſtion is weak, or where ſtronger foods would be improper. It is ſometimes made thin, to ſerve as a drink.

PANATHENÆA, παναθηναια, in Grecian antiquity, an ancient Athenian feſtival, in honour of Minerva, who was the protectreſs of Athens, and called Athena.

PANAX, ginſeng, in botany. See the article Ginseng.

PANCHYMAGOGUE, in pharmacy, a name given to ſome cathartic extracts, that have the reputation of purging off all kinds of humours.

PANCREAS, in anatomy, is a long flat gland, of that kind which anatomiſts all conglomerate, ſituated under the ſtomach, between the liver and ſpleen; its figure reſembles that of a dog's tongue, and is divided into two ſides, one ſuperior, the other inferior; two edges, one arterior, the other poſterior; and two extremities, one large, which repreſents the baſis of a tongue, and one ſmall, and a little rounded like the point of a tongue.

The word is Greek, and derived from παν, all, and κρεας, fleſh.

The pancreas is ſituated tranſverſely under the ſtomach in the duplicature of the poſterior portion of the meſocolon. The large extremity is connected to the firſt incurvation of the duodenum, and from thence it paſſes before the reſt of that inteſtine, all the way to its laſt incurvation; ſo that a great part of the duodenum lies between the pancreas and the vertebræ of the back. The ſmall extremity is fixed to the omentum, near the ſpleen.

The pancreas is compoſed of a great number of ſoft glandular molecules, combined in ſuch a manner as to exhibit the appearance of one uniform maſs on the outſide, the convexities more or leſs flatted. When theſe molecules are ſeparated a little from each other, we find, along the middle of the breadth of the pancreas, a particular duct in which ſeveral ſmaller ducts terminate laterally, on each ſide, like ſmall branches in a ſtem.

This canal, named ductus pancreaticus, or ductus Virtſungi, from the diſcoverer of it in the human body, is very thin, white, and almoſt tranſparent; and the extremity of the trunk opens commonly into the extremity of the ductus choledochus. From whence it diminiſhes gradually, and terminates in a point next the ſpleen. The ſmall lateral branches are likewiſe pretty large near the trunk, and very ſmall towards the edges of the pancreas, all of them lying in the ſame plane, like the branches of the common filix or fern.

The pancreatic duct is ſometimes double in man, one lying above the other. It is not always of an equal length, and ſometimes runs in a winding courſe, but always in the ſame plane; and it is nearer the lower than the upper ſide of the pancreas. It pierces the coats of the duodenum, and opens into the ductus choledochus commonly a little above the prominent point of the orifice of the canal; and ſometimes it opens immediately into the duodenum.

The arteries of the pancreas come from the pylorica duodenolis, and principally from the ſplenica, which adheres very cloſely to the whole lower ſide of the pancreas near the poſterior edge; and it ſends off in its paſſage a great many ramifications, named arteriæ pancreaticæ, which go off from each ſide more or leſs tranſverſely. It receives alſo ſome ramifications from the gaſtrica major, and meſenterica ſuperior.

The pancreatic veins are branches of the ſplenica, one of the principal branches of the vena portæ major, or ventralis. The vena ſplenica runs likewiſe along the

lower ſide of the pancreas near the edge, in a ſhallow depreſſion, formed in the ſubſtance of the gland. Theſe veins anſwer to the arteries of the ſame name; and there are likewiſe other ſmall veins, correſponding to the ſmall arteries, which are productions of the great meſaraica, &c.

The nerves of the pancreas come partly from the plexus hepaticus, partly from the plexus ſplenicus, and partly from the plexus meſentericus ſuperior; and it likewiſe receives ſome from the flat ganglion, or plexiform intertexture.

The pancreatic duct is not only double in ſome ſubjects, as has been ſaid, but the collateral branches have communications in form of iſlands, in ſeveral places within the body of the pancreas. See the article LIVER. *Winſlow.*

PANDECTS, in the civil law, collections made by Juſtinian's order, of five hundred and thirty-four deciſions of the ancient lawyers, on ſo many queſtions occurring in the civil law; to which that emperor gave the force and authority of law, by an epiſtle prefixed to them. The pandects conſiſt of fifty books, and make the firſt part of the body of the civil law.

PANDICULATION, a ſtretching, or that violent and tenſive motion of the ſolids, which uſually accompanies the act of yawning.

PANDORON, in antiquity, a muſical inſtrument, reſembling a lute, but with ſtrings of braſs; its frets were of copper, and its back flat, like the guitar.

PANEGYRIC, an oration in praiſe of ſome extraordinary thing, perſon, or virtue.

Panegyric is ranked among the demonſtrative kinds of orations, of which there are commonly reckoned two kinds, viz. the artificial, where every thing is reduced to certain heads; and the other natural, where the order of hiſtory is obſerved.

PANEGYRICUM, in church-hiſtory, an eccleſiaſtical book, uſed by the Greek church, containing the panegyrical orations of various authors, on the ſolemnities of Jeſus Chriſt and the ſaints.

PANEL, in law, ſignifies a ſchedule, or ſmall roll of parchment, in which is contained the names of the jurors returned by the ſheriff, to paſs upon trial; ſo that the impanelling of a jury is no more than the ſheriff's entering them upon his panel or roll.

PANIC denotes an ill-grounded terror or fright.

PANICUM, panic, in botany, a genus of plants, the flower of which is compoſed of two ſharp pointed valves, and incloſes the ſeed, which is ſingle and roundiſh, but ſomewhat flatted.

Panic-ſeed is accounted drying, refrigerant, and aſtringent; and therefore recommended in ſpitting of blood, and nocturnal pollutions.

PANNAGE, *Panagium*, in law-books, ſignifies the food that ſwine feed upon in woods, as maſt of beech and acorns; or money taken by the king's agiſtors, for the privilege of feeding hogs in the king's foreſt.

PANNEL, in joinery, is a typanum, or ſquare piece of thin wood, ſometimes carved, framed, or grooved in a larger piece, between two upright pieces and two croſs pieces.

PANNEL, in maſonry, is one of the faces of a hewn ſtone.

PANNELS *of a Saddle*, are two cuſhions or bolſters, filled with cows, deers, or horſe-hair, and placed under the ſaddle, on each ſide, to prevent the bows and bands from galling the horſe.

PANNICULUS CARNOSUS, in comparative anatomy, a robuſt fleſhy tunic, ſituated in beaſts, between the tunic and the fat; by means of which they can move their ſkin in whole or part: it is altogether wanting in mankind.

PANTHEA, in antiquity, ſtatues compoſed of the figures or ſymbols of ſeveral divinities.

PANTHEON, in Roman antiquity, a temple of a circular form, dedicated to all the gods: it was built by Agrippa, ſon-in-law to Auguſtus; but is now converted into a church, and dedicated to the virgin and all the martyrs.

PANTOMIME, in antiquity, a perſon who imitates all ſorts of actions and characters, by mere geſtures, without ſpeaking a word.

PAPAVER, the poppy, in botany. See the article POPPY.

PAPER, *παπυρος*, ſheets of a thin matter, made of ſome vegetable ſubſtance.

The materials on which mankind have, in different ages, contrived to write their ſentiments, have been extremely various; in the early ages they made uſe of ſtones, and tables of wood, wax, ivory, &c. See the article BOOK.

Paper, with regard to the manner of making it, and the materials employed therein, is reducible to ſeveral kinds; as Egyptian paper, made of the ruſh papyrus; bark paper, made of the inner rind of ſeveral trees; cotton paper; incombuſtible paper; and European paper, made of linen rags.

Egyptian paper was principally uſed among the ancients; being made of the papyrus, or biblus, a ſpecies of ruſh which grew on the banks of the Nile: in making it into paper, they began with lopping off the two extremes of the plant, the head and the root; the remaining part, which was the ſtem, they cut lengthwiſe into two nearly equal parts, and from each of theſe they ſtripped the ſcaly pellicles of theſe which it conſiſted. The innermoſt of theſe pellicles were looked on as the beſt, and that neareſt the rind as the worſt: they were therefore kept apart, and made to conſtitute two different ſorts of paper. As the pellicles were taken off, they extended them on a table, laying them over each other tranſverſely, ſo as that the fibres made right angles; in this ſtate they were glued together by the muddy waters of the Nile; or, when thoſe were not to be had, with paſte made of the fineſt wheat-flour, mixed with hot water and a ſprinkling of vinegar. The pellicles were next preſſed, to get out the water, then dried, and laſtly flatted and ſmoothed by beating them with a mallet: this was the Egyptian paper, which was ſometimes farther poliſhed by rubbing it with a glaſs-ball, or the like.

Bark-paper was only the inner whitiſh rind, incloſed between the bark and the wood of ſeveral trees, as the maple, plane, beech, and elm, but eſpecially the tilia, or linden-tree, which was that moſtly uſed for this purpoſe. On this, ſtripped off, flatted, and dried, the ancients wrote books, ſeveral of which are ſaid to be ſtill extant.

Chineſe paper is of various kinds; ſome is made of the rinds or barks of trees, eſpecially the mulberry-tree and elm, but chiefly of the bambu and cotton-tree. In fact, almoſt each province has its ſeveral paper. The preparations of paper made of the barks of trees, may be inſtanced in that of the bambu, which is a tree of the cane or reed-kind. The ſecond ſkin of the bark, which is ſoft and white, is ordinarily made uſe of for paper: this is beat in fair water to a pulp, which they take up in large moulds, ſo that ſome ſheets are above twelve feet in length: they are completed, by dipping them, ſheet by ſheet, in alum-water, which ſerves inſtead of the ſize among us, and not only hinders the paper from imbibing the ink, but makes it look as if varniſhed over. This paper is white, ſoft, and cloſe, without the leaſt roughneſs; though it cracks more eaſily than European paper, is very ſubject to be eaten by the worms, and its thinneſs makes it liable to be ſoon worn out.

Cotton-paper is a ſort of paper which has been in uſe upwards of ſix hundred years. In the French king's library are manuſcripts on this paper, which appear to be of the tenth century; and from the twelfth century, cotton-manuſcripts are more frequent than parchment ones. Cotton-paper is ſtill made in the Eaſt-Indies, by beating cotton-rags to a pulp.

Linnen, or European paper appears to have been firſt introduced among us towards the beginning of the fourteenth century; but by whom this valuable commodity was invented, is not known. The method of making paper of linnen or hempen-rags, is as follows: the linnen-rags being carried to the mill, are firſt ſorted; then waſhed very clean in puncheons, whoſe ſides are grated with ſtrong wires, and the bottoms bored full of holes. After this they are fermented, by laying them in heaps, cloſe covered with ſacking, till they ſweat and rot; which

which is commonly done in four or five days. When duly fermented, they are twiſted into handfuls, cut ſmall, and thrown into oval mortars, made of well ſeaſoned oak, about half a yard deep, with an iron plate at bottom, an inch thick, eight inches broad, and thirty long: in the middle is a waſhing-block, grooved, with five holes in it, and a piece of hair-ſieve faſtened on the inſide: this keeps the hammers from touching it, and prevents any thing going out except the foul water. Theſe mortars are continually ſupplied with water, by little troughs, from a ciſtern, fed by buckets fixed to the ſeveral floats of a great wheel, which raiſes the wooden hammers, for pounding the rags in the mortars. When the rags are beaten to a certain degree, called the firſt ſtuff, the pulp is removed into boxes, made like corn-chandlers bins, with the bottom-board aſlant, and a little ſeparation on the front, for the water to drain away. The pulp of the rags being in they take away as many of the front-boards as are needful, and preſs the maſs down hard with their hands: the next day they put on another board, and add more pulp, till the box is full; and here it remains mellowing a week, more or leſs, according to the weather. After this, the ſtuff is again put into clean mortars, and is beaten afreſh, and removed into boxes, as before; in which ſtate it is called the ſecond ſtuff. The maſs is beat a third time, till ſome of it being mixed with fair water, and brewed to and fro, appears like flour and water, without any lumps in it; it is then fit for the pit-mortar, where it is perfectly diſſolved, and is then carried to the vat, to be formed into ſheets of paper.

But lately, inſtead of pounding the rags to a pulp with large hammers, as above, they make uſe of an engine, which performs the work in much leſs time. This engine conſiſts of a round ſolid piece of wood, into which are faſtened ſeveral long pieces of ſteel, ground very ſharp. This is placed in a large trough with the rags, and a ſufficient quantity of water. At the bottom of the trough is a plate with ſteel bars, ground ſharp like the former; and the engine being carried round with prodigious velocity, reduces the rags to a pulp in a very ſhort time. It muſt be obſerved, that the motion of the engine cauſes the water in the trough to circulate, and by that means conſtantly returns the ſtuff to the engine. The trough is conſtantly fed with clean water at one end, while the dirty water from the rags is carried off at the other, thro' a hole, defended with wire-gratings, in order to hinder the pulp from going off with the dirty water.

When the ſtuff is ſufficiently prepared as above, it is carried to the vat, and mixed with a proper quantity of water, which they call priming the vat. The vat is rightly primed, when the liquor has ſuch a proportion of the pulp, as that the mould, on being dipped into it, will juſt take up enough to make a ſheet of paper of the thickneſs required. The mould is a kind of ſieve, exactly of the ſize of the paper to be made, and about an inch deep, the bottom being formed of fine braſs-wire, guarded underneath with ſticks, to prevent it bagging down, and to keep it horizontal; and further, to ſtrengthen the bottom, there are large wires placed in parallel lines, at equal diſtances, which form thoſe lines viſible in all white paper, when held up to the light: the mark of the paper is alſo made in this bottom, by interweaving a large wire in any particular form. This mould the maker dips into the liquor, and gives it a ſhake as he takes it out, to clear the water from the pulp. He then ſlides it along a groove to the coucher, who turns out the ſheet upon a felt, laid on a plank, and lays another felt on it; and returns the mould to the maker, who by this time has prepared a ſecond ſheet in another mould: and thus they proceed, laying alternately a ſheet and a felt, till they have made ſix quires of paper, which is called a poſt; and this they do with ſuch ſwiftneſs, that, in many ſorts of paper, two men make twenty poſts, or more in a day. A poſt of paper being made, either the maker or coucher whiſtles; on which four or five men advance, one of whom draws it under the preſs, and the reſt preſs it with great force, till all the water is ſqueezed from it; after which it is ſeparated, ſheet by ſheet, from the felts, and laid regularly one ſheet upon another; and having undergone a ſecond preſſing, it is hung up to dry. When ſufficiently dried, it is taken off the lines, rubbed ſmooth with the hands, and laid by till ſized, which is the next operation. For this they chooſe a fine temperate day, and having boiled a proper quantity of clean parchment or vellum-ſhavings, in water, till it comes to a ſize; they prepare a fine cloth, on which they ſtrew a due proportion of white vitriol and roch-allum finely powdered, and ſtrain the ſize thro' it into a large tub; in which they dip as much paper at once as they can conveniently hold, and with a quick motion give every ſheet its ſhare of the ſize, which muſt be as hot as the hand can well bear it. After this, the paper is preſſed, hung up ſheet by ſheet to dry; and being taken down, is ſorted, and what is only fit for outſide-quires, laid by themſelves: it is then told into quires, which are folded and preſſed. The broken ſheets are commonly put together, and two of the worſt quires are placed on the outſide of every ream or bundle; and being tied up in wrappers, made of the ſettling of the vat, it is fit for ſale.

Paper is of various kinds, and uſed for various purpoſes: with regard to colour, it is principally diſtinguiſhed into white, blue and brown; and with regard to its dimenſions, into atlas, elephant, imperial, ſuper-royal, royal, medium, demy, crown, fool's cap, and pot-paper.

Blotting PAPER is paper not ſized, and into which ink readily ſinks: it is uſed in books, &c. inſtead of ſand, to prevent blotting, and by chemiſts, &c. for filtrating.

Bliſtered PAPER is white paper waſhed over with a ſponge dipped in ſoot water. It is uſed by the painters in crayons to ſave labour in places which are to be ſhadowed the ſame depth of the teint of that paper. The lights are laid in with white.

Marbled PAPER. See MARBLING.

PAPER *Hangings*, furniture now greatly uſed, and generally approved, as it is at once airy and cheap.

The paper manufactured for hangings is of ſeveral kinds, ſome being made in repreſentation of ſtucco work, for the covering cielings, or the ſides of halls, ſtair-caſes, paſſages, &c. and others in imitation of velvet, damaſk, brocades, chints, or other ſuch ſilks and ſtuffs as are employed for hanging rooms. The principal difference in the manufacture lies, however, in the grounds: ſome of which are laid in varniſh, and others in the common vehicles for water colours; and in the raiſing a kind of coloured emboſſment by chopt cloth.

This emboſſed ſort is called flock-paper: the art of making which is of very late invention, and is a great improvement of the manufacture of paper hangings, both with regard to the beauty and durableneſs.

Unwrought PAPER *proper for Hangings.* — The kind of paper employed for making the paper-hangings is a ſort of coarſe cartoon manufactured for this purpoſe; and there being a particular duty on paper-hangings, it is required under conſiderable penalties to be ſtamped before it be painted, or otherwiſe decorated for this purpoſe. There is no occaſion however to be more particular in explaining the qualities of this kind of unwrought paper; becauſe it is to be had of all the great dealers in paper, manufactured in a proper manner.

Colours proper to be uſed for PAPER *Hangings.* — The colours proper to be uſed for the painting, or colouring the paper hangings, are all the kinds that can be uſed in water and varniſh. But, for common deſigns done with water only, the following are moſt proper.

For red; lake, vermilion, roſe pink, and red oker. For blue; Pruſſian blue, verditer, and indico. For yellow; the yellow berry waſh, Dutch pink, and yellow oker. For green; verdigriſe, or a mixture of the blue colours with the yellow colours, particularly with the yellow berry waſh. For orange; vermilion, or red lead, with Dutch pink. For purple; a waſh made of log-wood, or a mixture of the lake, or roſe pink, with deep coloured Pruſſian blue, or with indico. For black; lamp black, and in ſome nicer caſes ivory black. For white; whiting; and for the heightnings white lead.

Where great brightneſs is required, the lake ſhould be uſed for the crimſon red; and Pruſſian blue for the blue; but for many purpoſes roſe pink uſed alone for the crimſon red; and indico mixed with whiting for the blue; will anſwer the purpoſe with greatly leſs expence.

The lake, roſe pink, Pruſſian blue, and Dutch pink,

intended for this uſe, ſhould be had, of thoſe who make them, in a moiſt ſtate; before they have become more dry than to be of the conſiſtence of paſte. There is a double advantage in this; they ſave the trouble of levigation; and, mixing much more kindly with the vehicle than when they are dry, and to be ground afreſh, they both ſpread much farther on the work, and, lying more even, appear to be brighter.

Where hangings of more delicate deſigns, and greater value are to be painted, particularly thoſe in imitation of the India paper, carmine may be occaſionally uſed; but it muſt be laid on with the pencil, and employed ſparingly, otherwiſe it would too much enhance the expence.

The colours uſed in varniſh may be the ſame as thoſe uſed with water: but thoſe, which are above directed to be had of the makers in a moiſt ſtate, muſt for this purpoſe be had dry. Verdigriſe, and, for nicer purpoſes, the chryſtals of verdigriſe (commonly called diſtilled verdigriſe), are with advantage uſed in varniſh, though not proper to be commixt with water. A tincture of turmeric in ſpirit of wine gives a very good yellow for uſing along with the other colours in varniſh: but it muſt be uſed only on varniſhed grounds; as it will otherwiſe ſpread itſelf out of all bounds, and even run through the paper.

White and coloured Grounds for PAPER *Hangings.*—The common grounds laid in water are made by mixing whiting with the common glovers ſize, and laying it on the paper with a proper bruſh in the moſt even manner. This is all that is required, where the ground is to be left white; and the paper being then hung on a proper frame, till it be dry, is fit to be painted. When coloured grounds are required, the ſame method muſt be purſued; and the ground of whiting firſt laid, except in paler colours, ſuch as ſtraw colours or pinks, where a ſecond coating may ſometimes be ſpared, by mixing ſome ſtrong colour with the whiting.

Manner of painting the PAPER *Hangings.*—There are three methods by which paper hangings are painted: the firſt by printing on the colours; the ſecond by uſing the ſtencil, and the third by laying them on with a pencil, as in other kinds of painting.

When the colours are laid on by printing, the impreſſion is made by wooden prints; which are cut in ſuch manner, that the figure to be expreſſed is made to project from the ſurface by cutting away all the other part; and this, being charged with the colours tempered with their proper vehicle, by letting it gently down on a block on which the colour is previouſly ſpread, conveys it from thence to the ground of the paper, on which it is made to fall more forcibly by means of its weight, and the effort of the arm of the perſon who uſes the print. The manner of doing this, when more particularly explained, is thus.

The paper being properly prepared by a ground of whiting, colour, or varniſh as above explained, is laid on a proper block, on which a piece of leather is ſtrained: and the print being cut in ſuch manner, correſpondently to the deſign of the painting, that there ſhall be a projection on the ſurface anſwering to every part, where that colour intended to be conveyed by this print is neceſſary, the colour mixt with its proper vehicle is ſpread on a piece of leather, or oil cloth, laid on a flat block, ſomewhat larger than the print: which is done by a boy or man, who attends for that purpoſe; and having the colour by him, in a pot, ſpreads it with a bruſh on the block betwixt every ſtroke and impreſſion the printer makes. He then takes the print either in his right-hand, or, when too heavy to be ſo managed, in both, and drops it gently on the block, juſt charged with colour; from whence he again immediately raiſes it in the moſt perpendicular direction, and lets it fall in the ſtrongeſt, tho' moſt even manner he can on the paper; increaſing the force by all the additional velocity he can give the print. When this is done, the ſheet printed is immediately taken off the block, and hung up to dry; and another being put in its place, the ſame operation is repeated, till the whole quantity of paper be printed. It is eaſy to conclude that there muſt be as many ſeparate prints, as there are colours to be printed; and they are to be uſed ſucceſſively in the ſame manner as the firſt. But where there are more than one, great care muſt be taken, after the firſt, to let the print fall exactly in the ſame part of the paper, as that which went before; otherwiſe the figure of the deſign would be brought into irregularity and confuſion. In common paper of low price it is uſual, therefore, to print only the outlines, and lay on the reſt of the colours by ſtencilling; which both ſaves the expence of cutting more prints; and can be practiſed by common workmen, not requiring the great care and dexterity neceſſary to the uſing ſeveral prints.

The manner of ſtencilling the colours is this. The figure, which all the parts of any particular colour make in the deſign to be painted, is to be cut out, in a piece of thin leather, or oil cloth; which pieces of leather, or oil cloth, are called ſtencils; and being laid flat on the ſheets of paper to be printed, ſpread on a table or floor, are to be rubbed over with the colour properly tempered, by means of a large bruſh. The colour paſſing over the whole is conſequently ſpread on thoſe parts of the paper where the cloth or leather is cut away; and give the ſame effect, as if laid on by a print. This is nevertheleſs only practicable without great care in parts where there are only detached maſſes, or ſpots of colours: for where there are ſmall continued lines, or parts that run one into another, it is difficult to preſerve the connection or continuity of the parts of the cloth, or to keep the ſmaller corners cloſe down to the paper; and therefore, in ſuch caſes, prints are preferable. Stencilling is indeed a cheaper method of ridding coarſe work than printing: but without ſuch extraordinary attention and trouble, as render it equally difficult with printing, it is far leſs beautiful and exact in the effect. For the out-line of the ſpots of colour want that ſharpneſs and regularity that are given by prints; beſides the frequent extralineations, or deviations from the juſt figure, which happen by the original miſplacing of the ſtencils, or the ſhifting the place of them during the operation.

Pencilling is only uſed in the caſe of nicer work, ſuch as the better imitations of the India paper. It is performed in the ſame manner as other paintings in water, or varniſh. It is ſometimes uſed only to fill the outlines already formed by printing; where the price of the colour, or the exactneſs of the manner in which it is required to be laid on, render the ſtencilling or printing it leſs proper; at other times it is uſed for forming or delineating ſome parts of the deſign, where a ſpirit of freedom and variety, not to be had in printed outlines, are deſired to be had in the work.

The manner of proceeding with theſe ſeveral methods is, in common work, to ſtencil firſt all parts of each colour in the deſign; and to give an outline to the whole at laſt, by printing with brown or black; but where there is any running part of the deſigns, ſuch as ſcrolls, or the ſtems of creeping plants, or flowers, which are to be printed in any other colour than brown or black, a print muſt be uſed for them; though, if they require only brown or black, they may be done by the ſame print which makes the outlines.

In the finer paper, where ſeveral colours are laid on with the prints, the principal colour is begun with; and the reſt taken ſucceſſively; the print for the outline being laid on laſt. In caſes where the pencil is to be uſed, the outlines is nevertheleſs to be made before the colours are laid on by the pencil, if ſuch outline is to be made at all; becauſe that is the guide to the perſons who lay on the colour, and confines them to a correctneſs.

In paper printed with deſigns in chiaro oſcuro, ſuch as the imitation of ſtucco work, and baſs relieves, the order of printing muſt be, to lay on the ground colour firſt; afterwards the ſhades; and laſtly the lights: and the ſame rule of ſucceſſion ſhould be obſerved where the colours are pencilled.

The colours for painted grounds in common work are principally laid on, as was before mentioned, with ſize, and a ſmall proportion of gum arabic or ſenegal; with which, being properly diſſolved in water, the colours of a dry nature are to be ground in hand or horſe mills: but the moiſt colours may be mixt with them, by means of a ſtrong bruſh only; being put together in proper pots, and well ſtirred about.

Management of the Flock PAPER.—The paper deſigned for

for receiving the flock is generally firſt prepared with a varniſh ground; for as the flock itſelf requires to be laid on with varniſh, the other kind of ground would prevent it from taking on the paper; and render the coheſion ſo imperfect, that the flock would peel off with the leaſt violence. The ground muſt, therefore, either be varniſh with ſome proper colour, or be that of the paper itſelf; but if, nevertheleſs, for cheapneſs, as was at firſt practiſed, the ground be deſired to be laid on with water, ſuch ground muſt be laid by the ſtencil; by which means the part where the varniſh is to be laid for receiving the flock, muſt be kept intirely free from the matter of which the ground is formed. Inſtead of the oil of turpentine varniſh, a compoſition of drying oil and reſin, to which ſome gum ſanderac may be added, might be uſed with advantage, with reſpect to the expence: but the brownneſs of this mixture is injurious, where the brightneſs of the colour of the flock is of any moment; and it is likewiſe ſomewhat more incommodious in the uſing, on account of its drying much ſlower.

It is frequently practiſed to print ſome moſaic, or other ſmall running figure in colours, on the ground, before the flock be laid on; and it may be done with any pigment of the colour deſired, tempered in varniſh, and laid on by a print cut correſpondently to that end.

The manner of laying on the flock is, either by means of a print, or by a ſtencil; but as the ſtencil can execute nothing but detached parts; and conſequently is unfit for all deſigns where running work, ſcrolls, or other more complicated ornaments are introduced; it is extremely confined with reſpect to the nature of the deſigns, for which it can be employed; and the print is, therefore, moſt generally preferred. The method of laying on the flock by means of a print is this. A wooden print being cut as is above deſcribed for laying on the colour in ſuch manner, that the part of the deſign, which is intended for the flock, may project beyond the reſt of the ſurface, the varniſh is put on a block covered with leather, or oil cloth, in the ſame way as was before directed for the colours; and the print is to be uſed alſo in the ſame manner, to lay the varniſh on all the parts where the flock is to be fixed. The ſheet, thus prepared by the varniſhed impreſſion, is then to be removed to another block or table; and to be ſtrewed over with flock; which is afterwards to be gently compreſſed by a board, or ſome other flat body, to make the varniſh take the better hold of it: and then the ſheet is to be hung on a frame till the varniſh be perfectly dry; at which time the ſuperfluous part of the flock is to be bruſhed off by a ſoft camel's hair bruſh; and the proper flock will be found to adhere in a very ſtrong manner. When the ſtencil is uſed, the ſame method is to be perſued: the varniſh for holding the flock being laid on by that, inſtead of a print; and the flock afterwards ſtrewed upon it, as in the other caſe.

The uſual method of preparing the flock is, by cutting woollen rags, or pieces of cloth with the hand, by means of a large bill or chopping knife: but it is much more eaſily and better done, by a machine, which may be worked by a horſe-mill, at the ſame time ſuch mill is employed for cutting diamonds, or any other ſimilar purpoſe. In ſuch caſe, the conſtruction of that part of the machine, which is made for the cutting the flock, is this:

A box is made for containing the rags or cloth to be cut, which is open at the top, and of ſuch ſize as may beſt ſuit the quantity of rags that the force employed can cut. A blade is alſo to be made, the length of which is to be equal to the breadth of the box; and it ſhould be ſtrong; and muſt be charged with as great a weight as the force employed can be made to raiſe with a quick motion. The box, being filled with the rags or cloth to be cut, is placed under the blade, and made to move, by hitches, after the ſtroke of the blade is given, juſt ſo far as where it is proper the blade ſhould again cut the cloth or rags; while, at the ſame time, the blade is lifted up, and let fall on the cloth, which it cuts through, till by ſucceſſive ſtrokes, and the progreſſive motion of the box under it, the whole quantity of cloth or rags in the box has been cut. The box muſt then be turned, ſo that one of the ſides may become the front; and the operation muſt be repeated; by which means the cloth or rags, having been cut both ways, will be reduced to the ſtate in which the matter is called flock, and fit to be employed for the purpoſe of paper hangings. The work neceſſary for conveying from the principal mover in the mill, the motion for thruſting forwards the box, and raiſing the blade, may be eaſily ſupplied by any ingenious wheelwright; and need not therefore be particularly deſcribed here.

There is a kind of counterfeit flock-paper, which, when well managed, has very much the ſame effect to the eye as the real, though done with leſs expence. The manner of making this ſort is, by laying a ground of varniſh on the paper; and having afterwards printed the deſign of the flock in varniſh, in the ſame manner as for the true; inſtead of the flock, ſome pigment, or dry colour, of the ſame hue with the flock required by the deſign, but ſomewhat of a darker ſhade, being well powdered, is ſtrewed on the printed varniſh; and produces nearly the ſame appearance.

PAPIER *Maché* is paper reduced to the conſiſtence of a pulp by boiling and beating.

When this pulp is of a proper conſiſtence, it is caſt in a moiſt ſtate in proper moulds: and having been previouſly mixed with ſome gummous, or other adheſive body, will acquire ſo conſiderable a degree of tenacity and hardneſs, as to retain the figure, and anſwer the end of wood turned, or carved, or plaſter caſt into the ſame form.

The paper uſed for making the papier maché may be of any kind, according to the nicety required in the work to which it is applied. For very coarſe purpoſes, brown may be employed; and for the moſt nice, writing paper is beſt: and it is not very material, whether the paper be clean or foul, or whether it be written or printed upon, or blank: except where it might be intended to be only moulded, and not coloured, or varniſhed afterwards; which is ſeldom the caſe.

The gum or adheſive body uſed for giving the due texture to the papier maché may be gum-arabic, glue, or iſinglaſs: but for common purpoſes, gum-arabic, or glue are uſed, iſinglaſs being too dear, and indeed gum-arabic has an advantage over either of the other, of not ſhrinking near ſo much in drying.

The preparation of the papier maché may be as follows. "Take any quantity of paper; and boil it in water, ſtirring it about with a wooden ſpatula, till it become of a paſty ſubſtance; and appear to have loſt its coheſion. Pour off then the water from it; and beat it in a mortar, or ſuch kind of machine as will have the ſame effect, till it be a perfectly ſoft and yielding pulp. Prepare, in the mean time, a ſtrong gum water, by diſſolving gum arabic in water; and having preſſed the greateſt part of the water out of the pulp, add the gum water to it in ſuch proportion, that they may produce together the conſiſtence of a thick fluid. Put them then into a proper veſſel; and boil them ſlowly, till they form a paſte of the right conſiſtence for caſting." The papier maché will then be ready prepared for working with the proper moulds: but the ſtiffneſs of the paſte may be varied with advantage, according to the nature of the work. That intended for pieces where the figure is ſimple, and has no ſharp or emboſſed work, requiring to be ſtiffer; while the emboſſed work, or other ſuch as has relieved parts, ſhould be thinner. The uſing glue or ſize, inſtead of gum arabic, makes a ſaving; and will anſwer extremely well in the caſe of boxes, or any other pieces of a ſimple or flat form; becauſe the ſhrinking may be allowed for in the figure of the moulds: but for emboſſed work, or deſigns where ſeveral parts muſt be joined together, the uſe of gum-arabic will be found more expedient; as the relative proportions will be much better preſerved.

The moulds in which the papier maché is caſt may be either of plaſter of Paris, or wood. For emboſſed work, or deſigns of a more complex kind, plaſter is preferable: but for boxes, cups, or ſimpler forms, the moulds may be beſt of wood; as ſuch will laſt for a long time, and not require renewing ſo often, from the unavoidable wear, or the injury of a ſlight accidental violence, as thoſe made of plaſter. But in the choice of moulds, and ſubjects to which they are applied, regard ſhould be had to the figure, with reſpect to its roundneſs, or projecting parts: for,

embossed work or frames of any kind, where there are a variety of angles on one side, and a flat plainness on the other, are most expediently managed in plaster: and where there are nice joints, as in the case of boxes, or where the figure must be preserved on both sides, wood is much more proper. The plaster moulds for casting the papier maché must be made in the same manner, as those for casting in plaster. See CASTING.

But it is peculiarly necessary in casting the papier maché to grease the moulds extremely well; otherwise there will be a cohesion betwixt the matter cast and the moulds, that will be destructive to both. Where any subject cast is of considerable extension and one side of it a blank reverse, as in the case of bass reliefs, and other ornaments of that nature, it is usual to lay slips of whole strong paper over the papier maché: such paper being first well moistened with gum water, or strong size, which is rather better in this case. This not only makes a saving, but is really an advantage to the work, as it adds greatly to the strength and tenacity; and more especially preserves it, during the time of its drying, from the injuries of slighter violence: to answer this end more effectually, the paper itself applied to this purpose should, however, be very strong; and where the nature of the subject admits of it, laid on several times doubled.

The wooden moulds, which are the most proper sort for forming boxes, cups, or flat pieces of any kind, where there is no embossed work, must be made in two parts; or, more explicitly, there must be a convex part and a concave part; betwixt which a space must be allowed for the figure of the subject, that is to be cast. These may be best made of box, or other hard wood turned into the proper figure: and it is expedient to have two or three small perforations, or holes, through the substance of the wood of the concave part near the middle, to let out the fluid when the papier maché is compressed to give it the due form. The hollow betwixt the convex and concave parts of the mould may be about a seventh or eighth part of an inch thick, in the case of snuff or dressing boxes, or other pieces of the like magnitude; but it may be enlarged when bigger subjects come in question. The moulds when first used should be well greased, and placed before a fire, that they may imbibe as much as possible of the grease; which will render the oiling them afterwards, each time they are employed, more effectual.

When the moulds are prepared, the surface of the concave or hollow part must be spread all over with the paste, as evenly as possible; and as nearly as can be judged, of the thickness of the hollow betwixt the two parts; and then the cover or solid part of the mould must be put over the paste; and compressed till it be in its proper place. The cast being thus made, it must be suffered to remain in the mould till it gain a sufficient strength and tenacity of parts, by drying, to be able to maintain its form when taken out; and then, being freed from both parts of the mould, it must be dried, and afterwards varnished or painted, according to the purpose for which it is designed.

PAPILIO, the butterfly, in zoology, a numerous genus of four winged insects, distinguished by clavated antennæ.

The number of butterflies is so great, that authors commonly divide them into classes, or subdivisions, according to the number of their legs; some having six, and others only four legs; under each of which are comprehended a multitude of beautiful species, distinguished by the different colours and variegations of their wings.

PAPILIONACEOUS, among botanists, an appellation given to the flowers of certain plants, from their resembling the figure of a butterfly; they consist of four petals, whereof that which covers the others is called the vexillum; the two petals placed on each side are called the alæ or the wings; and the lowest petal is termed the carina, which is often divided into two portions.

PAPILLA, in anatomy, is a name given to the nipple of the breast, and also to the small eminences of the skin and tongue.

PAR, in commerce, implies any two things equal in value; and, in money affairs, it is so much as a person must give of one kind of specie, to render it just equivalent to a certain quantity of another.

PARABLE, a fable, or allegorical instruction, founded on something real or apparent, in nature or history, from which a moral is drawn, by comparing it with something in which the hearers are more immediately concerned.

PARABOLA, in geometry, a figure arising from the section of a cone, when cut by a plane parallel to one of its sides. See CONIC *Section*.

From the same point of a cone, therefore, only one parabola can be drawn: all the other sections within these parallels being ellipses; and all without hyperbolas.

To describe a parabola by a continual motion. — Let the straight rule GR (plate XCVII. *fig.* 6.) be fixed on a plane, then take another rule as RDC right-angled at D, and let its side DC slide along GK, take a string equal in length to the side RD, and fix one end of it in any point of the plane as in F, and the other end at R the extremity of the rule, then while DC slides along GK, keep by a pin P, the string RPF constantly as close DR as may be so that it may be always straight, the pin at P will by this motion describe the curve PAQ of a parabola.

The line GK is called the directrix, or director, and the point F the focus of the parabola.

From this description it may easily be seen that the distance of any point of the parabola from the focus, is equal to the perpendicular let fall from that point on the directrix; that is, FP=PD: consequently when D comes to B; then P must fall in A, whence AF=AB.

Properties of the PARABOLA. — The square of any ordinate is equal to the rectangle of the abscissa, and four times the distance of the focus from the vertex, that is $PM^2 = AM \times 4AF$. For $PF^2 = PM^2 + FM^2$, but PF=PD=BM; then $BM^2 = PM^2 + MF^2 = FF^2 + 4AM \times AF$ (Eu. 8. 2.); therefore $PM^2 = AM \times 4AF$.

When the point *m* falls between the vertex A and focus F, then $\overline{Bm}^2 = (\overline{Fp}^2 =) \overline{Fm}^2 + \overline{mp}^2$; also $Bm^2 = 4AF \times Am + \overline{Fm}^2$; whence $4AF \times Am = \overline{mp}^2$.

Let AF=*a*, AM or Am=*x*, PM or *pm*=*y*; then $4ax = yy$, the equation of the parabola, wherein 4*a* is called the *latus rectum*, or right parameter of the parabola.

To draw a tangent to any point of the parabola as P. Take AT=AM, or FT=FP, draw TP, it will be the tangent required.

The perpendicular on the tangent, from the focus, is a mean proportional between the distance from the vertex to the focus, and the distance of the focus from the point of contact; or AF : EF :: EF : FP. For the angles AFE and EPF are equal; and the angles EAF, FMP, PEF, are each right; therefore the triangles EAF, EPF, are similar; whence AF : EF :: EF : FP.

All lines within the parabola which are drawn parallel to the axis, are called diameters. Thus PI (*fig.* 7.) parallel to the axis AM is a diameter; and ordinates to those diameters are right lines, drawn parallel to the tangents at the vertices of those diameters. Thus OI is an ordinate to the diameter PI.

The parameter of any diameter is a right-line, such that the product under the same, and the abscissa, is equal to the square of the semi-ordinate.

If PI be a diameter, and BD an ordinate to the axis AD, then $PI \times 4AF = BI \times IC$. For $4AF \times AD = \overline{BD}^2 = DC^2$, and $4AF + AM = \overline{PM}^2$; therefore $\overline{AD - AM} \times 4AF = \overline{BD}^2 - \overline{MP}^2 = \overline{BD + MP} \times BD = MP = IC \times BI$. But AD−AM=MD=PI; whence $PI \times 4AF = BI \times IC$.

Every ordinate is bisected by its diameter; that is, if EG (*fig.* 8.) be a diameter, and AB an ordinate, AG will be equal to GB. For draw AI and BK perpendicular to the directrix IK. On A, as a center with the distance AI, describe a circle, and it will pass through the focus C; because AC=AI. Draw FC, which continue till it again cuts the circle in M, and join BC, BM. Now because AB is parallel to PQ, the angle ALC=ENF (Eu. 29. 1.); but ENF is a right angle; therefore CL=LM, and BC=BM=BK; consequently, if a circle be described upon the center B, with the distance BK, it will pass through the points C and M. Let the circle be described; then IK is a tangent

to both the circles ICM, KCM (Eu. 3. 18.); and conſequently MF×FC=IF²=FK² (Eu. 3, 36.); whence IF=FK. But IF : FK :: AG : GB (Eu. 6. 2.); therefore AG=GB.

The ſquares of all ordinates to the ſame diameter are to one another as their abſciſſas. Let BI (*fig.* 9) be a diameter, and CE, DG, ordinates to the ſame; then will $EC^2 : GD^2 :: BE : BG$. For let fall the perpendicular CH, DI; then CE will be parallel to DG, and the angle CEH=DGI; and by reaſon of the right angles CHE, DIG; the triangles CHE, DIG, are ſimilar; whence CH : DI :: CE : DG; and $\overline{CH}^2 : DI^2 :: \overline{CE}^2 : \overline{DG}^2$; but BE×*p* (*p* being put for the parameter) $=CH^2$, and BG×*p*=DI^2; therefore BE : BG :: $CE^2 : DG^2$.

The parameter (P) of any diameter BI is equal to four times the intercepted abſciſſa AL, together with the parameter (*p*) of the axis; that is, P=4AL+*p*. Draw the ordinate AE, then AE=BT, and BE=TA=AL. But BE×P=AE^2, or AL×P=$(\overline{BT}^2 = \overline{BL}^2 + \overline{LT}^2) = AL \times p + 4\overline{AL}^2$. Therefore P=*p*+4AL.

If a tangent be drawn to any point of the parabola as E (*fig.* 10.) meeting the diameter PI produced in Q, and if through the ſame point E be drawn EI an ordinate to that diameter, then PQ=PI. For draw PO perpendicular to the axis AFC; draw ECK, AB and M, parallel to PO and from P drawn the tangent PHS. The triangles POH, GEC, are ſimilar; therefore $\overline{PO}^2 : \overline{GE}^2 :: \overline{OH}^2 : \overline{GC}^2$; but $\overline{PO}^2 : \overline{GE}^2 :: OH : MG$. Hence $\overline{OH}^2 \times MG = OH \times GC^2$, or $MG \times OH = \overline{GC}^2$. Again, from the ſimilar triangles LQM, GME, we have $\overline{PO}^2 : GE^2 :: \overline{QL}^2 : \overline{MG}^2$; but $\overline{PO}^2 : \overline{GE}^2 :: OH : MG$; therefore $\overline{QL}^2 : \overline{MG}^2 :: OH : MG$; and conſequently $QL^2 \times MG = MG^2 \times OH$, or $\overline{QL}^2 = MG \times OH$. It has already been proved that $\overline{CG}^2 = MG \times OH$; hence GC=QL. Now GC+AG+AH=PI, and QL+AG+AO (AH)=PQ; therefore PI=PQ.

Carteſian PARABOLA is a curve of the ſecond order, expreſſed by the equation $xy = ax^3 + bx^2 + cx + d$, containing four infinite legs, viz. two hyperbolic ones, MM, B*m* (*fig.* 11.) AE being the aſymptote, tending contrary ways, and two parallel legs BN, MN, joining them, being the 66th ſpecies of lines of the third order, according to Sir Iſaac Newton, called by him a trident, and is made uſe of by Des Cartes, in the third book of his Geometry, for finding the roots of equations of ſix dimenſions by its interſections with a circle. Its moſt ſimple equation is $xy = x^3 + a^3$, and the points thro' which it is to paſs may be eaſily found by means of a common parabola, whoſe abſciſſa is $ax^2 + bx + c$, and an hyperbola whoſe abſciſſa is $\frac{d}{x}$; for *y* will be equal to the ſum or difference of the correſpondent ordinates of this parabola and hyperbola.

Diverging PARABOLA, a name given by Sir Iſaac Newton to five different lines of the third order, expreſſed by the equation $yy = ax^3 + bx^2 + cx + d$.

PARABOLIC *Conoid*, a ſolid figure generated by the rotation of a parabola about its axis. Its ſolidity is half that of its circumſcribing cylinder, being made up of a ſeries of circles in arithmetical proportion, whoſe number of terms is expreſſed by the axis of the conoid, firſt term 0, and laſt term the area of the baſe.

A parabolic conoid is to a cylinder of the ſame baſe and height as 1 to 2, and to a cone of the ſame baſe and height as 1 $\frac{1}{2}$ to 1, or as 3 to 2.

PARABOLIC *Cuneus*, a ſolid figure formed by multiplying the ſum of all the DB's by DS (pl. XCVII. *fig.* 12.) and is equal to a priſm, whoſe ends are ſimilar and equal triangles, each being in area equal to APB, and its altitude equal to AS.

PARABOLIC *Pyramidoid*, a ſolid figure generated by ſuppoſing all the ſquares of the ordinates applicates in the parabola ſo placed, as the axis ſhall paſs through all the centers at right angles; in which caſe, the aggregate of the planes will form the parabolic pyramidoid.

The ſolidity hereof is had by multiplying the baſe by half the altitude; the reaſon of which is obvious; for the component planes being a ſeries of arithmetical proportionals beginning from 0, their ſum will be equal to the extremes multiplied by half the number of terms.

PARABOLIC *Space*, the area contained between any entire ordinate and the curve of the incumbent parabola.

Segment of a PARABOLIC *Space* is that ſpace included between two ordinates.

PARABOLIC *Spindle*, a ſolid formed by the revolution of a parabola about an ordinate rightly applied. This ſolid is eight fifteenths of its circumſcribing cylinder.

PARABOLOIDES, in geometry, parabolas of the higher kind; the general equation of theſe curves is $p^{m-1} \times x^{m-1} = y^m$, wherein *m* may be expounded by any number (greater than 1) at pleaſure.

PARACENTESIS, in ſurgery, implies an operation, commonly called tapping, which is performed in the following manner.

The patient being laid on the ſide of his bed, the trocar is to be inſerted into the lower and lateral part of the cavity of the abdomen, at about eight fingers breadth from the navel, or in the middle of the ſpace between the navel and the angle of the os ilium, and after drawing out the ſharp pointed bodkin from the cannula, which is left in the wound, ſo much of the water may be drawn off at a time as the patient can well bear; and if the patient does not grow faint, the whole quantity may be drawn off at once. In order to keep him from fainting, the ſurgeon, or his aſſiſtant, muſt preſs both his hands on each ſide of the abdomen during the operation; or a broad linnen ſwath perforated in the middle, may be put round the abdomen, and gradually drawn tighter till all the water is evacuated; after which a flannel-compreſs, dipped in ſpirits of wine, may be placed on the wound, and retained by a tight roller. If the patient can only bear to have a few pounds of water taken at a time, as the wound is but ſmall and almoſt cloſes of itſelf, it may be dreſſed only with a couple of ſquare compreſſes, a plaſter and bandage; and if his ſtrength will permit, the operation may be repeated the next day on the other ſide of the abdomen; and ſo on the third day, about two fingers-breadth from the laſt perforation: freſh wounds are made, rather than to keep open the firſt, becauſe wounds kept open in hydropical ſubjects, are in danger of mortifying.

In a paracenteſis of the thorax, to diſcharge water, blood, matter, or ſuch other preternatural ſubſtances as are there lodged, it is neceſſary to conſider, before the operation, in which ſide of the thorax the matter is contained, and what part of that cavity is moſt proper to be perforated. In order to diſcover the firſt, the ſurgeon ſhould learn in which ſide the patient has before had any pain or inflammation; in what part he perceives the weight and fluctuation of matter; on which ſide he can lie eaſier than on the other: for that is uſually the ſide affected; the perſon not being able to lie on the ſound ſide, becauſe of the weight or preſſure of the matter on the mediaſtinum; and, laſtly, he may generally perceive ſome tumour, or inflammatory heat on the ſide affected. Having diſcovered which ſide of the thorax is to be perforated, the operation may then be ſafely performed between the ſecond and third of the ſpurious ribs on the left ſide, or between the third and fourth on the right ſide, counting from below upwards, ſo as to be about five or ſix fingers-breadth from the ſpine of the back, and as much below the angle of the ſcapula. The ſurgeon having marked the deſcribed place with ink, and taken up the integuments between his own fingers and thoſe of an aſſiſtant, as in cutting iſſues, he makes an inciſion about two inches long, according to the courſe of the ribs; then cautiouſly divides the intercoſtal muſcles and pleura by a tranſverſe inciſion with the ſcalpel; and having introduced the cannula, the contained humours of the thorax are thereby diſcharged. During the operation the patient ſhould be retained in an inclined poſture, by which means the ribs will be elevated more from each other, and a large ſpace made for the inciſion; and a ſufficient opening being made in the thorax, the finger is then to be introduced, in order to ſeparate the lungs from its adheſions to the pleura, and to make way for the peccant humours.

mours. After theſe are diſcharged, the orifice of the wound is to be ſtopped with a piece of ſoft linnen-rag rolled up, by which it may be kept open for future diſcharges; but over the orifice of the wound is to be applied ſoft lint, faſtened with thread, and over that a plaſter, compreſs and bandage. The dreſſing may afterwards be made once or twice a day, diſcharging and waſhing out the matter by injecting a decoction of vulnerary herbs. Theſe injections ſhould be continued till they are obſerved to return clean, and unmixed with bloody or purulent matter, which is a ſign the parts are healed; on which the convoluted linnen-rag and lint may be withdrawn, and the reſt of the cure completed, as directed under wounds of the thorax. For the method of performing a paracenteſis of the ſcrotum, ſee the article HYDROCELE.

PARACENTRIC *Motion*, in aſtronomy, implies the quantity which a revolving planet approaches nearer to, or recedes from the ſun, or center of attraction.

PARACLET, the comforter, a name given the Holy-Ghoſt.

PARADE, the placing any thing to public view, with all its advantages and ornaments.

PARADE, in war, is a place where the troops meet to go upon guard, or any other ſervice.

PARADE, in fencing, implies the action of parrying, or turning off any thruſt.

PARADISE, a term principally uſed for the garden of Eden, in which Adam and Eve were placed immediately upon their creation.

As to this terreſtrial paradiſe, there have been many enquiries about its ſituation. It has been placed in the third heaven, in the orb of the moon, in the moon itſelf, in the middle region of the air, above the earth, under the earth, in the place poſſeſſed by the Caſpian ſea, and under the arctic pole. The learned Huetius places it upon the river produced by the conjunction of the Tigris and Euphrates, now called the river of the Arabs, between this conjunction and the diviſion made by the ſame river before it falls into the Perſian ſea. Other geographers have placed it in Armenia, between the ſources of the Tigris, the Euphrates, the Araxis, and the Phaſis, which they ſuppoſe to be the four rivers deſcribed by Moſes.

The celeſtial paradiſe is that place of pure and refined delight, in which the ſouls of the bleſſed enjoy everlaſting happineſs. In this ſenſe it is frequently uſed in the New Teſtament: our Saviour tells the penitent thief on the croſs, "This day ſhalt thou be with me in paradiſe." and St. Paul ſpeaking of himſelf in the third perſon ſays, "I knew a man who was caught up into paradiſe, and heard unſpeakable words, which is not lawful for a man to utter."

Mahomet has promiſed his followers a paradiſe of mere ſenſual delights.

Bird of PARADISE, *Paradiſæa*, in ornithology, a genus of birds of the order of the picæ, the beak of which is a cultrato-ſubulated form, and acute; the forehead is gibbous, and the two middle feathers are extremely long, and very firm.

Of this genus there are a great many elegant ſpecies.

PARADOX, in philoſophy, a propoſition ſeemingly abſurd, as being contrary to ſome received opinion; but yet true in fact.

No ſcience abounds more with paradoxes than geometry: that the right line ſhould continually approach to the hyperbola, and yet never reach it, is a true paradox; and in the ſame manner, a ſpiral may continually approach to a point, and yet not reach it, in any number of revolutions, however great.

PARAGOGE, in grammar, a figure whereby a letter is added to the end of a word.

PARAGRAPH implies a ſection or diviſion of a chapter, and in references is marked thus, ¶.

PARALEPSIS, in rhetoric, the pretence of paſſing over ſomething, and yet mentioning it by the bye.

PARALIPOMA, a ſupplement of things omitted in a preceding work.

PARALLACTIC, ſomething relating to the parallax of the heavenly bodies. See PARALLAX.

PARALLAX, *Parallaxis*, in aſtronomy, is a change of the apparent place of any heavenly object in the ſphere of heaven, cauſed by its being ſeen from different points of view.

The word is Greek, and derived from παραλλαττω, to vary or change.

Let A B D (plate XCVII. *fig.* 13.) be the earth, *p*, z, O, part of the ſphere of the heaven; now though we are ſure, by geometrical reaſoning, that if two ſtraight lines were to be drawn from any two different points of the ſurface of the earth, as A and B, to the center of the ſun, or any of the planets at H, they would form an angle A H B; and if they were prolonged from thence to the ſphere of the heaven, they would croſs one another, and terminate in two points thereof, N and O, which would be at ſome diſtance from one another; yet this diſtance, for the moſt part, is too ſmall to be taken by any inſtrument: this diſtance between the points N and O is called the parallax, which is ſaid to be ſenſible, when great enough to be diſcoverable by obſervation; inſenſible, when too ſmall to be meaſured by any inſtrument.

The diurnal parallax of a phænomenon, which is generally underſtood, when the word is uſed without any epithet, is the arch of a great circle in the ſphere of the heaven, contained between the point wherein it appears to a ſpectator upon the ſurface of the earth, and the point wherein it would appear, if it were viewed by a ſpectator at the center of the earth: the former of theſe points is called the apparent place, the latter the true place of the phænomenon: it is called diurnal parallax, to diſtinguiſh it from the annual; and becauſe it ariſes from the ſemidiameter of the earth, whoſe revolution round her axis cauſes the viciſſitude of day and night; or becauſe it is alterable by the diurnal rotation of the earth, which changes the apparent altitudes of the heavenly bodies, and conſequently their parallax.

A phænomenon, which at different altitudes continues at the ſame diſtance from the center of the earth, has the greater parallax the farther it appears from the zenith of the obſerver, therefore the parallax is greateſt in the horizon. A phænomenon that appears in the zenith, whatever its diſtance from the earth is, has no parallax: thus, if a phænomenon be at H (plate XCVII. *fig.* 14.) in the viſible horizon of a ſpectator at A, its parallax is the arc N O; its apparent place is O, its true place N: if it be at ſome height above the horizon, as at G, its parallax is L M, which is leſs than N O: if it be higher, as at F, its parallax is I K, leſs than L M: if it be at E or *e*, it appears in the zenith at Z, and has then no parallax; for the lines A Z and C Z coinciding, its apparent place is the ſame with its true place.

Parallax always diminiſhes the altitude of a phænomenon, or makes it appear lower than it would do from the center of the earth: thus O, the apparent place of H, is farther from the zenith Z than its true place N is; in like manner, M, the apparent place of G, is lower than its true place L; and K, the apparent place of F, is lower than its true place I. The change of the altitude by parallax may, according to the different ſituation of the ecliptic and equator in reſpect of the horizon of the ſpectator, cauſe an apparent parallax or change of the latitude, longitude, declination, and right aſcenſion, of the phænomenon; it may change only ſome of them: thus (*fig.* 15.) let HO be the horizon, EC part of the ecliptic, P the pole of the ecliptic, Z the zenith, Z V an arc of a vertical drawn through I the true place, and F the apparent place of a planet; let P B be a circle of latitude drawn through the planet's true place, and P A a circle of latitude drawn through its apparent place; it is manifeſt that the parallax of altitude F I, by changing of the planet from I to F, alters its latitude from B I to A F; it alters its longitude alſo, as much as the arc A B amounts to. If the place of a planet be in a vertical circle which cuts the ecliptic in the 90th degree from the interſection of the horizon and ecliptic, that is, which cuts the ecliptic at right angles, the parallax will change the latitude of the planet, but not its longitude: thus, if a planet be in the point K of the vertical Z E H, this vertical being perpendicular to the ecliptic, and conſequently a circle of latitude, by the definition the parallax of altitude K L will be the ſame with the parallax of latitude; but ſince the

the ſame circle of latitude P E H paſſes through the true place K, and the apparent place L, the parallax of altitude K L does not change the longitude. Let E C, which before repreſented the ecliptic, be now the equator, P the pole of the equator, P E H the meridian, P I B a circle of declination paſſing through the true place, and P F A a circle of declination paſſing through the apparent place of the planet, the point B ſhews the true, and the point A the apparent right aſcenſion of the planet, and B A is the parallax of right aſcenſion: I B it is true, F A its apparent declination, and their difference is the parallax of declination: if the ſtar be in the meridian, as at K, the parallax of declination will be K L, the ſame as the parallax of altitude; but there will be no parallax of right aſcenſion, becauſe the ſame circle of declination P E H paſſes through the apparent place L, and the true place K.

The parallaxes of any two phænomena, as *f* and *h*, (*fig.* 16.) whoſe diſtances from the center of the earth are different, and apparent diſtances from the zenith equal, are nearly reciprocally as their diſtances from the center of the earth: thus, if the diſtance of *h* from C be double the diſtance of *f* from C, the parallax of *f* will be double the parallax of *h*. The converſe of this is true, if the parallax of *f* be double the parallax of *h*, the diſtance of *h* is double the diſtance of *f* from the earth.

One uſe of the knowledge of parallaxes is to find the true place of a phænomenon: in all obſervations of the heavenly bodies, it is neceſſary to know how much they are depreſſed by the parallax, that, by adding ſo much to their apparent, we may have their true altitudes: indeed, in all of them, except the moon, the parallax is ſo ſmall, that, in moſt caſes, we need not take any account of it; but then to know it to be thus ſmall is of good uſe, to prevent our falling into the miſtakes, and help us to correct the obſervations of thoſe who have ſuppoſed it too great; as all aſtronomers, till of late, have done: thus, Ptolemy ſettled the horizontal parallax of the ſun, when in perigee, about 3′; as Tycho did alſo: Kepler diminiſhed it to 1′; but, by the lateſt and beſt obſervations, it is found not to exceed 10″.

Another uſe of parallaxes is to find the diſtance of the heavenly bodies from the earth: thus, the horizontal parallax of any one of them being known, its diſtance from the earth may be found. The parallax of a phænomenon at any given altitude being known, its diſtance from the earth may be found.

The moon being the neareſt to the earth of all the heavenly bodies, her parallax is the greateſt, and, conſequently, the moſt eaſy to be determined; it amounts to about a whole degree.

The ſun, and all the primary planets, except Mars and Venus when in perigee, are at ſo great diſtances from the earth, that their parallax is too ſmall to be obſerved. When Mars is in oppoſition to the ſun, his diſtance from the earth is but half ſo much as the ſun's diſtance from the earth; and, conſequently, his parallax is then double to that of the ſun: Tycho, in the year 1582, endeavoured, with incredible diligence, to diſcover the parallax of Mars in oppoſition; but Kepler, having examined Tycho's obſervations, concluded from them, that Mar's parallax was ſcarcely ſenſible.

The horizontal parallax of a phænomenon would be found directly, if it were to be ſeen by two obſervers, diſtant from each other 90° of a great circle upon the earth, and ſo ſituated, that one of them had the phænomenon in his zenith, the other in his horizon: the diſtance between the two points in the ſphere of the heaven in which the phænomenon appeared to them, would be its parallax (*fig.* 17.) let a phænomenon be at H, to an obſerver at B it appears in the zenith at N; to one at A it appears in his horizon at O; its horizontal parallax is N O. This method is mentioned for the eaſineſs of conceiving it, but is not likely to be put in practice; and if it were, horizontal obſervations are very uncertain, by reaſon of the variableneſs of refraction in or near the horizon: but, the parallax of a phænomenon at any known altitude being found, its horizontal parallax may be computed from thence, by a very eaſy proceſs. Alſo, if two obſervers, not ſo far diſtant as 90 degrees, obſerve, at the ſame time, meridian altitudes of a phænomenon, the difference of declination which comes out from thoſe altitudes, is the parallax owing to the difference of latitude of the places of obſervation; this being known, the horizontal parallax, which would ariſe from a diſtance of 90° may be computed from it: thus the meridian altitudes of Mars, in perigee, were obſerved at the ſame time at Paris by Caſſini, and at Cayenne by Richer; and the horizontal parallax of Mars computed from thence: the beſt way to have found the parallax of Mars, by obſervations made at theſe two places, would have been to have obſerved, with the teleſcope, an occultation of ſome fixed ſtar by Mars; if this had appeared exactly the ſame in both places, it would have ſhewn that Mars had no ſenſible parallax; if he had, the moment that the upper edge of Mars' diſk appeared at Paris to touch the ſtar, it would at Cayenne have appeared a little higher than the ſtar: and theſe diſtances of Mars from the ſtar ſeen in one place, and not in the other, would have been owing to the parallax. As they had not an opportunity of making ſuch an obſervation in both places at the ſame time, they took the ſame day, at Paris and Cayenne, meridian altitudes of Mars, and of a fixed ſtar in Aquarius, nearly of the ſame declination as that planet then had, in order to find whether the difference between the altitudes of Mars and that ſtar were the ſame at Cayenne as at Paris; if it were, ſince the ſtar has no parallax, the declination of Mars would come out the ſame from the obſervations in both places, and his parallax would be inſenſible; if, on the contrary, the difference between the altitudes of Mars and of the ſtar were obſerved to be greater at one place than at the other, this would ſhew a difference between the declination of Mars, as calculated from the obſervations of him in one place, and his declination, as it came out from the obſervations in the other place; which difference would be the parallax of Mars, ariſing from his being viewed by two obſervers diſtant from each other, as much as the arc of a great circle contained between the parallels of Paris and Cayenne amounts to. And they found it equal to 25″ $\frac{1}{3}$.

Annual PARALLAX of a phænomenon, is the change of its apparent place in the ſphere of the heaven, which is cauſed by its being viewed from the earth in different parts of her orbit: the annual parallax of all the planets is conſiderable, but that of the fixed ſtars is inſenſible. See ABERRATION.

PARALLAX, in levelling, denotes the angle contained between the line of true level and that of apparent level.

PARALLEL, in geometry, is applied to lines, figures, and bodies, every where equidiſtant from each other, and which, though infinitely produced, would never meet; thus, the line O P (pl. XCVII. *fig.* 18.) is parallel to Q R.

Parallel lines ſtand oppoſed to lines converging and diverging. Geometricians demonſtrate, that if two parallels O P and Q R (*fig.* 19.) be cut by a tranſverſe line S T in A and B; 1. The alternate angles *x* and *y* are equal. 2. The external angle *u* is equal to the internal oppoſite one *y*; and, 3dly, the two internal oppoſite ones *x* and *y* are alſo equal to two right angles.

It is ſhewn on the principles of optics, that if the eye be placed between two parallel lines, they will appear to converge towards a point oppoſite to the eye. And if they run to ſuch a length, as that the diſtance between them be but as a point thereto, they will there appear to coincide.

Parallel lines are deſcribed by letting fall equal perpendiculars, and drawing lines through the extremes.

PARALLEL *Planes* are ſuch planes as have all the perpendiculars drawn betwixt them equal to each other.

PARALLEL *Rays*, in optics, are thoſe which keep at an equal diſtance from the viſible object to the eye, which is ſuppoſed to be infinitely remote from the object.

PARALLEL *Ruler*, or *Parallelifm*, an inſtrument conſiſting of two wooden, braſs, &c. rulers A B, C D, (*fig.* 20.) equally broad every where, and ſo joined together by the croſs blades E F and G H, as to open at different intervals, accede and recede, and yet ſtill retain their parallelifm.

The uſe of this inſtrument is obvious; for one of the rulers being applied to R S, and the other withdrawn to a given point V, a right angle A B, drawn by its edge through V, is a parallel to R S.

PARALLELS, or PARALLEL *Circles*, in geography, called alſo parallels or circles of latitude, are leſſer circles

of

of the ſphere conceived to be drawn from weſt to eaſt through all the points of the meridian, commencing from the equator to which they are parallel, and terminating with the poles.

They are called parallels of latitude, becauſe all places lying under the ſame parallel, have the ſame latitude.

PARALLELS *of Latitude*, in aſtronomy, are leſſer circles of the ſphere parallel to the ecliptic, imagined to paſs through every degree and minute of the colures.

They are repreſented on the globe by the diviſions on the quadrant of altitude, in its motion round the globe, when ſcrewed over the pole of the ecliptic. See the article GLOBE.

PARALLELS *of Altitude*, or *Almacantars*, are circles parallel to the horizon, imagined to paſs through every degree and minute of the meridian between the horizon and zenith, having their poles in the zenith.

They are repreſented on the globe by the diviſions on the quadrant of altitude, in its motion about the body of the globe, when ſcrewed to the zenith.

PARALLELS *of Declination*, in aſtronomy, are the ſame with parallels of latitude in geography.

PARALLEL *Sphere*, that ſituation of the ſphere wherein the equator coincides with the horizon, and the poles with the zenith and nadir. Conſequently the poles of the world become the poles of the horizon.

In this ſphere all the parallels of the equator become parallels of the horizon, conſequently no ſtars ever riſe or ſet, but all turn round in circles parallel to the horizon; and the ſun, when in the equinoctial, wheels round the horizon the whole day. After his riſing to the elevated pole, he never ſets for ſix months; and after his entering again on the other ſide of the line, never riſes for ſix months longer.

This is the poſition of the ſphere to ſuch as live under the poles, and to whom the ſun is never above 23° 30′ high.

PARALLEL *Sailing*, in navigation, is the ſailing under a parallel of latitude. See *Parallel* SAILING.

PARALLELEPIPED, or PARALLELOPIPED, in geometry, a regular ſolid, comprehended under ſix parallelograms, the oppoſite ones whereof are ſimilar, parallel, and equal.

All parallelepipeds, priſms, cylinders, &c. whoſe baſes and heights are equal, are themſelves equal.

A diagonal plane divides a parallelepiped into two equal priſms; ſo that a triangular priſm is half a parallelepiped upon the ſame baſe, and of the ſame altitude.

All parallelepipeds, priſms, cylinders, &c. are in a ratio compounded of their baſes and altitudes: wherefore, if their baſes be equal, they are in proportion to their altitudes; and converſely.

All ſimilar parallelepipeds, cylinders, cones, &c. are in a triplicate ratio of their homologous ſides, and alſo of their altitudes.

Equal parallelepipeds, priſms, cones, cylinders, &c. reciprocate their baſes and altitudes.

To meaſure the ſurface and ſolidity of a parallelepiped. Find the areas of the parallelograms ILMK, LMON, and OMKP (plate XCVIII. *fig.* 1.) add theſe into one ſum, and multiply that ſum by 2, the factum will be the ſurface of the parallelepiped.

If then the baſe ILMK be multiplied by the altitude MO, the product will be the ſolidity.

PARALLELISM, the ſituation or quality whereby any thing is denominated parallel.

PARALLELISM *of the Earth's Axis*, in aſtronomy, that ſituation of the earth's axis, in its progreſs through its orbit, whereby it is ſtill directed towards the pole-ſtar; ſo that if a line be drawn parallel to its axis, while in any one poſition, the axis, in all other poſitions, will be always parallel to the ſame line.

This parallelism is the neceſſary reſult of the earth's double motion, namely, round the ſun, and its own axis. And to it we owe the viciſſitudes of ſeaſons, and the inequality of day and night.

PARALLELISM *of the Rows of Trees*.—Theſe are never ſeen parallel, but always inclining to each other towards the farther extreme.

Hence mathematicians have taken occaſion to enquire in what lines the trees muſt be diſpoſed to correct this effect of the perſpective, and make the rows ſtill appear parallel. The two rows muſt be ſuch, as that the unequal intervals of any two oppoſite or correſpondent trees may be ſeen under equal viſual rays.

On this principle, ſome have ſhewn that the two rows of trees muſt be two oppoſite ſemi-hyperbolas.

M. Varignon, in Mem. de l'Acad. ann. 1717, renders the problem much more general, and requires not only that the viſual angles be equal, but to have them increaſe or decreaſe in any given ratio, provided the greateſt do not exceed a right angle. The eye requires to be placed in any point, either juſt at the beginning of the ranges, beyond or on this ſide.

He ſuppoſes the firſt row to be a right line, and ſeeks what line the other muſt be, which he calls the curve of the range: this he finds muſt be an hyperbola to have the viſual angles equal. The ſtraight and hyperbolical rows will be ſeen parallel to infinity; and if the oppoſite ſemi-hyperbola be added, we ſhall have three rows of trees, the ſtraight one in the middle, and all three parallel.

It is ſufficient that this ſecond hyperbola have the ſame center, its vertex in the ſame right line, and the ſame conjugate axis. Thus the two hyperbolas may be of all the different kinds poſſible, yet all have the ſame effect.

If it be required to have the trees appear under decreaſing angles, the ſtraight row being laid down as before, he ſhews, that if the decreaſe be in a certain ratio, the other line muſt be a parallel ſtraight line. But he goes yet farther, and ſuppoſing the firſt row any curve whatever, he ſeeks for another that ſhall make the rows have any effect deſired.

PARALLELOGRAM, in geometry, a quadrilateral right-lined figure, whoſe oppoſite ſides are parallel and equal to each other. It is generated by the equable motion of a right line always parallel to itſelf. When it has all its four angles right, and only its oppoſite ſides equal, it is called a rectangle or oblong. When the angles are all right, and the ſides equal, it is called a ſquare. If all the ſides be equal, and the angles unequal, it is called a rhombus or lozenge: and if the ſides and angles be unequal, it is called a rhomboides.

Properties of the PARALLELOGRAM.—In every parallelogram of what kind ſoever, as ABCD (p. XCVIII. *fig.* 2.) a diagonal DA divides it into two equal parts; the angles diagonally oppoſite B, C, and A, D, are equal; the oppoſite angles of the ſame ſide C, D, and A, B, &c. are together equal to two right angles; and each two ſides, together, greater than the diagonal.

Two parallelograms ABCD, and ECDF, on the ſame or equal baſe CD, and of the ſame height AC, or between the ſame parallels AF, CD, are equal: and hence two triangles CDA, and CDF, on the ſame baſe and of the ſame height, are alſo equal. Hence, alſo, every triangle CFD is half a parallelogram ACDB upon the ſame or an equal baſe CD, and of the ſame altitude, or between the ſame parallels. Hence, alſo, a triangle is equal to a parallelogram, having the ſame baſe and half the altitude, or half the baſe and the ſame altitude.

Parallelograms, therefore, are in a given ratio compounded of their baſes and altitudes. If then the altitudes be equal, they are as the baſes, and converſely.

In ſimilar parallelograms and triangles, the altitudes are proportional to the homologous ſides, and the baſes are cut proportionably thereby. Hence ſimilar parallelograms and triangles are in a duplicate ratio of their homologous ſides; as alſo of their altitudes, and the ſegments of their baſes; they are, therefore, as the ſquares of the ſides, altitudes, and homologous ſegments of the baſes.

In every parallelogram, the ſum of the ſquares of the two diagonals is equal to the ſum of the ſquares of the four ſides. For if the parallelogram be rectangular, it follows, that the two diagonals are equal; and conſequently the ſquare of a diagonal, or, which comes to the ſame thing, the ſquare of the hypothenuſe of a right angle, is equal to the ſquares of the ſides.

If the parallelogram be not rectangular, and of conſe-

quence

5 JA 59

Fig. 1. Center of Oscillation.

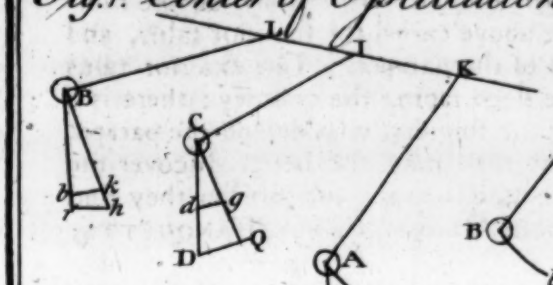


Fig. 2.

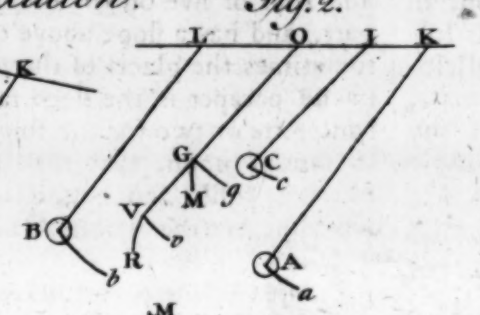


Fig. 3.

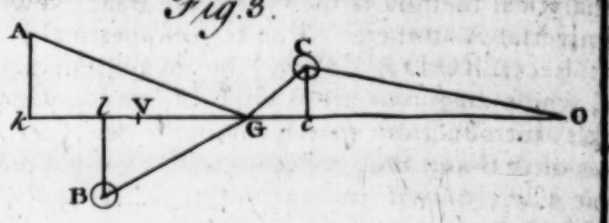


Fig. 4.

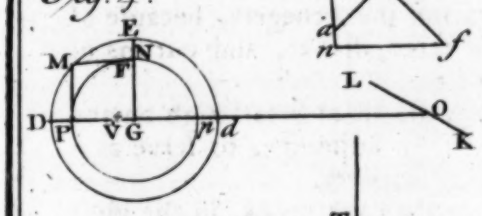


Fig. 5.

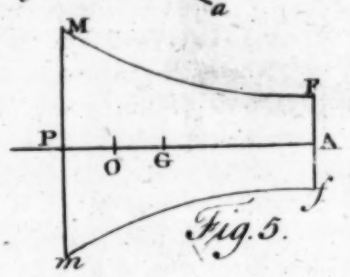


Fig. 6. Parabola.

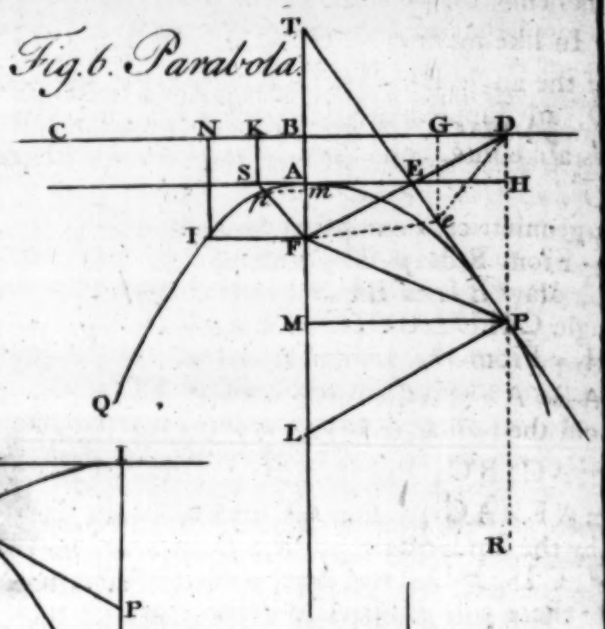


Fig. 7. Parabola.

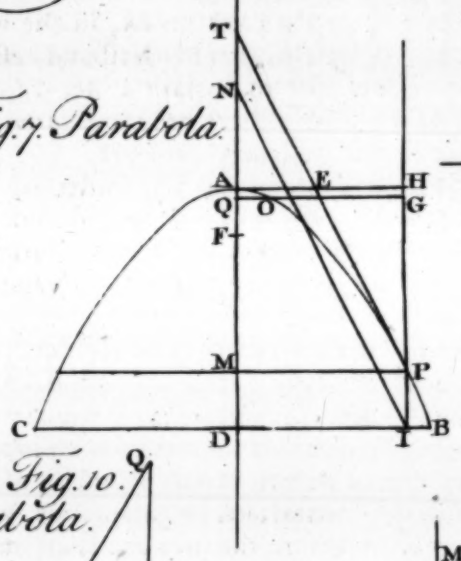


Fig. 8. Parabola.

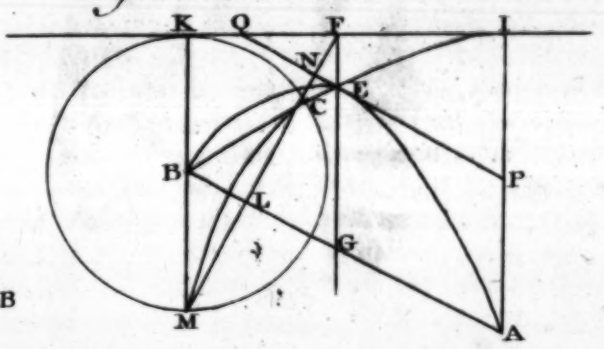


Fig. 9. Parabola.

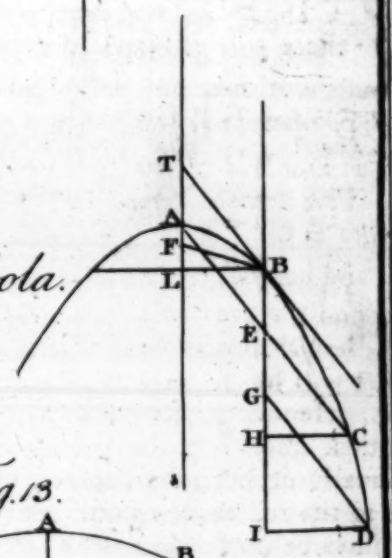


Fig. 10. Parabola.

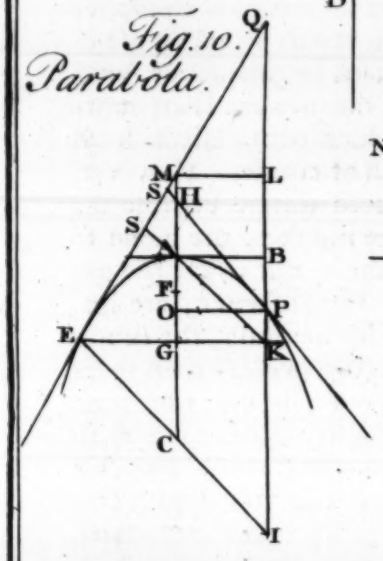


Fig. 11.

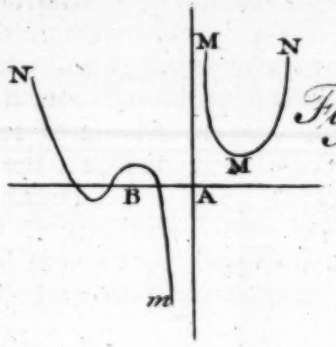


Fig. 12.

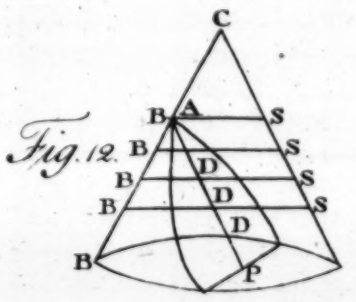


Fig. 13.

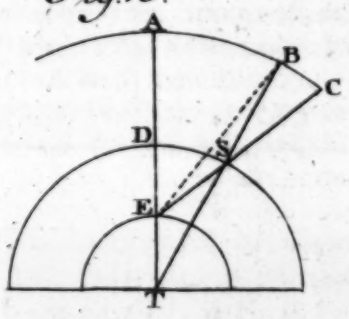


Fig. 14.

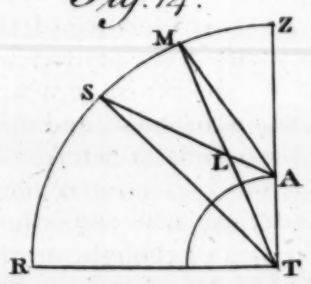


Fig. 15. 17. Parallax.

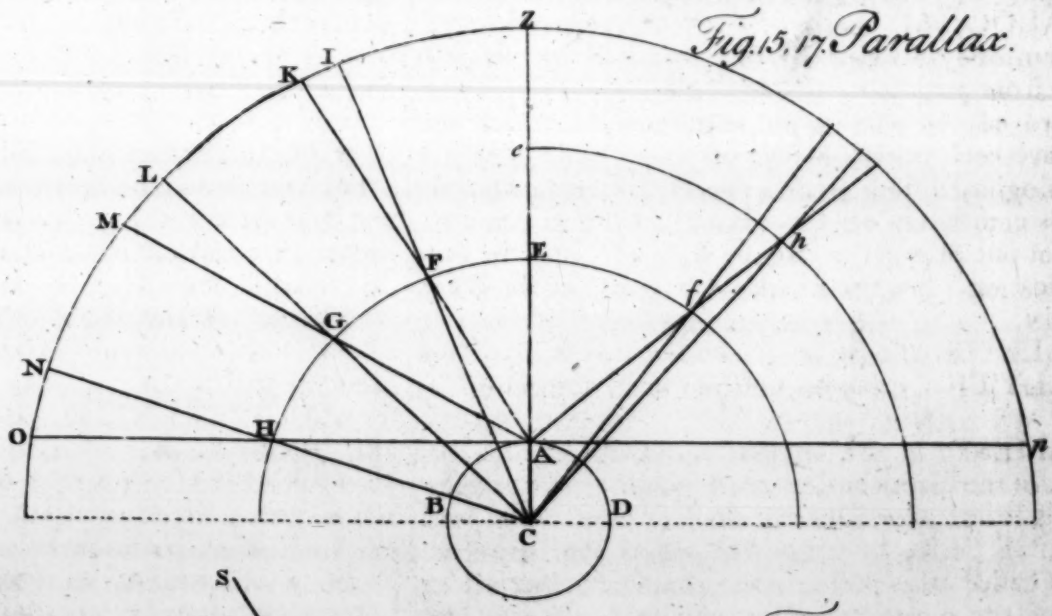


Fig. 16. Parallax.

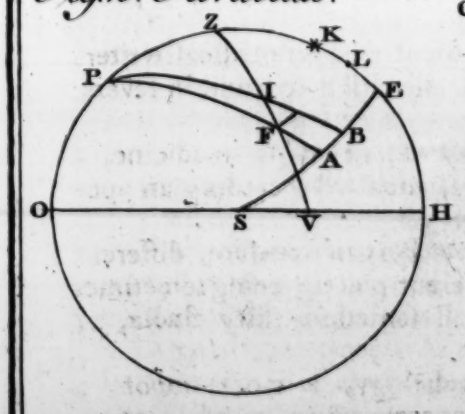


Fig. 18. 19.

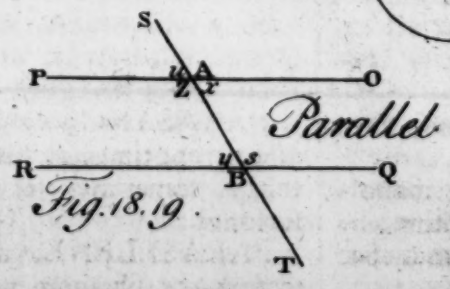


Fig. 20.

quence the two diagonals unequal, which is the moſt general caſe, the propoſition becomes of vaſt extent; for inſtance, in the whole theory of compound motions, &c. There are ſeveral ways of demonſtrating this problem, the analytical method is ſhewn by Sir Iſaac Newton, in his Univerſal Arithmetic. The trigonometrical is as follows: Let ABCDA (*fig.* 3.) be an oblique parallelogram, whoſe diagonals are AC, BD; then by lemma 1, (Clark's Introduction to Mechanics), the ſum of the ſquares of AB and BC, together with a double rectangle of thoſe ſides, drawn into the coſine of the angle ABC (radius being 1), is equal to the ſquare of the diagonal AC. In like manner, $\overline{BC}^2+\overline{CD}^2-2BC\times CD\times$ coſine of the angle $BCD=\overline{BD}^2$. But the angles ABC, BCD, are ſupplemental to each other; therefore their coſines are equal, conſequently $2BC^2+2CD^2=\overline{AC}^2+\overline{BD}^2$.

If a geometrical demonſtration be required, it may be thus.—From B draw BF, making the angle AFB = ABC, draw BE = BF. From C draw CH, making the angle CHD=BCD, produce BD, and draw CG =CH. From the ſimilar triangles ABF, ABC, we have AB : AF :: AC : AB; whence $\overline{AB}^2=AF\times FC$; and from the ſimilar triangles ABC, BEC, we get BC :CE :: AC : BC; therefore $\overline{BC}^2=AC\times CE$. $\therefore \overline{AB}^2+\overline{BC}^2=AF\times AC+CE\times AC=\overline{AC}^2-AC\times EF$. Again, by the ſimilar triangles BCD, HCD, we have BD :CD :: CD : HD; and by the ſimilar triangles BCG, BCD, there will ariſe BC : DB :: BG : BC. From this and the former proportion we get $\overline{BC}^2=BD\times BG$, and $\overline{CD}^2=BD\times HD$; conſequently $\overline{BC}^2+\overline{CD}^2=\overline{BG+HD}\times BD=\overline{BD}^2+HG\times BD=\overline{AC}^2-AC\times EF$. The iſoſceles triangles FBE, HCG, are ſimilar; therefore HG : FE :: AC : BD $\therefore HG\times BD=FE\times AC$; and conſequently $2\overline{AB}^2+2\overline{BC}^2=\overline{AC}^2+\overline{BD}^2$.

To find the area of a rectangled parallelogram, multiply the length ſuppoſed = 354 in the breadth = 132, the product will be the area of the parallelogram; namely, 46728. Hence, 1. Rectangles are in a ratio compounded of their ſides. 2. If, therefore, three right lines be continually proportional, the ſquare of the middle one is equal to the rectangle of the two extremes; and if four right lines be proportional, the rectangle under the two extremes is equal to that under the two middle terms.

Other parallelograms, not rectangular, have their areas found by reſolving them, by diagonals, into two triangles, and adding the areas of the ſeparate triangles into one ſum.

PARALLELOGRAM, or PARALLELISM, a machine for the ready reduction of deſigns; it is the ſame with the pentagraph. See the article PENTAGRAPH.

PARALOGISM, in logic, a falſe reaſoning, or a fault committed in demonſtration, when a conſequence is drawn from principles that are falſe; or, though true, are not proved; or when a propoſition is paſſed over that ſhould have been proved by the way.

A paralogiſm differs from a ſophiſm in this, that the ſophiſm is committed out of deſign and ſubtlety, and the paralogiſm out of miſtake and for want of ſufficient light and application. See the articles SOPHISM and DEMONSTRATION.

PARALYSIS, the palſy. See PALSY.

PARALYTIC, a perſon afflicted with the palſy. See PALSY.

PARAMESE, in the ancient muſic, the note above the meſe, in the Greek ſcale; correſponding to a la-mire, of Guido's ſcale. See DIAGRAM.

PARAMETER, in conic ſections, a conſtant line; otherwiſe called latus rectum when applied to the principal axis of the figure. See the articles ELLIPSIS, HYPERBOLA, and PARABOLA.

PARAMOUNT, in law ſignifies the ſupreme lord of the fee. See FEE.

The lords of theſe honours or manors that have manors under them are ſtiled lords paramount; and the king, by our law is the chief lord of all the lands in England. See MANOR.

PARAPET, in fortification, an elevation of earth deſigned for covering the ſoldiers from the enemies cannon or ſmall ſhot. The thickneſs of the parapet is from eighteen to twenty feet; its height is ſix feet on the inſide, and four or five on the outſide. It is raiſed on the rampart, and has a ſlope above called the ſuperior talus, and ſometimes the glacis of the parapet. The exterior talus of the parapet is the ſlope facing the country: there is a banquette or two for the ſoldiers, who defend the parapet to mount upon, that they may the better diſcover the country, foſſe, and counterſcarpe, and fire as they find occaſion. See the articles GLACIS, TALUS, BANQUETTE, &c.

Parapet of the covert way, or corridor, is what covers that way from the ſight of the enemy, which renders it the moſt dangerous place for the beſiegers, becauſe of the neighbourhood of the faces, flanks, and curtins of the place.

PARAPET is alſo a little wall raiſed breaſt high on the banks of bridges, keys, or high buildings, to ſerve as a ſtay, and prevent people's falling over.

PARAPHERNALIA, or PARAPHERNA, in the civil law, thoſe goods which a wife brings her huſband beſides her dower, and which are ſtill to remain at her diſpoſal excluſive of her huſband, unleſs there are ſome proviſion made to the contrary in the marriage contract.

PARAPHIMOSIS, in medicine, a diſorder of the penis, wherein the prepuce is ſhrunk, and withdrawn behind the glans, ſo as not to be capable of being brought to cover the ſame; which generally happens in venereal diſorders.

The cure of a paraphimoſis, according to Heiſter, conſiſts chiefly in returning the contracted prepuce over the naked glans; but as a violent inflammation is uſually the chief cauſe of its being ſo difficult to return the prepuce in the paraphimoſis, it may be firſt proper to make uſe of diſcutient and emollient fomentations or cataplaſms, with camphorated ſpirit of wine before the prepuce is attempted to be drawn over the glans, which being effected, all the other bad ſymptoms will vaniſh of courſe. However, ſome ſurgeons prefer the uſe of cold water, becauſe the former remedies often augment the influx of the blood to the parts, and ſo increaſe the tumor. But when the penis, ſcrotum, and lower part of the abdomen, are immerged in cold water, with plentiful bleeding, the tumor generally ſubſides in a ſhort time: the penis is then to be held between the ſurgeon's two foremoſt fingers of each hand; and the glans, having been firſt lubricated with oil or butter, is to be forcibly preſſed back with his thumbs, whilſt the prepuce is at the ſame time drawn forward under his fingers, ſo as to cover the denudated glands; but when the inflammation is not very large, it may be often ſufficient only to bathe the parts in water, when there is little or no virulency. On the contrary, when the tumefied penis tends to mortify through the violence of the inflammation, or long continuance of the diſorder, it will be moſt adviſable to bleed the patient firſt in the arm, and then in the vena dorſalis penis, in which laſt it ſhould be continued till the tumor ſubſides, and then the prepuce may be drawn over the glands as before.

PARAPHRASE, παραφρασις, an explanation of ſome text, in clearer and more ample terms, whereby is ſupplied what the author might have ſaid or thought on the ſubject; ſuch are eſteemed Eraſmus's paraphraſe on the New Teſtament, the Chaldee paraphraſe on the Pentateuch, &c.

PARAPHRENITIS, in medicine, an inflammation of the diaphragm.

PARAPHROSYNE, a word uſed by medical writers to expreſs a delirium, or an alienation of mind in fevers, or from whatever cauſe.

PARAPLEGIA, or PARAPLEXIA, in medicine, a ſpecies of paralyſis, or palſy, uſually ſucceeding an apoplexy. See PALSY.

PARASANG, an ancient Perſian meaſure, different at different times, and in different places; being ſometimes thirty, ſometimes forty, and ſometimes fifty ſtadia, or furlongs.

PARASELENE, in phyſiology, a mock moon, a meteor, or phænomenon, encompaſſing, or adjacent to, the

the moon, in form of a luminous ring; wherein are ſometimes obſerved one, ſometimes two, apparent images of the moon.

The paraſelones are formed after the name manner as the parhelia, or mock ſuns. See the article PARHELIUM.

PARASITES, or PARASITICAL PLANTS, in botany, ſuch plants as are produced out of the trunk or branches of other plants, from whence they receive their nouriſhment, and will not grow upon the ground, as the miſleto, &c.

PARASTATA, in the ancient architecture, an impoſt, or kind of anta, or pilaſter, built for the ſupport of an arch; or as ſome will have it, pilaſters, which ſtand alone, not adjoining to the wall. Daviler makes a paraſtata the ſame with impoſt, but Evelyn the ſame with pilaſter.

PARASTATÆ, or EPIDIDYMIDES, in anatomy, two tuberous varicoſe bodies, lying upon, and adhering to, the upper part of the teſticles, whereof they properly appear to be a part, though different from the reſt in form and conſiſtence.

The paraſtatæ are oblong, nearly of a cylindric figure, reſembling in ſome meaſure the body of a caterpillar, or ſilk-worm. They are connected with the teſticle by means of the tunica albuginea, and alſo with the vas deferens.

PARASYNANCHE, in medicine, a kind of angina, or quinzy, wherein the exterior muſcles of the throat are inflamed. See QUINZY.

PARATHENAR, in anatomy, the name of two muſcles of the foot; one of which, the parathenar major, is a pretty long muſcle, forming a part of the outer edge of the ſole of the foot. It is fixed backward by a fleſhy body to the outer-part of the lower-ſide of the os calcis, from the ſmall poſterior external tuberoſity, all the way to the anterior tuberoſity; there it joins the metatarſus, and at the baſis of the fifth metatarſal bone ſeparates from it again, and forms a tendon which is inſerted in the outſide of the firſt phalanx of the little toe, near its baſis, and near the inſertion of the other parathenar: this laſt is called the parathenar minor; being a fleſhy muſcle fixed along the poſterior half of the fifth bone of the metatarſus, and terminating under the head of that bone in a tendon which is inſerted in the lower part of the baſis of the firſt phalanx of the little toe.

PARATHESIS, in grammar, the ſame with appoſition. See APPOSITION.

PARATHESIS is alſo the ſame with parentheſis. See PARENTHESIS.

PARATITLES, *Paratitla*, in juriſprudence, ſhort notes or ſummaries of the titles of the digeſt and code; which have been made by ſeveral lawyers, in order to compare and examine the connection of the ſeveral parts with one another. See the articles DIGEST and CODE.

PARAVAIL, or PARAVAILE, ſignifies a perſon that is tenant to one who holds of another, or the loweſt tenant of the fee.

PARCÆ, in the heathen mythology, goddeſſes who were ſuppoſed to preſide over the accidents and events, and to determine the date or period of human life.

The ancients reckoned the parcæ, who were alſo called fates and deſtinies, to be three in number, becauſe all things have their beginning, progreſs, and end. They were called Atropos, Clotho, and Lacheſis, and are repreſented as ſpinning the thread of human life, in which employment Clotho held the diſtaff. Lacheſis turned the wheel, and Atropos cut the thread. Their perſons are variouſly deſcribed; ſometimes they are repreſented as old women, one holding a diſtaff, another a wheel, and a third a pair of ſciſſars. Others paint Clotho in a robe of divers colours, with a crown of ſtars upon her head, and holding a diſtaff in her hand; Lacheſis in a garment covered with ſtars, and holding ſeveral ſpindles; and Atropos they clad in black, cutting the thread with a large pair of ſciſſars.

PARCHMENT, in commerce, the ſkins of ſheep or goats prepared after ſuch a manner as to render it proper for writing upon, covering books, &c.

The manufacture of parchment is begun by the ſkinner, and finiſhed by the parchment-maker.

The ſkin having been ſtripped of its wool, and placed in the lime-pit, in the manner deſcribed under the article SHAMMY, the ſkinner ſtretches it on a kind of frame, and pares off the fleſh with an iron inſtrument; this done, it is moiſtened with a rag, and powdered chalk being ſpread over it, the ſkinner takes a large pumice-ſtone, flat at bottom, and rubs over the ſkin, and thus ſcowers off the fleſh; he then goes over it again with the iron inſtrument, moiſtens it as before, and rubs it again with the pumice-ſtone without any chalk underneath: this ſmooths and ſoftens the fleſh ſide very conſiderably. He then drains it again, by paſſing over it the iron inſtrument as before. The fleſh ſide being thus drained, by ſcraping off the moiſture, he in the ſame manner paſſes the iron over the wool or hair ſide; then ſtretches it tight on a frame, and ſcrapes the fleſh ſide again; this finiſhes its draining; and the more it is drained, the whiter it becomes. The ſkinner now throws on more chalk, ſweeping it over with a piece of lamb-ſkin that has the wool on, and this ſmooths it ſtill farther. It is now left to dry, and when dried, taken off the frame by cutting it all round. The ſkin thus far prepared by the ſkinner, is taken out of his hands by the parchment-maker, who firſt, while it is dry, pares it on a ſummer, which is a calf-ſkin ſtretched in a frame, with a ſharper inſtrument than that uſed by the ſkinner, and working with the arm from the top to the bottom of the ſkin, takes away about one half of its thickneſs. The ſkin thus equally pared on the fleſh ſide, is again rendered ſmooth, by being rubbed with the pumice-ſtone, on a bench covered with a ſack ſtuffed with flocks, which leaves the parchment in a condition fit for writing upon. The parings, thus taken off the leather, are uſed in making glue, ſize, &c. See GLUE, &c.

What is called vellum, is only parchment made of the ſkins of abortives, or at leaſt ſucking calves. This has a much finer grain, and is whiter and ſmoother than parchment; but is prepared in the ſame manner, except its not being paſſed through the lime-pit.

PARDALUS, or PARDUS, the leopard. See LEOPARD.

PARDON, in law, is the forgiveneſs of an offence againſt the king or the laws.

PAREGORICS, in pharmacy, medicines that aſſuage pain, otherwiſe called anodynes. See the article ANODYNES.

PARELCON, in grammar, a figure by which a word or ſyllable is added to the end of another.

PARENCHYMA, in anatomy, a term introduced by Eraſiſtratus, ſignifying all that ſubſtance which is contained in the interſtices betwixt the blood-veſſels of the viſcera, which he imagined to be extravaſated and concreted blood. The moderns having diſcovered all the viſcera to be vaſculary and glandulous, have rejected this term, together with the doctrine.

PARENCHYMA *of Plants*. Grew applies the term parenchyma to the pith or pulp, or that inner part of a fruit or plant through which the juice is ſuppoſed to be diſtributed. This, when viewed with a microſcope, appears to reſemble marrow, or rather a ſponge, being a porous, flexible, dilatable ſubſtance. Its pores are innumerable and exceedingly ſmall, receiving as much humour as is requiſite to fill and extend them, which diſpoſition of pores it is that is ſuppoſed to fit the plant for vegetation and growth.

PARENT, *Parens*, a term of relation applicable to thoſe from whom we immediately receive our being.

PARENTHESIS, in grammar, certain intercalary words, inſerted in a diſcourſe, which interrupt the ſenſe, or thread, but ſeem neceſſary for the better underſtanding of the ſubject.

The proper characteriſtic of a parentheſis is, that it may be either taken in or left out, the ſenſe and the grammar remaining intire. In ſpeaking, the parentheſis is to be pronounced in a different tone; and in writing, it is encloſed between ( ), called alſo a parentheſis, but commonly a bracket, or crotchet, to diſtinguiſh it from the reſt of the diſcourſe. The politeſt of our modern writers avoid all parentheſes, as keeping the mind in ſuſpenſe, embaraſſing it, and rendering the diſcourſe leſs clear, uniform, and agreeable.

PARERGA, *παρεργα*, a term ſometimes uſed in architecture for additions or appendages made, by way of ornament, to a principal work.

PARESIS, *παρεσις*, in medicine, is defined to be a palſy of the bladder, wherein the urine is either ſuppreſſed or diſcharged involuntarily.

PARGET, in natural hiſtory, a name given to ſeveral kinds of gypſum, or plaſter-ſtone. See the article PLASTER.

PARGETING, in building, is uſed for the plaſtering of walls, and ſometimes for the plaſter itſelf.

PARHELIUM, or PARHELION, in phyſiology, a mock ſun, or meteor, in form of a very bright light, appearing on one ſide of the ſun.

The prahelia are formed by the reflection of the ſun's beams on a cloud properly poſited. They uſually accompany the coronæ, or luminous circles; and are placed in the ſame circumference and at the ſame height. Their colours reſemble that of the rainbow, the red and yellow are on the ſide towards the ſun, and the blue and violet on the other. There are coronæ ſometimes ſeen without parhelia, and *vice verſa*.

Parhelia are double, tripple, &c. and in 1629, a parhelion of five ſuns was ſeen at Rome; and 1666, another at Arles of ſix.

M. Mariotte accounts for parhelia from an infinity of little particles of ice floating in the air, that multiply the image of the ſun by refraction or reflection; and by a geometrical calculus he has determined the preciſe figure of theſe little icicles, their ſituation in the air, and the ſize of the coronæ or circles which accompany the parhelia, and the colours wherewith they are painted. M. Huygens accounts for the formation of a parhelion in the ſame manner as for that of the halo. See the article HALO.

PARIETALIA OSSA, in anatomy, the ſecond and third bones of the cranium; being called alſo oſſa-bregmatis, and oſſa-ſincipitis.

PARIETES, in anatomy, a term uſed for the incloſures, or membranes, that ſtop up or cloſe the hollow parts of the body, eſpecially thoſe of the heart, thorax, &c.

PARIETARIA, pellitory of the wall, in botany, a plant with tender reddiſh ſtalks; rough, uncut, oblong leaves, pointed at both ends; and imperfect rough flowers, growing in cluſters along the ſtalks, followed each by a ſmall ſhining ſeed. It is perennial, common on old walls and among rubbiſh, and flowers in May.

The leaves of pellitory of the wall have been uſed in cataplaſms for diſcuſſing inflammatory ſwellings: decoctions of them, and their expreſſed juice, have been given as emollient diuretics, in nephritic caſes and iſchuries; and are ſaid, when long perſiſted on, to be uſeful aperients or ſweeteners in cutaneous defedations. The plant appears to be of no great activity, being rather oleraceous than medicinal: to the taſte, the leaves in ſubſtance and thin juice, are little other than herbaceous and watery.

PARISH, the precinct of a parochial church, or a circuit of ground inhabited by people who belong to one church, and are under the particular charge of its miniſter.

In England there are nine thouſand, nine hundred and thirteen pariſhes, of which three thouſand, eight hundred and forty-five are churches impropriate, and the reſt are annexed to colleges, or church dignities. In many of theſe pariſhes, on account of their large extent, and the number of pariſhioners, there are ſeveral chapels of eaſe.

PARISH-OFFICERS, officers choſen annually to regulate and manage the concerns of the pariſh, for which ſee the articles CHURCH-WARDENS and OVERSEERS *of the Poor*.

PARK, a large incloſure privileged for wild beaſts of chace, either by preſcription or the king's grant. No perſon can now erect a park without his obtaining firſt a licence under the broad-ſeal; but there may be ſuch in reputation, though erected without lawful warrant, and the owner may bring his action againſt perſons that kill his deer therein.

PARK is alſo uſed for a moveable incloſure, or fold, ſet up in the fields for ſheep to feed and reſt in during the night. This park is frequently removed by the ſhepherds to dung the ground one part after another.

PARK alſo ſignifies a large net, placed on the brink of the ſea, with only one entrance, which is next the ſhore, and which is left dry by the ebb of the tide; ſo that the fiſh once got in have no way left to eſcape.

PARK *of Artillery*. See ARTILLERY-PARK.

PARK *of Proviſions*. See *Park of* PROVISIONS.

PARLEY, a conference with an enemy. Hence to beat or ſound a parley, is to give a ſignal for holding ſuch a conference by beat of drum or ſound of trumpet.

PARLIAMENT is the grand aſſembly of the three ſtates of this kingdom, ſummoned together, by the king's authority, to conſult of matters relating to the public welfare, and particularly to enact and repeal laws. It conſiſts of the king, the lords ſpiritual and temporal, and the commons, and is at once the ſeat of the legiſlative authority, and the higheſt court of juſtice in Great-Britain. In the houſe of lords, criminal cauſes are tried on the impeachment of the commons; and this houſe has an original juriſdiction for the trial of peers upon indictments found by a grand jury; the lords likewiſe try ſuch cauſes as come thither on appeals from the court of chancery, and all their decrees are as judgments. The houſe of commons examine the right of elections, regulate diſputes concerning them, may expel their own members, and commit them to priſon; they are the grand inqueſt of the nation, and preſent public grievances or delinquents to the king and lords, in order to their being puniſhed. In ſhort, they are the repreſentatives of all the commons in the kingdom, and in them their conſtituents have placed the higheſt confidence, by inveſting them with the power of making laws, and entruſting them with all their liberties and privileges. Originally, new parliaments were called every year; but by degrees their term grew longer. In the reign of king Charles II. they were held a long time, with great interruptions between; but both methods were found of ſuch ill conſequence, that, in the beginning of the reign of king William III. an act was paſſed, by which the term of all parliaments was reſtrained to three ſeſſions, or three years; this was hence called the triennial act: but ſince that time, from other views, the period of parliaments has been lengthened to ſeven years. A parliament is called by the king's writ or letter directed to each lord, commanding him to appear; and by others writs, directed to the ſheriffs of each county, to ſummon the people to elect two knights for each county, and one or two burgeſſes for each borough. The number of the members in the houſe of lords is uncertain, as increaſing at the king's pleaſure. The members of the houſe of commons, when full, are five hundred and fifty three, viz. ninety-two knights of the ſhires; fifty-two deputies for twenty-five cities, London having four, ſixteen for the eight Cinque-ports; two for each univerſity; three hundred and thirty-two for an hundred and eighty boroughs; twelve for the boroughs in Wales, and forty-five members for Scotland. If three hundred of theſe members are met, it is reckoned a full houſe; and forty may compoſe a houſe for the diſpatch of buſineſs.

Upon the holding of a parliament, the king, the firſt day, ſits in the upper houſe, under a canopy, with the crown on his head, and dreſſed in his royal robes; and there, by himſelf, or the lord chancellor, declares the reaſons of their meeting, in the preſence of both the lords and commons; and then the commons are required to chooſe a ſpeaker, who is preſented to the king, and being approved by his majeſty, the buſineſs of the parliament goes on.

The lords and commons ſit each in a diſtinct apartment: in the houſe of lords, the princes of the blood ſit by themſelves on the ſides of the throne; at the wall, on the king's right hand, the two archbiſhops ſit by themſelves on a form. Below them, the biſhops of London, Durham, and Wincheſter, and all the other biſhops ſit according to the priority of their conſecration. On the king's left hand, the lord treaſurer, lord preſident, and lord privy-ſeal ſit upon forms above all dukes, marquiſſes, and earls, according to their creation. Acroſs the room are wool-ſacks, continued from an ancient cuſtom; and

the

the chancellor, or keeper, being of courſe the ſpeaker of the houſe of lords, ſit on the firſt wool-ſack before the throne, with the great ſeal or mace lying by him; below theſe are forms for the viſcounts and barons. On the other wool-ſacks are ſeated the judges, maſters in chancery, and king's counſel, who are only to give their advice in points of law: but they all ſtand up till the king gives them leave to ſit. The commons ſit promiſcuouſly, only the ſpeaker has a chair at the upper end of the houſe, and the clerk and his aſſiſtant ſit at a table near him. Before any buſineſs is done, all the members of the houſe of commons take the oaths of allegiance and ſupremacy, &c. and ſubſcribe their opinions againſt tranſubſtantiation, &c. and if any member of that houſe votes, or ſits there during any debate, after the ſpeaker is choſen, without having firſt taken theſe oaths, between the hours of nine and four in a full houſe, he is adjudged a popiſh recuſant convict, and incapable of any office, and forfeits five hundred pounds. The ſame teſt the lords too, though they do not take the oaths, are obliged to comply with. When the parliament is thus met, no members are to depart from it without leave. Upon extraordinary occaſions, all the members are ſometimes ſummoned, in which caſe every lord ſpiritual and temporal, and every knight, citizen, and burgeſs is to come to parliament, except he can reaſonably and honeſtly excuſe himſelf; or be amerced: that is, reſpectively, a lord by the lords, and a commoner by the commons.

All members of parliament, in order that they may attend the public ſervice of their country, have the privilege for themſelves and their menial ſervants, of being freed from arreſts, attachments, impriſonments, &c. for debts, treſpaſſes, &c. but not from arreſts for treaſon, felony, and breach of the peace: however, it is ordained by ſtatute, that actions may be commenced, in any of the courts of Weſtminſter, againſt perſons intitled to privilege of parliament, after a prorogation or diſſolution, till a new parliament is called, or the ſame become re-aſſembled; and likewiſe after an adjournment for above fourteen days; and the reſpective courts, in ſuch a caſe, have power to proceed to judgment, &c. Here the proceſs is to be ſummons diſtreſs infinite, &c. till the parties ſhall enter an appearance; and for default thereof, the real or perſonal eſtate of the defendant may be ſequeſtered; though the plaintiff may not, in that caſe, arreſt the body of any member of parliament: 12 William III. c. 3.

Anciently all the people had votes in elections, till it was enacted by Henry VI. that none but freeholders, who had a yearly revenue of forty ſhillings, ſhould be admitted to vote for knights of the ſhire.

The manner of debating upon, and paſſing bills in parliament, is as follows: any member may move to have a bill brought in, which, upon a queſtion put, being agreed to by the majority, this perſon, with others, is ordered to prepare and bring in the ſame. When it is ready, a time is appointed for its being read, and after the clerk's reading it, the ſpeaker reads an abſtract of it, and puts the queſtion whether or no it ſhall have a ſecond reading? and after a ſecond reading, the queſtion is put, whether or no it ſhall be committed? which is either to a committee of the whole houſe, if it be of importance, or to a private committee, any member naming the perſons. The committee being appointed, and a chairman choſen, the chairman reads the bill, paragraph by paragraph, puts every clauſe to the queſtion, fills up the blanks and makes amendments, according to the opinion of the majority. The bill thus gone through, the chairman makes his report at the ſide-bar of the houſe, reads all the additions and amendments, &c. and moves for leave to bring up the report to the table; which granted, he delivers it to the clerk, who reads the amendments, &c. The ſpeaker then puts the queſtion, whether they ſhall be read a ſecond time? and if agreed to, he reads them himſelf. To ſo many of the amendments as the houſe aquieſces in, the queſtion is now put, whether the bill, thus amended, ſhall be ingroſſed and written fair upon parchment, and read a third time? and the bill being ingroſſed, the ſpeaker holds it in his hand, and aſks if it ſhall paſs? If the majority be for it, the clerk writes on it, *Soit baillé aux ſeigneurs*, let it be delivered to the lords: or, if in the houſe of lords, *Soit baillé aux communes*, let it be delivered to the commons. If a bill be rejected, it cannot be any more propoſed during that ſeſſion. A bill for a general pardon has but one reading.

When a member of the houſe of commons ſpeaks, he ſtands up, uncovered, and directs his ſpeech to the ſpeaker only. If what he ſays be anſwered by another, he is not allowed to reply the ſame day, unleſs perſonal reflections have been caſt upon him; but when the commons, in order to have a greater freedom of debate, have reſolved themſelves into a committee of the whole houſe, every member may ſpeak to a queſtion as often as he thinks neceſſary. In the houſe of lords they vote, beginning at the puiſne, or loweſt baron, and ſo up orderly to the higheſt, every one anſwering *content* or *not content*. In the houſe of commons they vote by *yeas* and *nays*; and if it be dubious which are the greater number, the houſe divides. If the queſtion be about bringing any thing into the houſe, the *yeas* go out; but if it be about any thing the houſe already has, the *nays* go out. In all diviſions the ſpeaker appoints four tellers, two of each opinion. In a committe of the whole houſe, they divide by changing ſides, the *yeas* taking the right, and the *nays* the left of the chair; and then there are but two tellers. If a bill paſs one houſe, and the other demur to it, a conference is demanded in the painted chamber, where certain members are deputed from each houſe; and here the lords ſit covered, and the commons ſtand bare, and debate the caſe. If they diſagree, the affair is null; but if they agree, this, with the other bills that have paſſed both houſes, is brought down to the king in the houſe of lords, who comes thither clothed in his royal robes; before him the clerk of the parliament reads the title of each bill, and as he reads, the clerk of the crown pronounces the royal aſſent or diſſent. If it be a public bill, the royal aſſent is given in theſe words, *Le roy le veut*, the king will have it ſo; if private, *Soit fait comme il eſt deſiré*, let the requeſt be complied with: if the king refuſe the bill, the anſwer is, *Le roy s'aviſera*, the king will think of it: and if it be a money-bill, the anſwer is, *Le roy remercie ſes loyaux ſujets, accepte leur benevolence, & auſſi le veut*; the king thanks his loyal ſubjects, accepts their benevolence, and therefore grants his conſent.

PARNASSUS, a mountain of Greece, much celebrated by ancient poets, ſituated near Caſtro in Livadia.

PAROCHIAL, ſomething belonging to a pariſh. See PARISH, CHURCH, &c.

PARODICAL *Degrees of an Equation*, in algebra, are the ſeveral regular terms in quadratic, cubic, biquadratic equations, &c. the indexes of whoſe powers aſcend or deſcend orderly in an arithmetical progreſſion, as $z^3 + z^2 m + zr = s$, in a cubical equation, where no term is wanting, but having all its parodic degrees, the indexes of the terms regularly deſcending thus 3, 2, 1, 0.

PARODY, παρωδία, a popular maxim, adage, or proverb.

Parody is alſo a poetical pleaſantry, conſiſting in applying the verſes written in one ſubject, by way of ridicule to another; or in turning a ſerious work into a burleſque, by affecting to obſerve, as nearly as poſſible, the ſame rhymes, words and cadences. It comes near to what ſome of our late writers call traveſty; and was firſt ſet on foot by the Greeks, from whom we borrow the name.

PAROL, or PAROLE, in law, is uſed for a plea in court: ſometimes this word is joined with the term leaſe; thus leaſe-parol denotes a leaſe by word of mouth, in order to diſtinguiſh it from a leaſe in writing.

PARONYCHIA, a whitlow, in ſurgery, a painful kind of tumor, ariſing at the ends of the fingers at the roots of the nails.

The word is Greek, and formed of παρα, near, and ονυξ, the nail.

For the eaſier cure of a paronychia, its ſpecies ſhould firſt be conſidered. If it be of the mild or firſt kind, and has not penetrated deep, the cure may, without difficulty, be obtained. As ſoon as the purulent matter becomes

boiled in milk or water, make a gargariſm to be held in the mouth warm; and the remaining herbs may be ſowed up in a bag, and applied hot to the cheeks.

But if the diſorder cannot be thus diſperſed, emollient applications of mallows, &c. are good; and to forward the maturation externally, a half roaſted fig may be applied: and when the ſoftneſs of the tumor ſhews that the matter is ſuppurated, it ought immediately to be opened by the lancet, to prevent the matters lodging there, and eroding the bone, and producing a fiſtula or caries. After it is opened, the matter ſhould be gently preſſed out with the fingers, and the mouth frequently waſhed with red wine, and mixed with a decoction of vulnerary herbs, till it is well. When the ulcer has penetrated deep, it will be neceſſary to inject the ſame liquors with a ſyringe, and compreſs the part by a proper external bandage, to make the bottom part heal firſt; and when it is already become fiſtulous, and has callous edges, it may then often be cured by injecting tincture of myrrh, and elixir proprietatis, continuing this for ſome time. If all theſe prove ineffectual, the fiſtula muſt be laid open by inciſion, and the caries removed by medicines, cauſtics, or the actual cautery. If this proceeds, as ſometimes it does, from a carious tooth, this is firſt of all to be extracted, otherwiſe the tumor will degenerate into a fiſtula: and it is always beſt to be early in making the inciſion.

PASQUIN, a mutilated ſtatue at Rome, in a corner of the palace of the Urſini: it takes its name from a cobler of that city called Paſquin, famous for his ſneers and gibes, and who diverted himſelf with paſſing his jokes on all the people who went through the ſtreet. After his death, as they were digging up the pavement before his ſhop, they found in the earth the ſtatue of an ancient gladiator, well cut, but maimed, and half ſpoiled: this they ſet up in the place where it was found, and by common conſent named it Paſquin. Since that time all ſatires are attributed to that figure, and are either put into its mouth or paſted upon it, as if they were wrote by Paſquin redivivus; and theſe are addreſſed by Paſquin to Marforio, another ſtatue at Rome. When Marforio is attacked, Paſquin comes to his aſſiſtance; and when Paſquin is attacked, Marforio aſſiſts him in his turn.

PASQUINADE, a ſatirical libel faſtened to the ſtatue of Paſquin: theſe are commonly ſhort, merry, and pointed; and from hence the term has been applied to all lampoons of the ſame caſt. The difference between a paſquinade and a ſatire is, that the end of the latter is to correct and reform, while that of the former is only to ridicule and expoſe.

PASS, a ſtraight, difficult, and narrow paſſage, which ſhuts up the entrance into a country.

Pass *of Arms*, in chivalry, a bridge, road, &c. which the ancient knights undertook to defend.

Pass, or Passade, in fencing, an advance or leap forward upon the enemy.

PASSADE, in the manege, is a turn or courſe of a horſe backwards or forwards, on the ſame ſpot of ground.

PASSAGE, in the manege, is a horſe's walking or trotting in ſuch a manner that he raiſes the outward hind-leg, and the inward fore-leg together; and ſetting theſe two on the ground, raiſes the other two alternately, never gaining above a foot of ground at a time.

Passage, or Passo, in muſic, a part of an air or tune, conſiſting of ſeveral ſhort notes, as quavers, ſemiquavers, &c. laſting one, two, or at moſt three meaſures, in the beginning of a piece, which is to be afterwards imitated in the other notes of the piece, not with the ſame chords or notes, but only by obſerving the ſame motion, number and figure, as in the notes of the firſt paſſage.

Birds of Passage, a name given to thoſe birds which at certain ſtated ſeaſons of the year remove from certain countries, and at other ſtated times return to them again, as our quails, woodcocks, ſtorks, nightingales, ſwallows, and many other ſpecies.

Right of Passage, in commerce, is an impoſition or duty exacted by ſome princes, either by land or ſea, in certain cloſe and narrow places in their territories, on all veſſels and carriages, and even ſometimes on perſons or paſſengers coming in or going out of ports, &c.

PASSANT, in heraldry, a term applied to a lion, or other animal, in a ſhield, appearing to walk leiſurely: for moſt beaſts, except lions, the term trippant is frequently uſed inſtead of paſſant.

PASSIONS, in moral philoſophy, are certain motions of the ſoul, which make it purſue what appears to be good, and avoid whatever threatens evil.

Passions, in medicine, make one of the non-naturals, and produce very ſenſible effects. Joy, anger, and fear, are the principal. In the two firſt, the ſpirits are hurried with too great vivacity; whereas, in fear or dread, they are as it were curbed and concentrated: whence we may conclude, that they have a very bad effect upon health; and therefore it will be beſt to keep them within bounds as much as poſſible, and to preſerve an inward ſerenity, calmneſs, and tranquility. Continual ſorrow and anguiſh of mind render the fluids thick, and generate viſcid and acid crudities in the ſtomach, and at length render the body unapt for a due circulation; whence proceed obſtructions of the viſcera, and many chronical diſorders. Anger conſtringes the bilious veſſels in particular, and cauſes too great an evacuation of the bile; produces ſtrictures in the ſtomach and duodenum; whence the bilious humours are amaſſed and corrupted; laying a foundation for vomiting, bilious fevers, and cardialgiæ.

Passions, in painting, are the external expreſſions of the different diſpoſitions and affections of the mind; but particularly their different effects upon the ſeveral features of the face; for though the arms, and indeed every part of the body, ſerve likewiſe, by their quick, languid, and variouſly diverſified motions, to expreſs the paſſions of the ſoul; yet, in painting, this difference is moſt conſpicuous in the face.

In ſorrow, joy, love, ſhame, and compaſſion, the eyes ſwell all of a ſudden, are covered with a ſuperabundant moiſture, and drop tears; and in grief eſpecially, the corners of the mouth hang down, the eye-lids are half ſhut, and the pupil of the eye is elevated and half covered; and all the other muſcles of the face are relaxed, ſo that the viſage appears longer than ordinary.

In fear, terror, fright, and horror, the eye-brows are greatly elevated, the eye-lids are expanded as wide as poſſible, ſo as to diſcover the white of the eye, and the pupil is depreſſed and half covered by the lower eye-lid; the hair ſtands an end; the mouth is at the ſame time wide open, and the lips ſo far drawn back, that the teeth both of the upper and under jaw appear.

Contempt is expreſſed by raiſing one ſide of the upper-lip, ſo as to diſcover the teeth, whilſt the other ſide has a movement like that in laughter; the eye, on that ſide where the teeth appear, is half ſhut, whilſt the other remains open; however, both the pupils are depreſſed.

In jealouſy, envy, hatred, and malice, the eye-brows are knit; and, in laughter, all the parts agree, tending as it were towards the center of the face.

Mr. le Brun has been extremely happy in expreſſing the ſeveral paſſions, and the examples he has left of them deſerve imitation.

Passions, in poetry, are of ſingular uſe in diſtinguiſhing the characters of the actors. See the article Character.

Passion, or *Croſs of the* Passion, in heraldry, is ſo called, becauſe reſembling the ſhape of that on which our Saviour is thought to have ſuffered; that is, not croſſed in the middle, but a little below the top, with arms ſhort in proportion to the length of the ſhaft.

Passion-Flower, *Paſſiflora*, in botany, a genus of plants, the corolla of which conſiſts of five petals, of the largeneſs and figure of thoſe of the cup: the fruit is a berry, ſupported on a pedicle.

There are ſeveral ſorts of this plant, but that which is the moſt commonly cultivated is the *paſſiflora foliis palmatis intregrimus*, paſſion-flower with hard ſharped entire leaves, or the common paſſion-flower.

This grows naturally in the Braſils, yet is hardy enough to thrive in the open air here, and is ſeldom injured except in very ſevere winters, which commonly kills the branches to the ground, and ſometimes deſtroys the roots; this riſes in a few years to a great height, if they have proper ſupport. I have ſeen ſome of theſe plants, whoſe branches were trained up more than forty

feet

feet high. The ſtalks will grow almoſt as large as a man's arm, and are covered with a purpliſh bark, but do not become very woody. The ſhoots from theſe ſtalks are often twelve or fifteen feet long in one ſummer; they are very ſlender, ſo muſt be ſupported, otherwiſe they will hang to the ground, intermix with each other, and appear very unſightly. Theſe are garniſhed at each joint with one hand-ſhaped leaf, compoſed of five ſmooth entire lobes. Their foot ſtalks are near two inches long, and have two ſmall leaves or ears embracing the ſtalks at their baſe; and from the ſame point comes out a long claſper, which twiſts round the neighbouring plants, whereby the ſtalks are ſupported. The flowers come out at the ſame joints as the leaves; theſe have foot-ſtalks almoſt three inches long; they have an outer cover compoſed of three concave oval leaves, of a paler green than the leaves of the plant, which are little more than half of the empalement, which is compoſed of five oblong blunt leaves, of a very pale green; within theſe are five petals, nearly of the ſame ſhape and ſize with the empalement, ſtanding alternately between them. In the center of the flower ariſes a thick club-like column about an inch long, on the top of which ſits an oval germen, from whoſe baſe ſpreads out five awl-ſhaped horizontal ſtamina, which are terminated by oblong broad ſummits, faſtened in the middle to the ſtamina, hanging downward; theſe may be moved round without ſeparating from the ſtamina; their under ſurface is charged with yellow farina, and on the ſide of the germen ariſe three ſlender purpliſh ſtyles, near an inch long, ſpreading from each other, terminated by obtuſe ſtigmas. Round the bottom of the column are two orders of rays, the inner, which is the ſhorteſt, inclines upward to the column, the outer, which is near half the length of the petals, ſpreads flat upon them; theſe rays are compoſed of a great number of thread like filaments, of a purple colour at bottom, but are blue on the outſide. Theſe flowers have a faint ſcent, and continue but one day; after they fade, the germen on the top of the column ſwells to a large oval fruit, about the ſize and ſhape of the mogul plum, and when ripe is of the ſame pale yellow, incloſing a ſweetiſh diſagreeable pulp, in which are lodged oblong ſeeds. This plant begins to flower early in July, and there is a ſucceſſion of flowers daily, till the froſt in autumn puts a ſtop to them.

It may be propagated by ſeeds, which ſhould be ſown upon a moderate hot-bed, which will bring up the plants much ſooner than when they are ſown in the open air, ſo they will have more time to get ſtrength before winter. When the plants are come up two or three inches high, they ſhould be carefully taken up, and each planted in a ſeparate ſmall pot filled with good kitchen garden earth, and plunged into a moderate hot-bed to forward their taking new root; after which they ſhould be gradually inured to bear the open air, to which they ſhould be expoſed in ſummer, but in the autumn they muſt be placed under a garden frame to ſcreen them from the froſt, but they ſhould have the free air at all times in mild weather. In the ſpring following they ſhould be turned out of the pots, and planted againſt a good aſpected wall, where they may have height for their ſhoots to extend, otherwiſe they will hang about and entangle with each other, and by that means make but an indifferent appearance; but when buildings are to be covered, this plant is very proper for the purpoſe. After they have taken good root in their new quarters, the only care they will require is to train their ſhoots up againſt the wall, as they extend in length, to prevent their hanging about; and if the winter proves ſevere the ſurface of the ground about their roots ſhould be covered with mulch to keep the froſt from penetrating of the ground; and if the ſtalks and branches are covered with mats, peas haulm, ſtraw, or any ſuch light covering it will protect them in winter; but this covering muſt be taken off in mild weather, otherwiſe it will cauſe the branches to grow mouldy, which will be more injurious than the cold. In the ſpring the plants ſhould be trimmed, when all the ſmall weak ſhoots ſhould be entirely cut off, and the ſtrong ones ſhortened to about four or five feet long, which will cauſe them to put out ſtrong ſhoots for flowering the following year.

This plant is alſo propagated by laying down the branches, which in one year will be well rooted, ſo may be taken off from the old plants and tranſplanted, where they are deſigned to remain. The cuttings of this will alſo take root, if they are planted in a loamy ſoil not too ſtiff, in the ſpring before they begin to ſhoot. If theſe are covered with bell or hand glaſſes to exclude the air, they will ſucceed much better than when they are otherwiſe treated; but when the cuttings put out ſhoots, the air ſhould be admitted to them, otherwiſe they will draw up weak, and ſpoil: they muſt be afterward treated as the layers.

Thoſe plants, which are propagated by layers or cuttings, do not produce fruit ſo plentifully as the ſeedling plants, and I have found the plants, which have been propagated two or three times, either by layers or cuttings, ſeldom produce fruit, which is common to many other plants. *Miller's Gard. Dict.*

PASSION-WEEK, the week immediately preceding the feſtival of Eaſter: ſo called, becauſe in that week our Saviour's paſſion and death happened. See the article EASTER.

PASSIVE, in general, denotes ſomething that ſuffers the action of another, called an agent, or active power.

In grammar, the verb or word that expreſſes this paſſion, is termed a paſſive verb; which, in the learned languages, has a peculiar termination, as *amor*, *doceor*, &c. in Latin; that is, an *r* is added to the actives *amo*, *doceo*: and, in the Greek, the inflection is made by changing ω into ομαι, as τύπτω, τυπτομαι, &c. But, in the modern languages, the paſſive inflection is performed by means of auxiliary verbs, joined to the participle paſſive; as *I am praiſed*, in Latin *laudor*, and in Greek επαινεομαι; or *I am loved*, in Latin *amor*, and in Greek φιλεομαι. Thus it appears, that the auxliary verb *I am*, ſerves to form the paſſives of Engliſh verbs; and the ſame holds of the French, as *je ſuis loué*, I am praiſed; *j' aye été loué*, I have been praiſed, &c.

PASSOVER, a ſolemn feſtival of the Jews, celebrated on the fourteenth day of the month next after the vernal equinox, and inſtituted in commemoration of their coming out of Egypt; becauſe on the night before their departure the deſtroying angel, who put to death the firſt-born of the Egyptians, paſſed over the houſes of the Hebrews, which were ſprinkled with the blood of a lamb. The whole tranſaction is related in the twelfth chapter of Exodus.

They were ordered before this feſtival to kill the paſchal lamb, and to ſprinkle their door-poſts with its blood; and the following night, which was the grand feaſt of the paſſover, and which was to continue ſeven days, they were to eat the lamb roaſted with a ſallad of wild lettuces, or other bitter herbs, in the poſture of travellers; and if any part remained the day following, it was to be thrown into the fire; and for eight days together no leavened bread was to be uſed, on pain of being cut off from the people.

PASS-PAROLE, a command given at the head of an army, and thence communicated to the rear by paſſing it from mouth to mouth.

PASS-PORT, or PASS, a licence or writing obtained from a prince or governor, granting liberty and ſafe conduct to paſs through his territories without moleſtation.

PASS-VOLANT, or PASSE-VOLANT, in a military ſenſe, the ſame with a faggot. See FAGGOT.

PASTBOARD, a kind of thick paper formed of ſeveral ſheets of paper paſted together.

PASTE, a compoſition of water and flour, boiled to a conſiſtence; uſed by various artifices, as ſadlers, upholſterers, book-binders, &c.

In cookery, paſte is the compoſition of flour, &c. wherein pies are baked; and in confectionary, paſte denotes a preparation of ſome fruit, made by beating the pulp thereof with ſome fluid, or other admixture; and afterwards drying it with ſugar, till as pliable as common paſte.

PASTE, in the glaſs-trade, a kind of coloured glaſs, made of a calcined cryſtal, lead, and metellic preparations, ſo as to imitate the natural gems; for the manner of effecting which, ſee GEM.

PASTEL,

prominent, like a tubercle or bliſter, let the ſurgeon place a finger on each ſide of the affected part; and ſtretching the ſkin, by drawing it on both ſides, from the whitlow, make the inciſion: thus will the matter be diſcharged, and the finger will generally heal ſpontaneouſly. Hildanus, in cent. 1. obſ. 97, gives the following ſafe and ready method of curing a paronychia, which he had frequently tried with ſucceſs. He firſt fomented the finger ſeveral times, with the decoction of the flowers of the chamomile, and melilot, and fenugreek, and quince-ſeeds, boiled in cows milk; then he gradually cut off the ſurface of the ſkin where the pain was. The ſkin being thus removed, ſome red ſpecks appeared, in which, upon inciſion, he found one or two ſmall drops of a red water; and, this being diſcharged, he applied a linen cloth moiſtened with a ſolution of Venice treacle in brandy; the pain immediately ceaſed, and next day the finger was ſound.

If the diſorder is ſeated near the roots of the nails, beneath it, or at either of its ſides, the whole, or part of the nail, is generally loſt. If the purulent matter is concealed under the nail, it affects the adjacent parts with inflammation and intenſe pains. In this caſe, Solingen, with other ſurgeons, adviſes, firſt, to remove that part of the nail under which the morbific matter ſtagnates, either by extirpating it entirely, or by making an inciſion in it; and, having expreſſed the matter, the wound may be eaſily healed, by the application of lint moiſtened with ſpirit of wine or lime water.

PAROTIDES, *Parotid Glands*, in anatomy, denote two large glands behind the ears.

The word is Greek, and derived from παρα, near, and ους, the ear.

PAROTIDES, in medicine, are abſceſſes, or inflammations of the parotid glands.

Theſe tumors are either mild or malignant; they are ſaid to be mild, when they ariſe ſpontaneouſly, without any preceding contagious or peſtilential diſeaſe, as they frequently do in growing children; and theſe are generally not dangerous. Of this kind alſo are thoſe which ariſe after gentle fevers, being a critical tranſlation of the diſeaſe. Thoſe bubos are called malignant, which happen in the peſtilence or venereal diſeaſe; whence they are denominated peſtilential or venereal bubos. See the article BUBO.

PAROXYSM, in medicine, the acceſs or fit of a diſeaſe.

The word is Greek, and formed of παρα, and οξυς, ſharp.

PARRICIDE, *Parricida*, *Patricida*, in ſtrictneſs, denotes the murder or murderer of a father, as matricide is the murder or murderer of a mother.

The word is Latin, and formed of *pater*, a father, and *cædo*, to ſlay.

It is alſo extended to the murder of any near relation.

PARRYING, in fencing, the action of warding off the blows aimed at one by another. See the article FENCING.

PARSLEY, in botany, an umbelliferous plant, with deep green winged leaves, of which thoſe that grow on the ſtalk are divided into fine oblong narrow ſegments; the ſeeds are ſmall, ſomewhat crookedly plano-convex, of a duſky greeniſh colour, with four yellow ridges along the convex ſide; the root long, whitiſh, about the thickneſs of the finger. It is biennial, a native of moiſt grounds in the ſouthern parts of Europe, and common in our culinary gardens.

The roots of parſley are ſometimes uſed in apozems, and ſuppoſed to be aperient and diuretic, but liable to produce flatulencies. Their taſte is ſweetiſh, accompanied with a ſlight warmth or flavour, ſomewhat reſembling that of a carrot. The leaves of the plant have a greater warmth and leſs ſweetneſs than the roots.

The ſeeds, ſaid to be carminative, reſolvent, and diuretic, and commended in the German ephemerides for deſtroying cutaneous inſects in children, are in taſte warmer and more aromatic than any other part of the plant, and accompanied with a conſiderable bitterneſs.

Parſley is, by ſome ſkilful perſons cultivated in fields for the uſe of ſheep, it being a ſovereign remedy to preſerve them from the rot, provided they are fed twice a week for two or three hours each time with this herb; but hares and rabbets are ſo fond of it, that they will come from a great diſtance to feed upon it; and in countries where theſe animals abound, they will deſtroy it, if it be not very ſecurely fenced againſt them; ſo that whoever has a mind to have plenty of hares in their fields, by cultivating parſley, will draw all the hares of the country to them.

The beſt time for ſowing it in the fields is about the middle or latter end of February; the ground ſhould be made fine, and the ſeeds ſown pretty thick, in drills, drawn about a foot aſunder, that the ground may be kept hoed between the drills, to deſtroy the weeds, which, if permitted to grow, will ſoon over-run the parſley. Two buſhels of ſeed will ſow an acre of land.

PARSNIP, paſtinacha, in botany, the name of a well-known root.

The parſnip is to be propagated by ſowing its ſeeds in February or March, in a rich mellow ſoil, which muſt be deep dug, that the roots may be able to run deep without hindrance.

It is a common practice to ſow carrots, at the ſame time, upon the ſame ground with the parſnips; and if the carrots are deſigned to be drawn young, there is no harm in it. The parſnips, when they are grown up a little, muſt be thinned to a foot diſtance, and carefully kept clear of weeds. They are fineſt taſted, juſt at the ſeaſon when the leaves are decayed; and ſuch as are deſirous to eat them in ſpring ſhould have them taken up in autumn, and preſerved in ſand. When the ſeeds are to be ſaved, ſome very ſtrong and fine plants ſhould be left for it at four feet diſtance; and towards the end of Auguſt, or in the beginning of September, the ſeeds will be ripe; they muſt then be carefully gathered, and dried on a coarſe cloth. They ſhould always be ſown the ſpring following, for they do not keep well. *Miller's Gard. Dict.*

The common wild parſnip is frequent by road ſides, and in dry paſtures; it flowers in autumn, and ripens its ſeed ſoon after. The ſeeds deſerve to be brought into uſe in medicine, much more than they are at preſent. They are warm and carminative, though not ſo violently hot as the caraway ſeeds and others, which we commonly uſe on theſe occaſions. They diſpel flatuſes, and are in great eſteem among the country people, for curing the cholic. They alſo are diuretic and aperient, and gently promote the menſes.

PARSON, the rector or incumbent of a pariſh church.

PARSONAGE, a rectory, or pariſh church, commonly endowed with a houſe, glebe, and tithe, for the maintenance of a miniſter, with cure of ſouls within ſuch pariſh.

PART, *Pars*, a portion of ſome whole, conſidered as actually divided or diviſible.

Noble or eſſential PARTS, in phyſic, thoſe abſolutely neceſſary to life, as the heart, brain, &c.

Natural or genital PARTS, thoſe miniſtering to generation.

PART, in geometry and aſtronomy, is applied to the diviſion of lines and circles, &c.

Aliquot PART, and *Aliquant* PART, in arithmetic. See ALIQUOT and ALIQUANT.

Proportional PART is a part or number agreeable and analogous to ſome other part or number; or a medium to find ſome number or part unknown, by proportion and equality of reaſon.

Similar PARTS are thoſe which are to one another, as their wholes are to one another.

Organical PART. See ORGANICAL.

PART, in muſic, denotes a piece of the ſcore, or partition, written by itſelf, for the conveniency of the muſician; or it is one or more of the ſucceſſions of ſounds, which makes the harmony, written apart. Or, the parts are the ſounds made by ſeveral perſons, ſinging or playing in concert.

Muſic in parts was unknown to the ancients; they had but one part: all their harmony conſiſted in the ſucceſſion of notes, none in the conſonance.

There are four principal parts, the treble, baſs, tenor,

and counter tenor. Some compare the four parts in muſic to the four elements; the baſs, they ſay, repreſents the earth; the tenor, the water; counter-tenor, air; and treble, fire.

PARTS *of Speech*, in grammar, are all the words that enter the compoſition of a diſcourſe, as noun, pronoun, verb, participle, adverb, conjunction, prepoſition, and interjection.

PART *of Fortune*, in the judicial aſtrology, is the lunar horoſcope, or the point wherein the moon is, at the time when the ſun is in the aſcending part of the eaſt. The ſun in the aſcendant, is ſuppoſed, according to this ſcience, to give life, and the moon diſpences the radical moiſture, and is one of the cauſes of fortune. In horoſcopes, the part of fortune is repreſented by a circle divided by a croſs. See HOROSCOPE.

PARTERRE, in gardening, a level diviſion of ground, which for the moſt part faces the ſouth, and beſt front of an houſe; and is generally furniſhed with greens, flowers, &c.

There are ſeveral ſorts of parterres, as plain glaſs with borders, and parterres of embroidery, &c. Plain parterres are more beautiful in England than in any other country, by reaſon of the excellency of our turf, and that decency and unaffected ſimplicity that it affords to the eye of the ſpectator. Other parterres are cut into ſhell and ſcroll-work, with ſand-alleys between them; which ſort of parterres are eſteemed fineſt in France. As to the general proportions of parterres, an oblong or long ſquare is eſteemed the beſt: therefore a parterre ſhould not be leſs than twice as long as it is broad; twice and a half is accounted a very good proportion; and it is very rare that three times is exceeded. As to the breadth of a parterre, it is to take its dimenſions from the breadth of the front of the houſe; if the front of the houſe is one hundred feet long, the breadth of the parterre ſhould be one hundred and fifty feet; and if the front of the houſe be two hundred feet, the parterre ſhould be fifty feet broader: but where the front exceeds the breadth of this parterre, it will be a good proportion to make the parterre of the ſame dimenſions with the front. There ſhould be a terrace-walk on each ſide of the parterre, for an elevation proper for view; and, therefore, there ſhould never be the flat of a parterre between terrace-walk and terrace-walk above three hundred feet; nor can it be well made leſs than one hundred and forty. As to the adorning and furniſhing theſe parterres, whether it be plain or with embroidery, that depends much upon the form of them, and therefore muſt be left to the judgment and fancy of the deſigner.

PARTI, PARTIE, PARTY, or PARTED, in heraldry, is applied to a ſhield or eſcutcheon, denoting it divided or marked out into partitions.

PARTICIPATION, that which gives a part or ſhare in any thing, either by right or grace.

PARTICIPLE, *Participium*, in grammar, an adjective formed of a verb, ſo called becauſe it participates partly of the properties of a noun, and partly of thoſe of a verb; being variable through genders and caſes, like the former; and regarding time, action, paſſion, &c. in manner of the latter. See NOUN and VERB.

Thus the participle retains the attribute of the verb; and, moreover, the deſignation of the time or tenſe; there being participles of the preſent, the præterite, and future, eſpecially in Greek: but this is not always obſerved, the ſame participle being frequently joined with all ſorts of tenſes. There are active and paſſive participles; the active, in Latin, end in *ans* or *ens*, as *amans*, *docens*; the paſſive in *us*, as *amatus*, *doctus*; though there are ſome of theſe that are active, namely thoſe of verbs deponents, as *locutus*. But there are others likewiſe which add to this paſſive ſignification a ſort of compulſive, or obligatory ſenſe; theſe are to participles in *dus*, as *amandus*, *which ought to be loved*; though ſometimes the latter ſignification is entirely loſt.

The property of the participles of verbs active, is to ſignify the action of the verb, as it is in the verb, that is, in the courſe of the action itſelf; whereas the verbal nouns, which ſignify actions alſo, ſignify them rather in the habit than in the act: for which reaſon the participles have the ſame government as the verb, as *amans deum*; whereas verbal nouns have only the ſame government as nouns, as *amator dei*: and the participle itſelf has the ſame government as nouns when it ſignifies rather the habit than the act of the verb, by reaſon it then has only the nature of a ſimple noun verbal, as *amans virtutis*.

In our language, the participles and gerunds are not at all diſtinguiſhable.

PARTICLE, in phyſiology, the minute part of a body, an aſſemblage of which conſtitute all natural bodies. See the articles ATOM and MATTER.

It is the various arrangment and texture of theſe particles, with the difference of coheſion, &c. that conſtitute the various kinds of bodies. The ſmalleſt particles cohere with the ſtrongeſt attraction, and compoſe bigger particles of weaker coheſion, and many of theſe cohering compoſe bigger particles, whoſe vigour is ſtill weaker; and hereupon the operations in chemiſtry, and the colours of natural bodies depend, and which, by cohering, compoſe bodies of ſenſible bulk. The coheſion of the particles of matter, the epicureans imagined, was effected by means of hooked atoms; the ariſtotelians, by reſt; but Sir Iſaac Newton ſhews, that it is done by means of a certain power, whereby the particles mutually attract and tend towards each other. By this attraction of the particles, he ſhews, that moſt of the phænomena of the leſſer bodies are affected, as thoſe of the heavenly bodies are, by the attraction of gravity. See ATTRACTION and GRAVITATION.

PARTICLE, in grammar, a denomination for all thoſe ſmall words that tie or unite others together, or that expreſs the modes or manners of words, uſually included by grammarians under theſe four parts of ſpeech, viz. adverbs, prepoſitions, interjections, and conjunctions. See the articles PARTS *of Speech*, ADVERB, &c.

Mr. Locke obſerves, that it is in the right uſe of particles, the clearneſs and beauty of a good ſtyle more particularly conſiſts.

To expreſs the dependance of his thoughts and reaſonings, one upon another, a man muſt have words to ſhew what connection, reſtriction, diſtinction, oppoſition, emphaſis, &c. he gives to each reſpective part of his diſcourſe. This cannot be rightly underſtood without a clear view of the poſtures, ſtands, turns, limitations, exceptions, and ſeveral other thoughts of the mind. Of theſe there is a great variety, much exceeding the number of particles that moſt languages have to expreſs them by; for which reaſon it happens, that moſt of thoſe particles have divers, and ſometimes almoſt oppoſite ſignifications.

PARTICULAR, *Particularis*, a relative term referring to ſpecies or individual, and oppoſed to general or univerſal.

PARTIES, in law, ſignify the perſons that are named in a deed or fine, viz. thoſe that made the deed, or levied the fine, and alſo thoſe to whom the ſame was made or levied.

PARTING, or DEPARTING, a method of ſeparating gold and ſilver, by means of aqua-fortis; for the operation of which, ſee the articles ASSAYING and QUARTATION.

PARTNER and PARTNERSHIP. See the article FELLOWSHIP.

PARTRIDGE, in ornithology, is a ſpecies of tetrao, with a naked ſcarlet mark behind the eyes.

The common partridge is too well known, to need a farther deſcription: it is common in fields, and called by authors perdix. But beſides the common kind, there is another ſomewhat larger ſpecies called the red-legged partridge, with a grey tail, variegated in the upper part with brown.

PARTURITION, the ſame with delivery. See the article DELIVERY.

PARTY, in politics, denotes a faction conſidered as oppoſing another: ſuch are the Whigs and Tories.

In law, party-jury is one impanelled in actions brought for or againſt foreigners. See the article MEDIETAS LINGUÆ.

PARULIDES, in ſurgery, tumours and inflammations of the gums, commonly called gum-boils.

They are to be treated with diſcutients, like other inflammatory tumours. Sage, camomile and elder-flowers, boiled

PASTEL, a name by which ſome call iſatis, or woad. See ISATIS.

PASTERN *of a Horſe*, in the manege, is the diſtance between the joint next the foot, and the coronet of the hoof. This part ſhould be ſhort, eſpecially in middle-ſized horſes, becauſe long paſterns are weak, and cannot ſo well endure travelling.

PASTERN-JOINT, the joint next a horſe's foot.

PASTIL, or PASTEL, among painters, a kind of paſte made of different colours, ground up with gum-water, in order to make crayons. See CRAYON.

Sometimes the crayons themſelves are called paſtils.

PASTIL, in pharmacy, is a dry compoſition of ſweet ſmelling reſins, aromatic woods, &c. ſometimes burnt to clear and ſcent the air of a chamber.

PASTOR, properly ſignifies a ſhepherd, but is now generally uſed for a parſon or miniſter that hath cure of ſouls.

PASTORAL, in general ſomething that relates to ſhepherds; hence we ſay, paſtoral life, manners, poetry, &c.

The original of poetry is aſcribed to that age which ſucceeded the creation of the world: and as the keeping of flocks ſeems to have been the firſt employment of mankind, the moſt ancient ſort of poetry was, probably, paſtoral. It is natural to imagine, that the leiſure of thoſe ancient ſhepherds admitting and inviting ſome diverſion, none was ſo proper to that ſolitary and ſedentary life as ſinging; and that in their ſongs they took occaſion to celebrate their own felicity. From hence a poem was invented, and afterwards improved to a perfect image of that happy time; which, by giving us an eſteem for the virtues of a former age, might recommend them to the preſent. And ſince the life of ſhepherds was attended with more tranquility than any other rural employment, the poets choſe to introduce their perſons, from whom it received the name of paſtoral.

A paſtoral is an imitation of the action of a ſhepherd, or one conſidered under that character. The form of this imitation is dramatic, or narrative, or mixed with both; the fable ſimple; the manners not too polite nor too ruſtic; the thoughts are plain, yet admit a little quickneſs and paſſion, but that ſhort and flowing; the expreſſion humble, yet as pure as the language will afford; neat, but not florid; eaſy, and yet lively. In ſhort, the fable manners, thoughts and expreſſions are full of the greateſt ſimplicity in nature. The complete character of this poem conſiſts in ſimplicity, brevity, and delicacy; the two firſt of which render an eclogue natural, and the laſt delightful.

If we would copy nature, it may be uſeful to take this idea along with us, that paſtoral is an image of what they call the golden age. So that we are not to deſcribe our ſhepherds, as ſhepherds at this day really are, but as they may be conceived then to have been, when the beſt of men followed the employment. To carry this reſemblance yet farther, it would not be amiſs to give theſe ſhepherds ſome ſkill in aſtronomy, as far as it may be uſeful to that ſort of life. And an air of piety to the gods ſhould ſhine through the poem, which ſo viſibly appears in all the works of antiquity: and it ought to preſerve ſome reliſh of the old way of writing; the connection ſhould be looſe, the narrations and deſcription ſhort, and the periods conciſe. Yet it is not ſufficient that the ſentences only be brief, the whole eclogue ſhould be ſo too. For we cannot ſuppoſe poetry, in thoſe days, to have been the buſineſs of men, but their recreation at vacant hours.

But with reſpect to the preſent age, nothing more conduces to make theſe compoſures natural, than when ſome knowledge in rural affairs is diſcovered. This may be made to appear rather done by chance than on deſign, and ſometimes is beſt ſhewn by inference; leſt, by too much ſtudy to ſeem natural, we deſtroy that eaſy ſimplicity from whence ariſes the delight. For what is inviting, in this ſort of poetry, proceeds not ſo much from the idea of that buſineſs, as of the tranquility of a country life.

We muſt, therefore, uſe ſome illuſion to render a paſtoral delightful; and this conſiſts in expoſing the beſt ſide only of a ſhepherd's life, and in concealing its miſeries. Nor is it enough to introduce ſhepherds diſcourſing together in a natural way, but a regard muſt be had to the ſubject, that it contain ſome particular beauty in itſelf, and that it be different in every eclogue. Beſides, in each of them, a deſigned ſcene or proſpect is to be preſented to our view, which ſhould likewiſe have its variety. This variety is obtained, in a great degree, by frequent compariſons, drawn from the moſt agreeable objects of the country; by interrogations to things inanimate; by beautiful digreſſions, but thoſe ſhort; ſometimes by inſiſting a little on circumſtances; and laſtly, by elegant turns on the words, which renders the numbers extremely ſweet and pleaſing. As for the numbers themſelves, though they are properly of the heroic meaſure, they ſhould be the ſmootheſt, the moſt eaſy and flowing imaginable.

It is by rules, like theſe, we ought to judge a paſtoral. And ſince the inſtructions given for any art are to be delivered as that art is in perfection, they muſt, in neceſſity, be derived from thoſe in whom it is acknowledged ſo to be. It is, therefore, from the practice of Theocritus and Virgil, the only undiſputed authors of paſtoral, that the critics have drawn the foregoing notions concerning it.

Theocritus excels all others in nature and ſimplicity. The ſubjects of his Idyllia are purely paſtoral; but he is not ſo exact in his perſons, having introduced reapers and fiſhermen, as well as ſhepherds. He is apt to be too long in his deſcriptions, of which that of the cup, in the firſt paſtoral, is a remarkable inſtance. In the manners he ſeems a little defective, for his ſwains are ſometimes abuſive and immodeſt, and, perhaps, too much inclining to ruſticity; for inſtance, in his fourth and fifth Idyllia. But it is enough that all others learned their excellencies from him; and that his dialect alone has a ſecret charm in it, which no other could ever attain.

Virgil, who copies Theocritus, refines upon his original; and in all points where judgment is principally concerned, he is much ſuperior to his maſter. Though ſome of his ſubjects are not paſtoral in themſelves, but only ſeem to be ſuch, they have a wonderful variety in them, which the Greek was a ſtranger to. He exceeds him in regularity and brevity, and falls ſhort of him in nothing but ſimplicity and propriety of ſtyle; the firſt of which, perhaps, was the fault of his age, and the laſt of his language.

Among the moderns, their ſucceſs has been greateſt, who have moſt endeavoured to make theſe ancients their pattern. The moſt conſiderable genius appears in the famous Taſſo and our Spenſer. Taſſo, in his Aminto, has as far excelled all the paſtoral writers, as in his Gieruſalemme he has out-done the epic poets of his country. But as this piece ſeems to have been the original of a new ſort of poem, the paſtoral comedy in Italy, it cannot ſo well be conſidered as a copy of the ancients. Spenſer's Calendar, in Mr. Dryden's opinion, is the moſt complete work of this kind, which any nation has produced ever ſince the time of Virgil. Not but that he may be thought imperfect in ſome few points. His eclogues are ſomewhat too long, if we compare them with the ancients. He is, ſometimes, too allegorical, and treats on matters of religion, in a paſtoral ſtyle, as the Mantuan had done before him. He has employed the lyric meaſure, which is contrary to the practice of the old poets. His ſtanza is not ſtill the ſame, nor always well choſen; this laſt may be the reaſon why his expreſſion is ſometimes not conciſe enough: for the tetraſtic has obliged him to extend his ſenſe to the length of four lines, which would have been more cloſely confined in the couplet.

In the manners, thoughts, and characters, he comes near to Theocritus himſelf; though, notwithſtanding all the care he has taken, he is certainly inferior in his dialect: for the Doric had its beauty and propriety in the time of Theocritus; it was uſed in part of Greece, and frequent in the mouths of many of the greateſt perſons; whereas the old Engliſh and country phraſes of Spenſer were either entirely obſolete, or ſpoken only by people of the loweſt condition. As there is a difference between ſimplicity and ruſticity, ſo the expreſſion of ſimple thoughts ſhould be plain, but not clowniſh. The addition he has made of a calendar to his eclogues is very beautiful; ſince by this, beſides the general moral of innocence and ſimplicity, which is common to other authors of paſtoral, he has one peculiar to himſelf; he compares human life to the ſeveral ſeaſons, and at once expoſes to his readers a

view of the great and little worlds, in their various changes and aſpects. Yet the ſcrupulous diviſion of the paſtorals into months has obliged him either to repeat the ſame deſcription in other words, for three months together; or, when it was exhauſted before, entirely to omit it: whence it comes to paſs, that ſome of his eclogues, as the 6th, 8th, and 10th, for example, have nothing but their titles to diſtinguiſh them. The reaſon is evident, becauſe the year has not that variety in it to furniſh every month with a particular deſcription, as it may every ſeaſon.

PASTORAL COLUMN. See COLUMN.

PASTORAL STAFF, the ſame with croſier. See the article CROSIER.

PASTURE, or PASTURE-LAND, that reſerved for feeding cattle.

Paſture-land is of ſuch advantage to huſbandry, that many prefer it even to corn-land, becauſe of the ſmall hazard and labour that attends it, and as it lays the foundation for moſt of the profit that is expected from the arable land, becauſe of the manure the cattle afford which are fed upon it. Where dung is not to be bought, as is often the caſe in places diſtant from large towns, the farmer is forced to proportion his arable to his paſture-land, in ſuch manner, that the cattle fed on the latter may be ſufficient for a ſupply of dung, ſo neceſſary for producing the fruits of the former.

Paſture-lands, are of three kinds: 1. The uplands: theſe lie ſo high as not to be overflowed by rivers, or land-floods. 2. Thoſe low lands which lie near rivers and fens. And 3. Thoſe that lie near the ſea. See the articles UP-LAND, MARSH-LAND, &c.

Paſture-land requires the refreſhment of dung, as well as the arable or corn-land; but there is to be a difference made in the laying it on and ſpreading it. A harrow performs the office of ſpreading the dung on ploughed lands; but the beſt contrivance for paſtures, is, to lay the dung in ſmall heaps, and draw over it a gate ſtuck full of buſhes. All dung that is laid on paſture-land, muſt be laid on in winter, that the rains may waſh its fatneſs into the ground before the ſun ſcorches it, or evaporates its goodneſs. Fine mould mixed with the dung, and ſpread with it over the land, is very good for paſtures; for it is waſhed down to the very roots of the graſs, and gives them a new and fine ſoil juſt in thoſe places where it is moſt wanted.

The beſt manure for paſture-land is the rotten bottoms of old hay-ſtacks; for theſe moulder away into a very rich ſoil, and are always full of vaſt quantities of ſeed, fallen at times from the hay, which all grow when ſpread on the ground: and thus new nouriſhment, and a new ſet of plants, are given at once to the exhauſted ground. But as particularly uſeful as this is for paſture-ground, it is as improper for corn-land, and ſhould by no means ever be ſuffered to mix with the manure for thoſe grounds; as it will then raiſe graſs and other plants, which though of uſe in the paſture are weeds among the corn.

PASTURE *of Plants*, a term uſed by Tull, for the nouriſhment they draw from the earth.

PASTY, in cookery, a preparation of veniſon, veal, lamb, or other meat; which being well boned, beaten to a pulp, and highly ſeaſoned, is incloſed in a proper paſte, and baked in an oven.

PATAVINITY, *Patavinitas*, among critics, denotes a peculiarity of Livy's diction, derived from Patavium, or Padua, the place of his nativity; but wherein this patavinity conſiſts, they are by no means agreed.

PATE, in fortification, a kind of platform, reſembling what is called an horſeſhoe; not always regular, but generally oval, encompaſſed only with a parapet, and having nothing to flank it. It is uſually raiſed in marſhy grounds, to cover the gate of a place.

PATE'E, or PATTE'E, in heraldry, a croſs ſmall in the center, and widening to the extremes, which are very broad.

PATELLA, in anatomy, a bone which covers the fore-part of the joint of the knee, called alſo rotula, and popularly the knee-pan. The patella is convex on the outſide, and on the inſide unequal, having an eminence and two depreſſions. Its ſubſtance is ſpungeous, and conſequently it is brittle: it is connected by tendons and ligaments to the tibia and the os femoris, which is the ligament by which it is connected to the thigh, and has a motion of aſcent and deſcent in the flexion of the tibia. In infants and children it is cartilaginous.

PATELLA, the LIMPET, is a genus of ſhell-fiſh, with a ſimple ſhell, of a conic or other gibboſe figure, and a very wide opening at the mouth or bottom; always applying itſelf firmly to ſome ſolid body, which ſerves it in the place of another ſhell: the animal inhabiting it is called limax.

PATENT, in general, denotes ſomething that ſtands open or expanded: thus a leaf is ſaid to be patent when it ſtands almoſt at right angles with the ſtalk.

PATENT, or LETTERS-PATENT. See the article LETTER.

PATENTEE, a perſon to whom the king has granted his letters patent.

PATER-NOSTER, the Lord's prayer, ſo called from the two firſt words thereof in Latin. It is alſo ſometimes uſed for a chaplet or ſtring of beads. And, in architecture, the ſame term is uſed for a ſort of ornament cut in the form of beads, either oval or round, uſed on aſtragals, baguettes, &c.

PATERNITY, the quality of a father.

PATH, in general denotes the courſe or tract marked out or run over, by a body in motion. See the article MOTION.

PATH *of the Vertex*, a term frequently uſed by Mr. Flamſteed, in his doctrine of the ſphere, for a circle deſcribed by any point of the earth's ſurface, as the earth turns round its axis; this point is conſidered as vertical to the earth's center, and is the ſame with the vertex or zenith in the ptolemaic projection.

The ſemi-diameter of this path is always equal to the ſine of the complement of the latitude of the point that deſcribes it.

PATHETIC, whatever relates to the paſſions, or that is proper to excite or awake them.

In muſic, this term is uſed for ſomething very moving, expreſſive, or paſſionate, and is capable of exciting pity, compaſſion, anger, or the like. The chromatic genus, with its greater and leſſer ſemi-tones, either aſcending or deſcending, is very proper for the pathetic; as is alſo an artful management of diſcords, with a variety of motions now briſk, now languiſhing, now ſwift, now ſlow. Nieuwentyt mentions a muſician of Venice, who excelled in the pathetic to ſuch a degree, as to be able to play his auditors into diſtraction; he adds, that the great means he made uſe of, was the variety of his motions, &c.

PATHETIC NERVES, in anatomy, a pair of very ſmall nerves which ariſe in the brain, and run to the trochlear muſcle of the eye. Theſe nerves have obtained the name pathetic, from their ſerving to move the eyes in the various paſſions.

PATHOGNOMONIC, παθωγνομονικ⊙, among phyſicians an appellation for a ſymptom, or concourſe of ſymptoms, that are inſeparable from a diſtemper, and are found in that only, and in no other.

PATHOLOGY, that part of medicine which explains the nature of diſeaſes, their cauſes and ſymptoms.

PATHOS, παθ⊙, a Greek term, literally ſignifying paſſion, is ſometimes uſed for the energy of a diſcourſe, or its power to move the paſſions.

PATIENT, among phyſicians, a perſon under the direction of a phyſician or ſurgeon, in order to be cured of ſome diſeaſe.

PATANCE, in heraldry, is a croſs flory at the ends; from which it differs only in this, that the ends, inſtead of turning down like a flour de lis, are extended ſomewhat in the pattee-form.

PATRIARCHS, among Chriſtians, are eccleſiaſtical dignitaries, or biſhops, ſo called from their paternal authority in the church.

PATRIARCHAL CROSS, in heraldry, is that where the ſhaft is twice croſſed; the lower arms being longer than the upper ones.

PATRICIAN, among the ancient Romans, a title given to the deſcendants of the hundred, or, according to others, of the two hundred firſt ſenators choſen by Romulus, and by him called *patres*, fathers.

PATRIMONY, a right or eſtate inherited by a perſon from his anceſtors.

PATRIPASSIANS, *Patripaſſiani*, in church-hiſtory, a Chriſtian ſect, who appeared about the latter end of the ſecond century; ſo called from their aſcribing the paſſion to the Father; for they aſſerted the unity of God in ſuch a manner as to deſtroy all diſtinction of perſons, and to make the Father and Son preciſely the ſame; in which they were followed by the Sabellians, and others. The author and head of the Patripaſſians was Praxeas, a philoſopher of Phrygia in Aſia.

PATROL, in war, a round or march made by the guards, or watch, in the night-time, to obſerve what paſſes in the ſtreets, and to ſecure the peace and tranquillity of a city or camp. The patrol generally conſiſts of a body of five or ſix men, detached from a body on guard, and commanded by a ſerjeant.

PATRON, among the Romans, was an appellation given to a maſter who had freed his ſlave.

Patron was alſo a name which the people of Rome gave to ſome great man, under whoſe protection they uſually put themſelves.

PATRON, in the church of Rome, a ſaint, whoſe name a perſon bears, or under whoſe protection he is put, and whom he takes particular care to invoke.

PATRON, in the canon and common law, is a perſon, who having the advowſon of a parſonage, vicarage, or the like ſpiritual promotion, belonging to his manor, hath, on that account, the gift and diſpoſition of the benefice, and may preſent to it whenever it becomes vacant.

PATRONAGE, the right of diſpoſing of a church or benefice, and enjoying ſeveral other privileges, ſuch as having the honourable rights of the church, being interred in the chancel, &c.

PATRONYMIC, among grammarians, is applied to ſuch names of men or women as are derived from thoſe of parents or anceſtors.

PAVEMENT, a layer of ſtone, or other matter, ſerving to cover and ſtrengthen the ground of divers places for the more commodious walking on.

PAVILLION, in architecture, ſignifies a kind of turret or building, uſually inſulated, and contained under a ſingle roof; ſometimes ſquare, and ſometimes in form of a dome: thus called from the reſemblance of its roof to a tent.

PAVILLION, in military affairs, ſignifies a tent raiſed on poſts to lodge under in the ſummer time.

PAVILLION, in heraldry, denotes a covering in form of a tent, which inveſts or wraps up the armories of divers kings and ſovereigns, depending only on God and their ſword.

PAVILLIONS, among jewellers, the under ſides and corners of the brilliants, lying between the girdle and the collet.

PAULIONISTS, in church hiſtory, Chriſtian heretics of the third century, diſciples of Paul Samoſatenſis, biſhop of Antioch, who denied Chriſt's divinity, maintaining that when we call him the Son of God, we do not thereby mean that he is really and truly God; but only that he was ſo perfect a man, and ſo ſuperior in virtue to all others, that he has this name given him by way of eminence. The Paulioniſts continued to the fifth century, notwithſtanding the prohibition of the emperor Conſtantine the Great, who forbad them and other heretics to hold public aſſemblies.

PAULICIANS, Chriſtian heretics of the ſeventh century, diſciples of one Conſtantine, a native of Armenia, and a favourer of the errors of Manes; who, as the name of Manichees was become odious to all nations, gave thoſe of his ſect the title of Paulicians, on pretence that they followed only the doctrine of St. Paul. One of their moſt deteſtable maxims was, not to give alms to the poor, that they might not contribute to the ſupport of creatures, who were the works of the bad god. See MANICHEES.

PAVO, in aſtronomy, a ſouthern conſtellation, called the peacock.

PAUSE, a ſtop or ceſſation of ſpeaking, ſinging, playing, or the like. The uſe of pointing in grammar, is to make proper pauſes, in certain places. There is a pauſe in the middle of each verſe; in an hemiſtich it is called a reſt or repoſe.

PAUSE, in muſic, a character of ſilence, or reſt, called alſo by ſome a mute figure; becauſe it ſhews that ſome part or perſon is to be ſilent, while the reſt continue the ſong.

PAW, PATTE, in heraldry, the fore-foot of a beaſt, cut off ſhort. If the leg be cut off, it is called gambe. Lions-paws are much uſed in armory.

PAW, in the manage. A horſe is ſaid to paw the ground, when his leg, being either tired or painful, he does not reſt upon the ground, and fears to hurt himſelf as he walks.

PAYMENT, the diſcharge of a debt, either by money really told, or by bills of exchange, &c. See the article DEBT.

PEACE, *Pax*, in its general ſignification, ſtands in contradiſtinction to war.

PEACE, in our law-books, ſignifies a quiet and inoffenſive behaviour towards the king and his people. It is obſerved, that all authority for keeping the peace comes originally from the king, who is the ſupreme officer or magiſtrate for the preſervation of it. Alſo the lord-chancellor and judges of the king's bench, &c. have a general power to keep the peace over all the realm: as have likewiſe all courts of record within their own precincts, and ſheriffs of counties, juſtices of the peace, conſtables, &c. No perſon may break the peace without being liable to puniſhment; and where any perſon is in danger of harm, or ſome bodily prejudice from another, on oath made thereof before a juſtice of the peace, or other magiſtrate, he may be ſecured by bond or recognizance, which is commonly called binding to the peace.

PEACE *of the King* is that peace or ſecurity, both of life and goods, which the king promiſes to all his ſubjects, or others that are under his protection. There is alſo the peace of the king's highways, which is to be free from all annoyances and moleſtation; to which may be added the peace of the plough, whereby both the plough and plough-cattle are ſecured from diſtreſſes; and fairs are ſaid to have their peace, ſo that no perſon may be troubled there for debts contracted elſewhere.

PEACH, *Perſica*, in botany, the name of a genus of trees, the characters of which are theſe: the flower is of the roſaceous kind, being compoſed of many petals, arranged in a circular form. The piſtil ariſes from the cup, and finally becomes a fleſhy fruit of a roundiſh figure, ſulcated lengthwiſe, and containing a ſtone rough and full of irregular holes, containing an oblong kernel.

The curious in fruits account twenty-eight ſorts of peaches, but many of them ſeem very trifling diſtinctions. The fineneſs of this fruit, in general, depends on the firmneſs of the pulp, the delicacy of the flavour, and the thinneſs of the ſkin. A fine peach ſhould be of a fine deep red next the ſun, and of a pale whitiſh hue next the wall; and the pulp ſhould be of a yellow caſt, and very juicy; and the ſtone ſhould be ſmall, though the fruit in general be large.

The varieties of the peach are produced, like thoſe of the fine flowers, by ſowing the ſeeds; and, though many raiſed this way will be of little value, as is alſo the caſe in flowers, yet probably among a parcel of ſtones, ſaved from the finer kinds of peaches, there would be ſome new kinds produced; which, as they were raiſed here, would be eaſily kept up in their perfection; which is not to be expected of thoſe brought from other countries.

The beſt method of ſaving the ſtones is, to let ſome of the fineſt peaches of the beſt kinds hang till they drop of themſelves from the tree, and then the ſtones ſhould be immediately planted on a bed of light rich earth, planting them four inches deep in the earth, and at about ſix inches aſunder. The beds ſhould be covered, to preſerve them in winter; and in ſpring when the trees come up, they muſt be cleared of weeds, and well watered. The next ſpring they ſhould be carefully taken up, and planted in the nurſery at greater diſtances; and, after two or three years ſtanding here, they may be removed to the places where they are to remain; or may at that time, when the condition of their fruit is known, be grafted on other ſtocks, which is the common way now uſed to propagate theſe trees.

The

The common method of propagating the peach is, by grafting. In order to this, ſome good ſtocks ſhould be provided, which ſhould be of the muſcle, or a white pear plum. When theſe ſtocks are two or three years old, they will be ſtrong enough to bud; and the common ſeaſon for doing this is about Midſummer. The buds ſhould be choſen from a healthy tree, which produces a great deal of fruit: they muſt be taken from the trees either in a cloudy day, or elſe in the morning or evening, when the ſun has not much power; they ſhould then be inoculated on the ſtalks as ſoon as poſſible, and the ſtalks treated with the uſual care afterwards. See INOCULATION.

When theſe are to be tranſplanted where they are to remain, the moſt proper ſoil for them is a light rich paſture land, taken up with the turf, and rotted together, before it is to be uſed; and the borders to be made with this cannot be too wide, and ought to be raiſed five or ſix inches above the level of the ground; or, if the ſoil be moiſt, more than that. They muſt be tranſplanted in autumn, as ſoon as the leaves are fallen off; and ſhould never be ſet at leſs than fourteen feet diſtance from one another. The heads of the trees are then to be raiſed up againſt the walls, to keep the roots from being moved by the winds; and they ſhould be watered at times, with a noſe on the watering pot, and the water ſprinkled all over them. In the middle of May the new ſhoots are to be nailed to the wall, training them horizontally; and the foreright ſhoots are to be rubbed off: in October the new branches ſhould be pruned, ſhortening them according to the ſtrength of the tree; if ſtrong, they may be left eight inches long; if weak, they ſhould only be left five; and the ſame care is to be taken of them for the ſucceeding years.

There are two general rules always to be obſerved in the pruning of peach and nectarine trees, which are, 1. Always to have enough bearing wood. 2. Not to lay in the branches too cloſe to one another. All peach-trees produce their fruit from the young wood, either of the ſame, or, at the moſt, of the former year's ſhoot; for this reaſon the branches are to be ſo pruned, as to encourage them to throw out new ſhoots in every part of the tree: and this is to be done in May, when, by pinching, or ſtopping the ſtrong ſhoots, there may be new wood forced out in any part of the tree. This is the method of the ſummer pruning; the winter pruning is uſually done in February or March, but is much better done at Michaelmas, as ſoon as their leaves begin to fall; and the wounds will then have time to heal before the ſevere froſts come on.

In pruning of theſe trees it muſt always be obſerved alſo, that it is beſt done under a wood bud, not a bloſſom bud; which may be diſtinguiſhed by the wood buds being leſs turgid, and longer, and narrower than the bloſſom bud; for, if the ſhoot have not a leading bud where it is cut, it will commonly die down to the leading bud. In nailing the ſhoots to the wall, they ſhould be placed at as equal diſtances as poſſible, and ſo far apart that the leaves may have room; and they muſt always be trained as horizontally as poſſible, that the lower part of the tree may be well wooded, which it will not be, if the branches are ſuffered to run upright. *Miller's Gard. Dict.*

PEACOCK, *Pavo*, in ornithology, a genus of birds, of the order of the gallinæ, the characters of which are theſe: there are four toes on each foot, and the head is ornamented with an erect creſt of feathers.

Of this genus there are ſeveral ſpecies, diſtinguiſhed by their different colours. The male of the common kind is, perhaps, the moſt gaudy of all the bird kind; the length and beauty of whoſe tail, and the various forms in which the creature carries it, are ſufficiently known and admired.

PEAK, a rocky mountainous country in the weſt of Derbyſhire, remarkable for its mines of lead and iron, &c.

PEAN, in heraldry, is when the field of a coat of arms is ſable, and the powderings or.

PEAR, *Pyrus*, in botany. All the ſorts of pears, propagated in gardens, are produced by budding, or grafting them upon ſtocks of their own kind, which are commonly called tree-ſtocks, or elſe upon the quince or white-thorn ſtocks; but the laſt are now generally diſuſed, the fruit produced this way being apt to be dry and mealy. The quince ſtocks are, however, in great eſteem for the trees deſigned for dwarfs or for walls; becauſe they do not let the ſhoots grow ſo faſt and luxuriant. But there are objections againſt even theſe, which are of ſome conſequence; for there are many kinds of pear which will not do upon them, but will die, or become weak and good for nothing after three or four years; and the hard-baking pears are rendered very unpleaſant by being grafted on theſe ſtocks, while the buttery or melting ones are meliorated by them. And it is to be added, that no ſort of pear will thrive upon a quince ſtock in a poor or gravelly ſoil.

PEAR-*Trees* planted either againſt walls, or in eſpaliers, muſt not be placed nearer to one another than twenty feet. Pear-trees commonly produce their bloſſom buds firſt, at the extremity of their laſt year's ſhoots; the common way of pruning is very prejudicial, therefore, as it takes off the part which ſhould bear the fruit, and occaſions new ſhoots from the ſame branch, which will over-fill the tree with wood, the trees ſhould always be carefully looked over in ſummer, and all the foreright ſhoots taken off; by which means the fruit will not be overſhaded, and the trees will need but little winter pruning. The ſeveral ſorts of ſummer pears all ripen beſt in eſpaliers, but the winter pears require a ſouth-eaſt or ſouth-weſt, or elſe an eaſt wall. *Miller's Gard. Dict.*

PEARCH-GLUE, the name of a kind of glue of remarkable ſtrength and purity, made from the ſkins of pearches. See GLUE.

PEARL, *Margarita*, in natural hiſtory, a hard, white, ſhining body, uſually roundiſh, found in a teſtaceous fiſh reſembling an oyſter.

Pearls, though eſteemed of the number of gems by our jewellers, and highly valued, not only at this time, but in all ages, proceed only from a diſtemper in the creature that produces them, analogous to the bezoars, and other ſtony concretions in ſeveral animals of other kinds; and what the ancients imagined to be a drop of dew concreted into a pearl in the body of the pearl-fiſh, which they ſuppoſed roſe from the bottom to the ſurface of the water to receive it, is nothing more than the matter deſtined to form and enlarge the ſhell, burſting from the veſſels deſtined to carry it to the parts of the ſhell it ſhould have formed, and by that means producing theſe little concretions.

The fiſh in which theſe are uſually produced is the Eaſt Indian pearl oyſter, as it is commonly, though not very properly, called: it has a very large and broad ſhell of the bivalve-kind, ſometimes meaſuring twelve or fourteen inches over, but thoſe of eight inches are more frequent: it is not very deep; on the outſide it is of a duſky brown, and within of a very beautiful white, with tinges of ſeveral other colours, as expoſed in different directions to the light. Beſides this ſhell, there are many others that are found to produce pearls; as the common oyſter, the muſcle, the pinna marina, and ſeveral others, the pearls of which are often very good, but thoſe of the true Indian berberi, or pearl oyſter, are in general ſuperior to all. The ſmall or ſeed pearls, alſo called ounce pearls, from their being ſold by the ounce, and not by tale, are vaſtly the moſt numerous and common; but as in diamonds, among the multitude of ſmall ones, there are ſmaller numbers of larger found, ſo in pearls there are larger and larger kinds; but as they increaſe in ſize, they are proportionably leſs frequent, and this is one reaſon of their great price. We have Scotch pearls frequently as big as a little tare, ſome as big as a large pea, and ſome few of the ſize of a horſe-bean; but theſe are uſually of a bad ſhape, and of little value in proportion to their weight. Philip II. of Spain had a pearl perfect in its ſhape and colour, and of the ſize of a pigeon's egg. De Boot tells us of one in the emperor Rudolph's poſſeſſion, of thirty carrats weight; Tavernier mentions one in Perſia, for which that crown paid to the amount of more than a hundred thouſand pounds ſterling; and we are told of Cleopatra's poſſeſſing one worth fourſcore thouſand pounds of our money: pearls of ſuch vaſt ſizes as theſe are as rare as the great diamonds; but, as among diamonds,

monds, there are a conſiderable number, which though very ſhort of this, are of great value. The fineſt, and what is called the true ſhape of the pearl, is a perfect round; but if pearls of a conſiderable ſize are of the ſhape of a pear, as is not unfrequently the caſe, they are not leſs valued, as they ſerve for earings and other ornaments. Their colour ought to be a pure white, and that not a dead and lifeleſs, but a clear and brilliant one; they muſt be perfectly free from any foulneſs, ſpot or ſtain, and their ſurfaces muſt be naturally ſmooth and gloſſy, for they bring their natural poliſh with them, which art is not able to improve.

All pearls are formed of the matter of the ſhell, and conſiſt of a number of coats ſpread with perfect regularity one over another, in the manner of the ſeveral coats of an onion, or like the ſeveral ſtrata of the ſtones found in the bladders or ſtomachs of animals, only much thinner. It is obſerved that the whiteſt pearls, brought into Europe, contract a yellowneſs on the ſurface, which no art can recover; but there is a way of taking off the whole outer coat of the pearl, in which caſe the ſecond ſurface, which is as bright as the originally external one, preſerves its beauty for a long time. This, however, is a very nice operation to perform, and at beſt greatly diminiſhes the value of the pearl by taking from its ſize and weight. It is ſaid that thoſe pearls which have ſomewhat of a yellowiſh caſt never alter, nor ever loſe their luſtre; and if this be true, the ancients, who prefered thoſe which were a little yellowiſh to the perfectly white ones, had great reaſon on their ſide.

The little protuberances, like warts, which we ſee riſing in hemiſpherical figures from the ſurfaces of ſhells, are evidently of the pearl-kind, only not detached: when theſe are of a good colour, and tolerably large, our workmen cut them out, and make ſomething of them under the name of wens of pearls.

This valuable article of commerce is not the product of any peculiar part of the world. The Eaſt-Indies and America produce the pearl ſhell-fiſh in abundance, and it is found with good pearls in many parts of Europe. The coaſts of the iſland Ceylon afford pearls ſuperior to thoſe of all the Eaſt in the beauty of their colour, but there are no very large ones found there. The Perſian gulph abounds with the pearl-fiſh, and fiſheries are eſtabliſhed on the coaſts of the ſeveral iſlands in it. In America, there are fiſheries in the gulph of Mexico, and along the coaſt of Terra Firma, all which yield conſiderable advantage. The European pearls are principally found on the coaſts of Scotland, and the neighbouring parts. The pearls met with in apothecaries ſhops are of various kinds, all that are unfit for the jewellers purpoſes coming thither; conſequently ſome of the rough and ill ſhaped pearls, and thoſe of bad colours, are at times to be met with there; though the generality are what are only too ſmall for working into toys, &c. Theſe, after levigation, make an impalpable powder, which is much talked of as an ingredient in what is called pearl-cordials; but moſt of the apothecaries uſe only levigated oyſter-ſhell under its name.

Manner of fiſhing for PEARLS *in the Eaſt-Indies.* There are two ſeaſons for pearl-fiſhing, the firſt is in March and April, and the laſt in Auguſt and September; and the more rain there falls in the year, the more plentiful are theſe fiſheries. At the beginning of the ſeaſon there are ſometimes two hundred and fifty barks on the banks; the larger barks having two divers, and the ſmaller one. Each bark puts off from ſhore at ſun-riſe, with a land-breeze, which never fails; and returns again by a ſea breeze, which ſucceeds it about noon. As ſoon as the barks arrive at the place where the fiſh lie, and have caſt anchor, each diver binds a ſtone ſix inches thick, and a foot long, under his body; which ſerves him as ballaſt, prevents his being driven away by the motion of the water, and enables him to walk more ſteadily under the waves. They alſo tie another very heavy ſtone to one foot, by which they are ſpeedily ſunk to the bottom of the ſea: and as the oyſters are uſually firmly faſtened to the rocks, they arm their hands with leathern-mittens to prevent their being wounded in pulling them violently off; but this taſk ſome perform with an iron-rake. In the laſt place, each diver carries down with him a large net in the manner of a ſack, tied to his neck by a long cord, the other end of which is faſtened to the ſide of the bark. This net is to hold the oyſters gathered from the rock, and the cord is to pull up the diver when his bag is full, or he wants air. See DIVING.

In this equipage he ſometimes precipitates himſelf ſixty feet under water; and as he has no time to loſe, he no ſooner arrives at the bottom, than he begins to run from ſide to ſide, tearing up all the oyſters he meets with, and cramming them into his budget.

At whatever depth the divers are, the light is ſo great that they eaſily ſee whatever paſſes in the ſea: and to their great conſternation ſometimes perceive monſtrous fiſhes, from which all their addreſs in muddying the water, &c. will not always ſave them, but they unhappily become their prey: and of all the dangers of the fiſhery, this is one of the greateſt and moſt uſual. The beſt divers will keep under water near half an hour, and the reſt do not ſtay leſs than a quarter. During this time they hold their breath without the uſe of oils, or any other liquors; only acquiring the habit by long practice. When they find themſelves ſtreightened, they pull the rope to which the bag is faſtened, and hold faſt by it with both hands; when thoſe in the bark, taking the ſignal, heave them up into the air, and unload them of their fiſh, which is ſometimes five hundred oyſters, and ſometimes not above fifty. Some of the divers need a moment's reſpite to recover breath; others jump in again inſtantly, continuing this violent exerciſe without intermiſſion for ſeveral hours.

Manner of fiſhing for PEARLS *in America.*—The firſt to whom the Indians made this valuable diſcovery, was Baſco Nunez de Balboa, who in his paſſage for making further diſcoveries on the South-ſea, was preſented with ſome pearls by Tumaco, an Indian prince. At preſent they are found in ſuch plenty, that there are few perſons of ſubſtance near Panama, who do not employ all, or, at leaſt, part of their ſlaves in this fiſhery, the manner of which not being commonly known, it will not be improper to deſcribe it here.

The owners of the negroes employ the moſt proper perſons for this fiſhery, which being performed at the bottom of the ſea, they muſt be both expert ſwimmers, and capable of holding their breath a long time. Theſe they ſend to the iſlands, where they have huts built for their lodgings, and boats which hold eight, ten, or twenty negroes under the command of an officer. In theſe boats they go to ſuch parts as are known to produce pearls, and where the depth of the water is not above ten, twelve, or fifteen fathom. Here they come to an anchor, and the negroes having a rope faſtened round their bodies, and the other end to the ſide of the boat, they take with them a ſmall weight to accelerate their ſinking, and plunge into the water. On reaching the bottom they take up an oyſter, which they put under the left arm; the ſecond they hold in their left hand, and the third in their right; with theſe three oyſters, and ſometimes another in their mouth, they riſe to breathe, and put them in a bag. When they have reſted themſelves a while and recovered their breath, they dive a ſecond time; and thus continue, till they have either completed their taſk, or their ſtrength fails them. Every one of theſe negro divers is obliged daily to deliver his maſter a certain fixed number of pearls; ſo that when they have got the requiſite number of oyſters in their bag, they begin to open them, and deliver the pearls to the officer, till they have made up the number due to their maſter; and if the pearl be but formed, it is ſufficient, without any regard to its being ſmall or faulty. The remainder, however large or beautiful, are the negroe's own property, nor has the maſter the leaſt claim to them, the ſlaves being allowed to ſell them to whom they pleaſe, though the maſter generally purchaſes them at a very ſmall price.

Theſe negroes cannot every day make up their number, as in many of the oyſters the pearl is not at all, or but imperfectly formed, or the oyſter is dead, whereby the pearl is ſo damaged as to be of no value; and as no allowance is made for ſuch pearls, they muſt make up their number with others.

Beſides the toil of this fiſhery, from the oyſters ſtrongly adhering to the rocks, they are alſo in no ſmall danger from ſome kinds of fiſh, which either ſeize the negroes,

groes, or by ſtriking on them, cruſh them by their weight againſt the bottom. Every negro to defend himſelf againſt theſe animals, carries with him a ſharp knife, with which if the fiſh offers to aſſault him, he endeavours to ſtrike it in a part where it has no power to hurt him; on which the fiſh immediately flies. The officers keep a watchful eye on thoſe voracious creatures, and on diſcovering them, ſhake the ropes faſtened to the negroes bodies, that they may be upon their guard; many, on the divers being in danger, have thrown themſelves into the water, with the like weapon, and haſten down to their defence: but too often all their dexterity and precaution is not ſufficient to protect the diver from being devoured by theſe fiſh, or loſing one of his legs or arms by their bite. Several ſchemes have been practiſed to prevent ſuch melancholy accidents; but they have hitherto proved very ineffectual.

The pearls of theſe fiſheries are generally of a good water, and ſome very remarkable both in their ſhape and ſize; but there is a difference in their water and colour; ſome being highly valuable, and others as remarkably defective. Some of theſe pearls, though indeed but few, are ſent to Europe, the greateſt part being carried to Lima; where the demand for them is very great, being not only univerſally worn there by all perſons of rank, but alſo ſent from thence into the inland parts of Peru.

Mother of PEARL is the ſhell, not of the pearl oyſter, but of another ſea-fiſh of the oyſter kind. This ſhell on the inſide is extremely ſmooth, and of the whiteneſs and water of pearl itſelf; and it has the ſame luſtre on the outſide, after the firſt laminæ or ſcales have been cleared off with aqua-fortis, and the lapidaries mill. Mother of pearl is uſed in inlaid-works, and in ſeveral toys, as ſnuff-boxes, &c.

PEARL, in heraldry, in blazoning with precious ſtones, is the ſame with argent, or white.

PEARL, PIN, or WEB, in medicine, an excreſcence growing in the eye.

PEARL-FISH, *Rhombus*. See RHOMBUS.

PEARL-FORT, a fortreſs in Dutch Brabant, ſituated on the river Scheld, four miles north-weſt of Antwerp.

PEAT, a kind of turf uſed for fuel in ſeveral countries.

In Holland they have a way of charring peats ſo that it may ſerve for fuel in ſeveral chemical operations; but this manner of charring is not yet known in ſeveral countries where, perhaps, peat might be found.

PEBBLES, *Calculi*, ſmall ſtones, compoſed of a cryſtaline matter debaſed by earths, and hence ſubject to veins, clouds, and other variegations.

PECCANT, in medicine, a term uſed for thoſe humours of the body which offend either by their quantity or quality.

PECK, a meaſure of capacity, four of which make a buſhel.

PECTORAL, an epithet for medicines good for diſorders of the breaſt and lungs. The ordinary intention of theſe medicines is either to attenuate or thicken the humours of theſe parts, and to render them fit to be expectorated or ſpit out.

PECTORALIS, in anatomy, a pair of muſcles which poſſeſſes almoſt all the whole breaſt, and ſerves to move the arm forwards. This muſcle has its origin in the clavicle, the ſternum, and all the true ribs, and its termination at four fingers breadth below the head of the humerus. Its action is probably much aſſiſted by the action of the coraco-brachialis, and that of the deltoides by that of the upper part of this pectoral muſcle, which is uſually a kind of diſtinct muſcle. Naturaliſts obſerve a ſingular mark of providence, in the ſize and ſtrength of the pectoral muſcle in different animals. It is by the action of this muſcle, that the flying of birds is chiefly performed; and therefore much larger and ſtronger in birds, than in any animals not made for flight.

PECULIAR, in the canon law ſignifies a particular pariſh or church that has juriſdiction within itſelf for granting probates of wills, and adminiſtrations, exempt from the ordinary or biſhop's courts. The king's chapel is a royal peculiar, exempt from all ſpiritual juriſdiction, and reſerved to the viſitations and immediate government of the king himſelf. There is likewiſe the archbiſhop's peculiar; for it is an ancient privilege of the ſee of Canterbury, that wherever any manors or advowſons belong to it, they forthwith become exempt from the ordinary, and are reputed peculiars: there are fifty-ſeven ſuch peculiars in the ſee of Canterbury.

Beſides theſe, there are ſome peculiars belonging to deans, chapters and prebendaries, which are only exempted from the juriſdiction of the archdeacon; theſe are derived from the biſhop, who may viſit them, and to whom there lies an appeal.

Court of PECULIARS, is a court in which the affairs belonging to peculiars are tranſacted.

PEDAGOGUE, or PÆDAGOGUE παιδαγωγος, a tutor or maſter, to whom is committed the diſcipline and direction of a ſcholar, to be inſtructed in grammar and other arts.

PEDALS, the largeſt pipes of an organ, ſo called becauſe played and ſtopped with the foot. The pedals are made ſquare, and of wood; they are of modern invention, and ſerve to carry the ſounds an octave deeper than the reſt. See ORGAN.

PEDANEUS, in the civil law, a petty judge who has no formal ſeat of juſtice, but hears cauſes ſtanding, and without any tribunal.

PEDANT, is uſed for a rough unpoliſhed man of letters, who makes an impertinent uſe of the ſciences, and abounds in unſeaſonable criticiſms and obſervations. Dacier defines a pedant, a perſon who has more reading than good ſenſe; and Malebranche deſcribes him, as a man full of falſe erudition, who makes a parade of his knowledge, and is ever quoting ſome Greek or Latin author, or hunting back to a remote etymology: hence,

PEDANTRY, the quality or manner of a pedant.

PEDESTAL, in architecture, the loweſt part of an order of columns, being that which ſuſtains the column, and ſerves it as a foot or ſtand.

The pedeſtal conſiſts of three principal parts, viz. a ſquare, trunk, or dye, which makes the body; a corniche, the head; and a baſe, the foot of the pedeſtal. The pedeſtal is properly an appendage to a column, not an eſſential part of it; though M. Le Clerc thinks it eſſential to a complete order.

There are as many kinds of pedeſtals as there are of orders of columns, viz. the Tuſcan, Doric, Ionic, Corinthian, and Compoſite: ſome ſay the height of the pedeſtal in each order, ought to be a third part of the whole column, comprehending the baſe and capital, and their proper adjuncts, as architrave, frieze, and corniche, a fourth part of the ſame pillar. Indeed Vignola, and moſt of the moderns, make the pedeſtal and all its ornaments in all the orders one third of the height of the column, including the baſe and capital; but ſome deviate from this rule. See BASE, &c.

The whole height of the Tuſcan column, comprehending the architrave, frieze and corniche, being divided into nine parts, two of theſe, according to Vitruvius, go to the height of the pedeſtal; which is by him deſcribed in two different forms, one of which is plain, having only a plinth for the baſe, and another for the capital: the height of each of theſe plinths is one ſixth of the whole height of the pedeſtal, and the projecture of theſe plinths is one ſixth of their height. In the pedeſtal that he deſcribes of the other form, he alſo divides the whole height of the pedeſtal into ſix parts, one of which goes to the baſe, and one to the capital. Palladio and Scamozzi make the Tuſcan pedeſtal three modules high, Vignola five. See TUSCAN.

For the proportion of the Doric pedeſtal, ſee the article DORIC.

And for the proportions of the Ionic pedeſtal, ſee the article IONIC.

The Corinthian pedeſtal is the richeſt and moſt delicate of all. The proportions of this pedeſtal are alſo given already under the article CORINTHIAN-ORDER.

Vitruvius divides the whole height of the Compoſite column into thirteen parts, making the height of the pedeſtal three of thoſe parts. Vignola makes the Compoſite pedeſtal of the ſame height with the Corinthian, viz. ſeven modules; Scamozzi, ſix modules two minutes; Palladio, ſix modules ſeven minutes; in the goldſmith's arch, ſeven modules eight minutes. Its members in Vignola

Vignola are the ſame with thoſe of the Corinthian, but with this difference, that whereas theſe are moſt of them enriched with carvings in the Corinthian, they are all plain in the Compoſite, and there is alſo a difference in the profiles of the baſe and corniche in the two orders. Daviler obſerves, that the generality of architects uſe tables or pannels, either in relievo or creux in the dyes of pedeſtals, without any regard to the character of the order: thoſe in relievo he obſerves are only ſuitable to the Tuſcan and Doric; the three others muſt be indented, which he ſays is a thing the ancients never practiſed, as being contrary to the rules of ſolidity and ſtrength.

Pedeſtals acquire other denominations, as thoſe following: 1. Square pedeſtal, is that whoſe height and width are equal, as that of the arch of the lions at Verona, of the Corinthian order; and ſuch ſome followers of Vitruvius, as Serlio, Philander, &c. have given to their Tuſcan orders. 2. Double pedeſtal, is that which ſupports two columns, and has more breadth than height. 3. Continued pedeſtal, is one which ſupports a row of columns without any break or interruption, as thoſe which ſuſtain the fluted columns of the palace of the Thuilleries, on the garden ſide.

PEDESTALS *of Statues*, are ſuch as ſerve to ſupport ſtatues of figures. Vignola obſerves, that there is no part of architecture more arbitrary, and in which more liberty may be taken, than in the pedeſtals of ſtatues; there being no rules or laws preſcribed by antiquity, nor any ſettled even by the moderns. There being then no ſettled proportion for theſe pedeſtals, the height depends on the ſituation, and the figure that they ſuſtain: when on the ground, the pedeſtal is uſually two thirds or two fifths of that of the ſtatue; the more maſſive the ſtatue is, the ſtronger the pedeſtal muſt be. Their form and character, &c. are to be extraordinary and ingenious, far from the regularity and ſimplicity of the pedeſtals of columns. The ſame author gives a multiplicity of forms, as oval, triangular, multangular, &c.

PEDIÆUS, in anatomy, the ſecond of the extenſor-muſcles of the foot, having its origin in the lower part of the perone and annular ligament; and being divided into four tendons, which are inſerted into the external part of the firſt articulation of the four toes. Its uſe is to extend the foot, together with the firſt of the extenſors, called the extenſor communis.

PEDICLE, among botaniſts, that part of a ſtalk which immediately ſuſtains the leaf of a flower or a fruit, and is common' called a foot-ſtalk.

PEDICULUS, LOUSE, in zoology, a genus of inſects, the body of which is lobated at the ſides; the legs are ſix, ſerving only for walking; and the eyes are two, and are ſimple.

Moſt animals are infeſted with lice, or inſects which feed upon them: thus ſheep have one ſpecies, oxen another, &c. and mankind are not free from them; for beſides the common kind, whoſe natural habitation is in the heads of children, there is another kind called the crab-louſe, whoſe natural reſidence is about the pubes. Authors alſo reckon the death-watch among the number of lice.

PEDILUVIUM, a bathing of the feet. This bath may be prepared of the ſame ingredients with other baths. It may either conſiſt of light, pure water alone; or, to correct the qualities of heavy and hard water, a lixivium or bran of wheat or chamomile-flowers may be added.

Pediluvium is highly expedient for the purpoſes of derivation in thoſe diſeaſes which ariſe from congeſtions of the humours to the head and breaſt, produced by ſpaſms of the inferior parts, and eſpecially of the hypochondria. Among this kind, beſides lethargic diſeaſes, we may reckon almoſt all diſorders of the head, ſuch as madneſs, melancholy, cephalæas, hemicranias, the clavus hyſtericus, vertigo's, toothachs, pains of the ears, a gutta roſacea; inflammations and defluxions of ſaline humours on the eyes; immoderate hæmorrhages from the noſe, and long watchings. Of this kind are alſo ſome diſorders which affect the breaſt, ſuch as convulſive aſthmas, dyſpnœas ariſing from a plethora, palpitations of the heart, dry coughs, and ſpittings of blood. Beſides, baths for the feet in conſequence of their ſingular efficacy in relaxing ſpaſms, are highly beneficial in ſpaſmodic and convulſive diſorders, in pains, cardialgias, colics, eſpecially of the hæmorrhoidal kind, gripes produced by the ſtone, and inflations of the ſtomach.

It is to be obſerved, that pediluvium produces more happy effects, if before it is uſed the quantity of blood is leſſened by veneſection in the feet: it ſhould be uſed about bed-time; and the feet kept warm till the patient goes to bed, by which means perſpiration all over the body is increaſed.

PEDIGREE. See the article DESCENT.

PEDIMENT, in architecture, is a kind of low pinnacle, ſerving to crown an ordonnance, or finiſh a frontiſpiece, and is placed as an ornament over gates, doors, windows, niches, altars, &c. being ordinarily of a triangular form, but ſometimes forming an arch of a circle. The parts of a pediment are the tympanum and the corniche, which crowns it, and the entablature, which ſerves it as a baſe, or ſcale. Architects have taken a great deal of liberty in the form of this member; nor do they vary leſs as to the proportion of the pediment. The moſt beautiful, according to Daviler, is that where its height is about one fifth of the length of its baſe.

The pediment is uſually triangular, and ſometimes an equilateral triangle, called alſo a pointed pediment; it is ſometimes circular, though M. Felibien obſerves, that we have no inſtance of round pediments in the antique, beſides thoſe in the chapels of the rotundo. Sometimes its upper corniche is divided into three or four ſides, or right lines: ſometimes the corniche is cut or open a-top, which is an abuſe introduced by the moderns, particularly Michael Angelo; for the deſign of this part over doors, window, &c. being chiefly to ſhelter thoſe underneath from the rain, to leave it open in the middle is to fruſtrate its end. Sometimes the pediment is formed of a couple of ſcrolls or wreaths like two conſoles joined together; ſometimes again it is without a baſe, or its lower corniche is cut out, all but what is beſtowed on two columns or pilaſters, and on theſe is raiſed an arch or ſweep, inſtead of an entablature, of which Serlio gives an inſtance in the antique in a Corinthian gate at Foligny, in Umbria; and Daviler a modern one in the church of St. Peter at Rome.

Under this kind of pediments come thoſe little arched corniches, which form pediments over doors and windows, ſupported by two conſoles, inſtead either of entablature or columns.

Sometimes the pediment is made double, i. e. a leſs pediment is made in the tympanum of a larger, on account of ſome projecture in the middle, as the frontiſpiece of the church of the Great Jeſus at Rome; but this is accounted an abuſe in architecture, though authoriſed by very good buildings, as the large pavilion of the Louvre, where the caryatides ſupport three pediments, one in another: ſometimes the tympanum of the pediment is cut out, or left open to let in light, as is ſeen under the portico of the capitol at Rome; laſtly, this open pediment is ſometimes triangular, and enriched with ſculpture, as roſes, leaves, &c. as is found in moſt of the Gothic churches.

M. Le Clerc obſerves, that the modillions in the corniche of the pediment ſhould always anſwer exactly over thoſe of the entablature. Indeed Vitruvius ſays, that the ancients did not allow of any modillions at all in pediments. M. Le Clerc alſo obſerves, that the corniche which ſerves the pediment as a baſe, ſhould have no cymatium, by reaſon the cymatium of the reſt of the entablature, when it meets the pediment, paſſes over it. This change of determination occaſions a conſiderable difficulty; the cymatium in this caſe appearing too broad in the turn of the angle, to remedy which, architects have recourſe to ſeveral expedients.

A pointed pediment may crown three arches, but a circular pediment can only crown agreeably. There ſhould never be uſed more than two tympana over each other in the ſame frontiſpiece, and even where there are two, it would be proper to have the lower circular, and the upper pointed.

PEDOMETER, or PODOMETER, the ſame with perambulator. See PERAMBULATOR.

PEDRERO, PETERERO, or PATERERO, a ſmall piece of ordnance, uſed on board ſhips, for the diſcharging

jng of nails, broken iron, or partridge ſhot, on an enemy attempting to board. See ORDNANCE.

They are generally open at the breech, and their chamber made to take out, to be loaded that way, inſtead of at the muzzle.

PEDUNCLE, among botaniſts, the ſame with pedicle. See PEDICLE.

PEDUNCULI CEREBELLI, in anatomy, three medullary proceſſes of the cerebellum, whereby that part is joined to the medulla oblongata.

The firſt of theſe proceſſes aſcends from the cerebellum towards the teſtes, and forms what is called the valvula magna of the brain; the ſecond forms the annular prominence of Willis; and the third deſcends to the ſpinal marrow.

PEE, in mining, is uſed for the place where two veins meet and croſs one another.

PEER, in general, ſignifies an equal, or one of the ſame rank and ſtation.

The term peers is now applied to thoſe who are impannelled in an inqueſt upon a perſon for convicting or acquitting him of any offence laid to his charge; and the reaſon why the jury is ſo called, is, becauſe by the common law, and the cuſtom of this kingdom, every perſon is to be tried by his peers or equals, a lord by the lords, and a commoner by commoners.

PEER *of the Realm*, a noble lord who has a ſeat and vote in the houſe of lords, which is alſo called the houſe of peers. Theſe lords are called peers, becauſe, though there is a diſtinction of degrees in our nobility, yet in public actions they are equal, as in their votes in parliament, and in trying any nobleman or other perſon impeached by the commons, &c. See the article PARLIAMENT.

PEERESS, a woman who is noble by deſcent, creation, or marriage.

PEGASUS, among the poets, a horſe imagined to have wings, being that whereon Bellerophon was fabled to be mounted, when he engaged the chimæra.

The opening of the fountain Hippocrene, on mount Helicon, is aſcribed to a blow of Pegaſus's hoof. Pegaſus was feigned to have flown away to heaven, where it became a conſtellation.

PEGASUS, in aſtronomy, a conſtellation of the northern hemiſphere, in form of a flying horſe, ſaid by different authors to contain nineteen, twenty, and ninety-three ſtars.

PELAGIANS, a Chriſtian ſect who appeared about the latter end of the fourth, or the beginning of the fifth century.

Pelagius, the author of this ſect, was born in Wales, and his name was Morgan, which in the Welſh language ſignifies *ſea-born*; from whence he had his Latin name Pelagius. Some of our ancient hiſtorians pretend that he was abbot of Bangor; but this is impoſſible, becauſe the Britiſh monaſteries were of a later date. St. Auſtin gives him the character of a very pious man, and a Chriſtian of no vulgar rank: according to the ſame father, he travelled to Rome, where he aſſociated himſelf with perſons of the greateſt learning and figure; and wrote his commentaries on St. Paul's Epiſtles, and his letters to Melania and Demetrias; but being charged with hereſy, he left Rome, and went into Africa, and from thence to Jeruſalem, where he ſettled. He died ſomewhere in the eaſt, but where is uncertain. He was charged with maintaining the following doctrines: 1. That Adam was by nature mortal, and whether he had ſinned or not, would certainly have died. 2. That the conſequences of Adam's ſin were confined to his own perſon. 3. That new-born infants are in the ſame condition with Adam before the fall. 4. That the law qualified men for the kingdom of heaven, and was founded upon equal promiſes with the goſpel. 5. That the general reſurrection of the dead does not follow in virtue of our Saviour's reſurrection. 6 That the grace of God is given according to our merits. 7. That this grace is not granted for the performance of every moral act; the liberty of the will, and information in points of duty, being ſufficient, &c. Pelagius's ſentiments were condemned by ſeveral councils in Africa, and by a ſynod at Antioch.

There was alſo a ſect of ſemi-pelagians: who, with the orthodox, allowed of original ſin; but denied that the liberty of the will could be ſo far impaired thereby, that men could not of themſelves do ſomething, which might induce God to afford his grace to one more than another: and as to election, they held, that it depended on our perſeverance; God chooſing only ſuch to eternal life, as continued ſtedfaſt in the faith.

PELECOIDES, in geometry, a figure in form of an hatchet; ſuch is the figure B C D A, plate XCVIII. *fig.* 3. contained under the two inverted quadrantal arcs A B and A D, and the ſemi-circle B C D. The area of the pelecoides is demonſtrated to be equal to the ſquare A C, and that again to the parallelogram E B. It is equal to the ſquare A C, becauſe it wants of the ſquare on the left hand the two ſegments A B and A C, which are equal to the two ſegments B C and C D, by which it exceeds on the right hand.

PELICAN, *Pelicanus*, in ornithology, a genus of birds, of the order of the anſeres, the beak of which is very long, crooked, and unguiculated at the extremity: its ſides are not denticulated, and the anterior part towards the head is naked.

PELICAN, in chemiſtry, a kind of double veſſel, generally made of glaſs, and uſed in extracting tinctures by circulation: it conſiſts of a cucurbit and alembic-head, with two tubes bending into the cucurbit again. See plate XXXIX. *fig.* 4.

PELLETS, in heraldry, are thoſe roundles of a black colour, called alſo ogreſſes and gum-ſtones.

PELLICLE, a thin ſlim, or fragment of a membrane.

PELLUCID, the ſame with diaphanous or tranſparent, and ſtands oppoſed to opaque. See TRANSPARENT.

PELVIS, the inferior part of the cavity of the abdomen, ſo called from its reſembling a baſon or ewer, in Latin called pelvis. See ABDOMEN.

PELVIS *of the Kidneys*, a membranaceous cavity in the kidneys, which receives the urine, and conveys it to the ureters.

PENANCE, a puniſhment either voluntary or impoſed by authority for the faults a perſon has committed.

PENATES, in Roman antiquity, were a kind of tutelar deities, either of countries or particular houſes; in the latter ſenſe they were the ſame with the lares.

PENCIL, an inſtrument uſed by painters for laying on colours. Pencils are of various kinds, and made of various materials, the larger of boars-briſtles, the thick end of which are bound to a ſtick; bigger or leſs according to the uſes they are deſigned for: theſe, when large, are called bruſhes. The finer ſorts of pencils are made of camels, badgers, and ſquirrels hair, and of the down of ſwans; theſe are tied at the upper end with a piece of ſtrong thread, and incloſed in the barrel of a quill.

All good pencils on being drawn between the lips come to a fine point.

PENCIL is alſo an inſtrument uſed in drawing, &c. made of long pieces of black-lead, or red-chalk, placed in a groove cut in a ſlip of cedar, on which other pieces of cedar being glued, the whole is planed round, and one of the ends being cut to a point, it is fit for uſe.

PENDANT, an ornament ſuſpended to the ear, frequently conſiſting of diamonds, pearls, and other precious ſtones.

PENDANTS, in heraldry, are parts hanging down from the label, to the number of two, three, four, five, or ſix at moſt, reſembling the drops in the Doric frieze. When they are more than three, they muſt be ſpecified in the blazoning.

PENDANT *Feathers*, among falconers, are thoſe feathers that grow behind the thighs of an hawk.

PENDANTS, among floriſts, the ſame with apices or antheræ. See APICES.

PENDENTIVE, in architecture, the whole body of a vault ſuſpended out of the perpendicular of the walls, and bearing againſt the arch boutants; or according to Daviler, it is the portion of a vault between the arches of a dome, uſually enriched with ſculpture.

PENDULOUS, a term applied to any thing that bends or hangs downwards: thus, the flowers, whoſe ſlender

Fig. 1. Parallelepiped.

Fig. 2 Parallelogram.

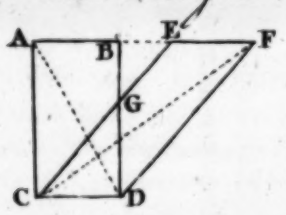


Fig. 3.

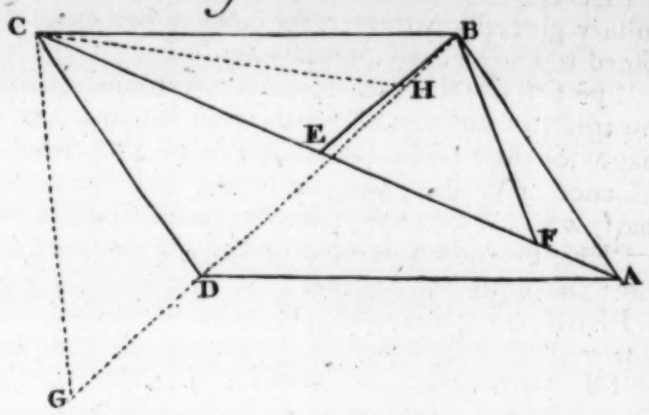


Fig. 4. Pendulum.

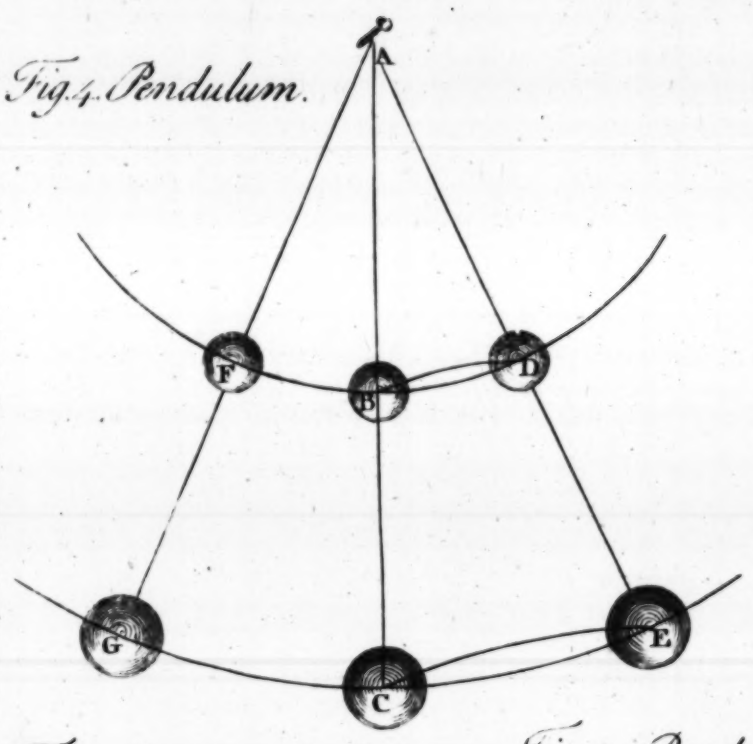


Fig. 5. Pendulum.

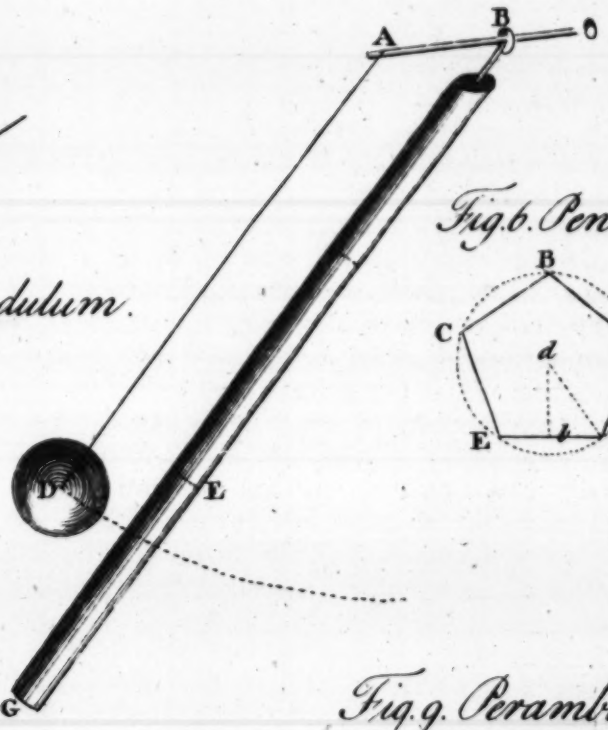


Fig. 3. Pelecoides.

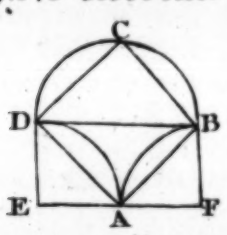


Fig. 6. Pentagon.

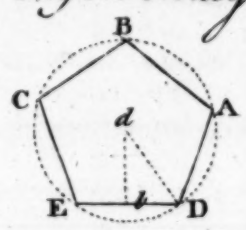


Fig. 7. Pentagraph.

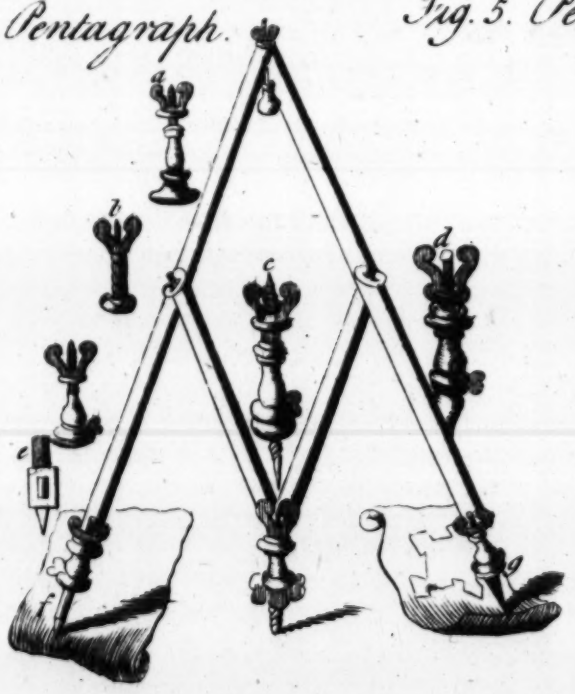


Fig. 10.

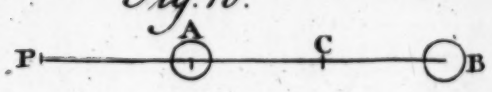


Fig. 9. Perambulator.

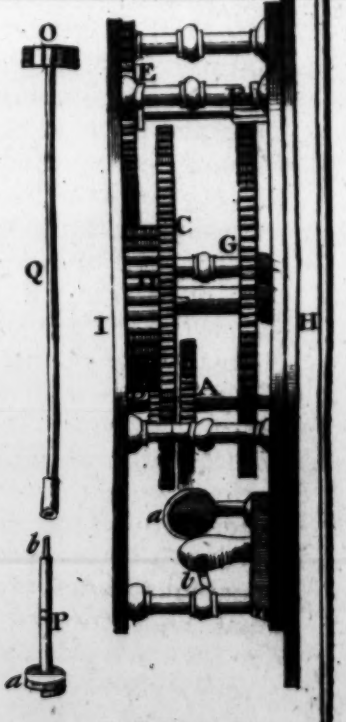
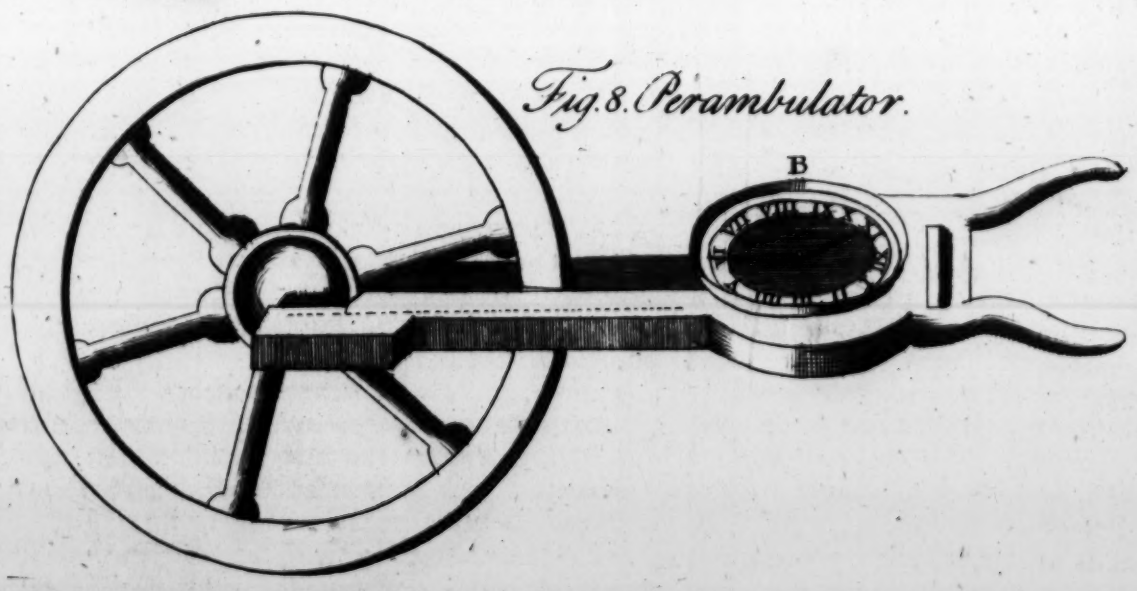


Fig. 8. Perambulator.



5 IA 59

ſlender ſtalks are not able to ſuſtain their heads upright, are called pendulous flowers. See the articles BOTANY and FLOWER.

PENDULUM, in mechanics, any heavy body ſo ſuſpended, as that it may vibrate backwards and forwards, about ſome fixed point, by the force of gravity.

The word is derived from the Latin *pendeo*, to hang, or be ſuſpended.

A pendulum is any body, as B (plate XCVIII. *fig.* 4.) ſuſpended upon, and moving about a point A as a center. The nature of a pendulum conſiſts in the following particulars: 1. The times of the vibrations of a pendulum, in very ſmall arches are all equal. 2. The velocity of the bob, in the loweſt point, will be nearly as the length of the chord of the arch which it deſcribes in the deſcent. 3. The times of vibration in different pendulums, A B, A C, are directly as the ſquare roots of their lengths. 4. The time of one vibration is to the time of the deſcent, through half the length of the pendulum, as the circumference of a circle to its diameter. 5. The quantity of matter in the pendulous body is as the weight and the ſquare of the time directly, and the length of the pendulum inverſely. 6. Whence the length of a pendulum, vibrating ſeconds, will be found 39 inches nearly; and of one half ſecond pendulum nine, eight inches.

From theſe properties of the pendulum we may diſcern its uſe as an univerſal chronometer, or regulator of time, as it is uſed in clocks, and ſuch-like machines. By this inſtrument alſo we can meaſure the diſtance of a ſhip, by meaſuring the interval of time between the fire and the ſound of the gun; alſo the diſtance of a cloud, by numbering the ſeconds, or half-ſeconds, between the lightning and thunder. Thus, ſuppoſe between the lightning and thunder, we number 10 ſeconds; then, becauſe ſound paſſes through 1142 feet in one ſecond, we have the diſtance of the cloud equal to 11420 feet. Again, the height of any room, or other object, may be meaſured by a pendulum vibrating from the top thereof. Thus, ſuppoſe a pendulum from the height of a room vibrates once in three ſeconds; then ſay, as 1 is to the ſquare of 3, viz. 9, ſo is 39,2 to 352,8 feet, the height required. Laſtly, by the pendulum we diſcover the different force of gravity on diverſe parts of the earth's ſurface, and thence the true figure of the earth. See the article EARTH.

The greateſt inconvenience attending this moſt uſeful inſtrument is, that it is conſtantly liable to an alteration of its length, from the effects of heat and cold, which very ſenſibly expand and contract all metalline bodies, as is evident from the pyrometer. See the article PYROMETER.

When pendulums were firſt applied to clocks, they were made very ſhort; and the arches of the circle being large, the time of vibration, through different arches, could not in that caſe be equal; to effect which, the pendulum was contrived to vibrate in the arch of a cycloid.

From what has been ſaid under the article CYCLOID, it appears that if AC (plate XCVIII. *fig.* 5.) be the length of a pendulum ſo diſpoſed, as to vibrate between the two ſemicycloids A D and A L, the bob will deſcribe in its motion the cycloid D C L. The properties of which motion will now eaſily appear: for, with reſpect to the velocity acquired by deſcending through any arch R C or B C, it is always as $\sqrt{OC}$ which is as the chord S C $= \frac{1}{2}$ R C; conſequently the velocity at C is every-where as the ſpace paſſed through, or as the arch of the cycloid deſcribed in the deſcent.

But ſince it is always S = T V, in all kinds of motion; if in any caſe S be as V, it is evident T muſt be a given quantity, or always the ſame. That is, when the ſpaces (S, s,) are as the velocities (V, v,) the times (T, t,) will be always equal; and, therefore, all the arches of a cycloid, great or ſmall, are deſcribed in equal times. Alſo the time of vibration in the cycloid is to the time of deſcent through half its length, as the circumference of a circle to its diameter.

If A C be the length of a pendulum vibrating ſeconds, it may be eaſily found, ſince it is known by moſt accurate experiments, that a body deſcends freely by gravity through 193$\frac{1}{2}$ inches in the firſt ſecond of time; therefore by making this analogy, as $3{,}14159^2 : 1^2 :: 193\frac{1}{2} : 19{,}6 = AK$, and ſo AC = 39,2 inches, the length of a ſecond pendulum, as required. And, ſince the lengths are as the ſquares of the times of vibrations, we have 4 : 1 :: 39,2 : 9,8 inches, the length of an half-ſecond pendulum.

Since the length of a pendulum A C, for vibrating ſeconds, is ſo conſiderable, the bob, without the cycloidal cheeks A L and A D, will indeed deſcribe the arch of a circle, as fC e, when it vibrates; but then this circular arch will, for ſome diſtance on each ſide the loweſt point C, coincide with the cycloid very nearly, as, for example, to g and h; and hence it follows, that a common pendulum, vibrating through very ſmall arches g, h, will perform all its vibrations in equal times. And hence the above-mentioned cycloidal cheeks came into diſuſe.

Hence the time of deſcent through the arch Cg of the cycloid is to the time of deſcent through the diameter of the generating circle, as $\sqrt{4a}$ (ſuppoſing A C = 2 a) multiplied by $\frac{3{,}14159}{4} = 0{,}7854$, to $\sqrt{a}$.

In all that has been hitherto ſaid the power of gravity has been ſuppoſed conſtantly the ſame. But, if the ſaid power varies, the lengths of pendulums muſt vary in the ſame proportion, in order that they may vibrate in equal times; for we have ſhewn, that the ratio of the times of vibration and deſcent through half the lengths is given, and conſequently the times of vibration and deſcent through the whole length is given. But the times of vibration are ſuppoſed equal, therefore the times of deſcent through the lengths of the pendulum are equal. But bodies deſcending through unequal ſpaces, in equal times, are impelled by powers that are as the ſpaces deſcribed, that is, the powers of gravity are as the lengths of the pendulums. See VIBRATION.

PENETRATION, the act whereby one thing takes the place of another, or has its extenſion in the ſame part of ſpace before poſſeſſed by the other.

PENGUIN, in ornithology, the name of a ſea-bird common on the coaſts of America, eſpecially about the banks of Newfoundland, and the iſlands about the Streights of Magellan. It has eight furrows on the beak, and white ſpots before the eye; is a very ſingular bird, and about the ſize of a gooſe.

PENIS, the YARD, in anatomy, the primary organ of generation in man; being called alſo mentula, virgo, priapus, and by a multitude of other names.

Anatomiſts divide the penis into three parts, the body, the glans, and the urethra. In the body of the penis, are obſervable the cuticle and cutis, as the common integuments; the prepuce, being a reduplication of the cutis covering the glans; and in the lower of this is fixed the frenulum, all which are deſcribed under their ſeveral heads.

After theſe is obſervable the proper teguments or coats of the penis. This is a robuſt coat, of a membranous nature, ſurrounding every part of the penis. It is ſometimes double, and has in the interſtitial ſpace a celluloſe coat which is diſcoverable by inflation and drying in that ſtate. Under this are the two bodies which conſtitute the penis; theſe, being called the corpora cavernoſa, or ſpongioſa, are deſcribed under the article CAVERNOSE.

PENITENCE, properly ſignifies the ſame with repentance; but is alſo uſed for the diſcipline or puniſhment, uſually called penance.

PENITENTS, an appellation given to certain fraternities of penitents diſtinguiſhed by the different ſhape and colour of their habits.

PENNY, in commerce, an ancient Engliſh coin, which is now generally a money of account.

It was equal in weight to our threepence; five of which made a Saxon ſcilling, and thirty a mark, or mancuſe, equal to our ſeven ſhillings and ſixpence.

Till the time of Edward I. the penny was ſtruck with a croſs, ſo deeply indented, that it might be eaſily broke into two, thence called half pennies, or into four, called four things, or farthings: but that prince coined it without indenture, and ſtruck round the halfpence and farthings. He alſo ordered that the penny ſhould weigh

thirty-two grains of wheat, and called it the penny ſterling, twenty of which were to weigh an ounce.

At preſent a penny, bating a few ſilver pence current among us, is only a money of account, containing the twelfth part of our ſhilling, or the two hundred and fortieth part of a pound.

PENNY-EARTH, in agriculture, denotes a hard, loamy, or ſandy earth, with a large proportion of ſea-ſhells intermixed with it.

PENNY-ROYAL, *Pulegium*, in botany. See the article PULEGIUM.

PENNY-WEIGHT, a Troy weight, containing twenty-four grains, each of which is equal in weight to a grain of wheat, gathered out of the middle of the ear, and well dried. See WEIGHT.

PENSION, a ſum of money paid annually for ſervices or conſiderations already paſt.

PENSIONARY, or PENSIONER, a perſon who has an appointment, or yearly ſum, payable during life, by way of acknowledgment, charged on the eſtate of a prince, company, or particular perſon.

Grand PENSIONARY, an appellation given to the firſt miniſter of the ſtates of Holland.

PENSIONARY, is alſo the firſt miniſter of the regency of each city in Holland.

PENSIONER, in general, denotes a perſon who receives a penſion, yearly ſalary, or allowance.

PENTACROSTIC, in poetry, a ſet of verſes ſo diſpoſed as that there are always five acroſtics of the ſame name, in five diviſions of each verſe. See the article ACROSTIC.

PENTAGON, in geometry, a figure of five ſides and five angles.

The word is Greek, and compounded of πεντε, five, and, γωνια, angle.

If the five ſides be equal, and alſo the angles, the figure is called a regular pentagon as (plate XCVIII. *fig.* 6.)

The moſt conſiderable property of a regular pentagon is, that one of its ſides D E is equal in power to the ſides of a hexagon, and a decagon, inſcribed in the ſame circle A B C D E, that is, the ſquare of the ſide D E, is equal to the ſum of the ſquares of the ſides D *a* and D *b*.

Pappus has alſo demonſtrated, that twelve regular pentagons contained more than twenty equilateral triangles inſcribed in the ſame circle, *lib.* 5. *probl.* 45.

The dodecahedron, which is the fourth regular ſolid, conſiſts of twelve pentagons.

PENTAGRAPH, or PARALLELOGRAM, an inſtrument whereby deſigns of any kind may be copied in what proportion you pleaſe, without being ſkilled in drawing.

It conſiſts of four braſs or wooden rulers, (plate XCVIII. *fig.* 7.) two of them from fifteen to eighteen inches long; the other two, half that length. At the ends and middle of the long rulers, as alſo at the ends of the ſhorter, are holes, upon the exact fixing whereof, the perfection of of the inſtrument chiefly depends. Thoſe in the middle of the long rulers are to be at the ſame diſtance from thoſe at the ends of the long ones, and thoſe of the ſhort ones, ſo as to form a parallelogram.

It is fitted together by a large pillar *a*, having at one end a ſcrew and nut, whereby the two long rulers are joined, and at the other a little knot for the inſtrument to ſlide on: *b* is a rivet with a ſcrew and nut, wherewith each ſhort ruler is faſtened to the middle of each long one: *c* is a pillar, one end whereof, being hollowed into a ſcrew, has a nut fitted to it; at the other end is a worm to ſcrew into the table; when the inſtrument is to be uſed, it joins the ends of the two ſhort rulers: *d* is a pen or pencil ſcrewed into a little pillar: *e* is a braſs-point, moderately blunt, ſcrewed, likewiſe, into a little pillar.

Uſe of the PENTAGRAPH. 1. To copy a deſign in the ſame ſcale as the original: ſcrew the worm *c* into the table; lay a paper under the pencil *d*, now placed at *f*, and the deſign under the point *e*, now placed at *g*; then, conducting the point over the ſeveral lines of the deſign, the pencil *f* will draw the ſame on the paper. 2. If the deſign be to be reduced into half, &c. the ſpace, the worm muſt be placed at the end of the long ruler *d*, and the paper and pencil in the middle. In this ſituation conduct the braſs-point as before, and the pencil will draw its copy in the proportion required, the pencil here moving half the length that the point does.

On the contrary, if the deſign be to be enlarged by one half, the braſs point, with the deſign, muſt be placed in the middle at *c*, the pencil and paper at the end of the long ruler, and the worm at the other.

3. To enlarge or reduce in other proportions, there are holes drilled at equal diſtances on each ruler, namely, all along the ſhort one, and half way the long ones, in order for placing of the braſs-point, pencil, and worm, in a right line therein; that is, if the piece carrying the point be put in the third hole, the two other pieces muſt be put in its third hole.

If then the point and deſign be placed at any hole of the great ruler, and the pencil with the paper at any hole of the ſhort ruler, which forms the angle therewith, the copy will be leſs than half the original. On the contrary, if it be placed at one of the holes of that ſhort ruler, which is parallel to the long ruler, the copy will be greater than half the original.

Few of theſe inſtruments will do any thing tolerably but ſtraight lines, and many of them not thoſe.

PENTAMETER, in ancient poetry, a kind of verſe conſiſting of five feet, or metres; whence the name.

The two firſt feet may be either dactyls or ſpondees, at pleaſure; the third is always a ſpondee, and the two laſt anapeſts.

PENTANDRIA, in botany, one of Linnæus's claſſes of plants, the fifth in order; the characters of which are that all the plants comprehended in it have hermaphrodite flowers, with five ſtamina or male parts in each: they are ſubdivided into orders, which are denominated *monogynia*, *digynia*, *trigynia*, &c. according as there are one, two, three, &c. piſtils, or female parts, in each flower. See STAMINA.

To this genus belongs the vine, of the order of the *monogynia*; the elm, of the *digynia*; ſumach, of the *trigynia*, &c.

PENTAPETALOUS, an appellation given to flowers that conſiſt of five petals or leaves.

PENTAPTOTON, in grammar, denotes a noun which has only five caſes.

PENTASTICH, πεντασιχον, in poetry, a ſtanza, or diviſion of a poem, conſiſting of five verſes; whence the name.

PENTASTYLE, in architecture, a building wherein there are five rows of columns. See the article COLUMN.

PENTATEUCH, πεντατευχος, an appellation given to the firſt five books of the Old Teſtament, viz. Geneſis, Exodus, Leviticus, Numbers, and Deuteronomy.

The Samaritans acknowledge no other ſcriptures beſides the Pentateuch, which they ſtill preſerve in the old Hebrew or Phœnician character, as alſo in the vulgar Samaritan.

PENTECOST, a ſolemn feſtival of the Jews, ſo called becauſe it was celebrated on the fiftieth day after the ſixteenth of the month Niſan, which was the ſecond day of the paſſover.

The feaſt of Pentecoſt was inſtituted in memory of the law's being given, on the fiftieth day after the Iſraelites came out Egypt.

It was on the feaſt of Pentecoſt that the Holy Ghoſt miraculouſly deſcended on the apoſtles. See WHITSUNDAY.

PENTHEMIMERIS, in ancient poetry; a part of a verſe conſiſting of two feet and a long ſyllable.

PENULTIMA, or PENULTIMATE SYLLABLE, in grammar, denotes the laſt ſyllable but one of a word; and hence the anti-penultimate ſyllable is the laſt but two or that immediately before the penultima.

PENUMBRA, in aſtronomy, a partial ſhade obſerved between the perfect ſhadow and the full light in an eclipſe.

It ariſes from the magnitude of the ſun's body; for were he only a luminous point, the ſhadow would be all perfect; but by reaſon of the diameter of the ſun, it happens that

that a place which is not illuminated by the whole body of the ſun, does yet receive rays from a part thereof. See the article ECLIPSE.

PEPPER, *Piper*, in natural hiſtory, an aromatic fruit or berry, of a hot dry quality, growing in Sumatra, Java, and Malabar. The pepper-corns adhere i ncluſters to the ſtalks, with pedicles: when ripe, they are firm, not juicy, of a red colour which changes in drying to a black.

We have three kinds of pepper at this time in uſe in the ſhops; namely, the black, the white, and the long pepper.

Common or Black PEPPER, the fruit gathered, probably, before perfect maturity, and dried in the ſun.

White PEPPER, the ripe fruit decorticated by maceration in water. Some of the grains, as brought to us, have pieces of a dark coloured ſkin ſtill upon them.

Of theſe pungent hot ſpices, the black ſort is the hotteſt and ſtrongeſt, and moſt commonly made uſe of for medicinal as well as culinary purpoſes. They both ſeem to heat the conſtitution more than ſome other ſpices that are of equal pungency upon the palate; and from thoſe ſpices they differ in this, that their pungency does not reſide in the volatile parts or eſſential oil, but in a ſubſtance of a more fixed kind, which does not riſe in the heat of boiling water. Pepper, infuſed in water, impregnates the menſtrum pretty ſtrongly withits flavour, but weakly with its taſte; by boiling for ſome time, a little more of its pungent matter is extracted, and its flavour diſſipated.

Long PEPPER, the fruit of an Eaſt Indian plant of the ſame genus with that which produces the black pepper; of a cylindrical figure, about an inch and a half in length, having numerous minute grains diſpoſed round it in a kind of ſpiral direction. This ſpice is hotter and more pungent than either of the preceding kinds, and its ſpirituous extract is proportionably more fiery.

Jamaica-PEPPER. See PIMENTA.

Capſicum, or *Guiney* PEPPER. See the article CAPSICUM.

PERAMBULATION, in law, ſignifies the walking about a foreſt, pariſh or the like, by juſtices or others, in order to mark down and preſerve the limits and bounds thereof.

PERAMBULATIONE FACIENDA, a writ commanding the ſheriff to make preambulation, in order to ſettle the bounds of two adjoining manors.

PERAMBULATOR, in ſurveying, an inſtrument for meaſuring diſtances, called alſo pedometer, way-wiſer and ſurveying wheel.

It conſiſts of a wheel (plate XCVIII. *fig.* 8.) two feet ſeven inches and a half in diameter; conſequently, half a pole, or eight feet three inches in circumference. On one end of the axis is a nut, three quarters of an inch in diameter, and divided into eight teeth; which, upon moving the wheel round, fall into the eight teeth of another nut *c* (*fig.* 9.) fixed on one end of an iron rod Q, and thus turn the rod once round, in the time the wheel makes one revolution. This rod, lying along a groove in the ſide of the carriage of the inſtrument, has at its other end a ſquare hole, into which is fitted the end *b* of a ſmall cylinder P. This cylinder is diſpoſed under the dial-plate of a movement, at the end of the carriage, in ſuch a manner as to be moveable about its axis: its end is cut into aperpetual ſcrew, which falling into the thirty-two teeth of a wheel pependicular thereto, upon driving the inſtrument forward, that wheel makes a revolution each ſixteenth pole. On the axis of this wheel is a pinion with ſix teeth, which, falling into the teeth of another wheel of ſixty teeth, carries it round every hundred and ſixtieth pole, or half a mile.

This laſt wheel, carrying a hand or index round with it over the diviſions of a dial plate, whoſe outer limb is divided into one hundred and ſixty parts, correſponding to the one hundred and ſixty poles, points out the number of poles paſſed over. Again, on the axis of this laſt wheel is a pinion, containing twenty teeth, which, falling into the teeth of a third wheel, which hath forty teeth, drives it once round in three hundred and twenty poles, or a mile. On the axis of this wheel is a pinion of twelve teeth, which, falling into a teeth of the fourth wheel, having ſeventy-two teeth, drives it once round in twelve miles.

This fourth wheel, carrying another index over the inner limb of the dial-plate, divided into twelve for miles, and each mile ſubdivided into halves, quarters, and furlongs, ſerves to regiſter the revolutions of the other hand, and to keep account of the half miles and miles paſſed over as far as twelve miles.

The uſe of this inſtrument is obvious from its conſtruction. Its proper office is in the ſurveying of roads and large diſtances, where a great deal of expedition, and not much accuracy, is required. It is evident, that driving it along, and obſerving the hands, has the ſame effect as dragging the chain, and taking account of the chains and links.

Its advantages are its handineſs and expedition; its contrivance is ſuch, that it may be fitted to the wheel of a coach, in which ſtate it performs its office, and meaſures the road without any trouble at all.

PER ARSIN ET THESIN, in muſic. Per arſin, in a ſong, counterpoint, fugue, &c. is when the notes aſcend from grave to acute; and per theſin, when they deſcend from acute to grave.

PERCEPTION, in logic, the firſt and moſt ſimple act of the mind, whereby it perceives or is conſcious of its ideas. See the article IDEA.

In bare perception, the mind is for the moſt part only paſſive; yet impreſſions made on the ſenſes cauſe no perception, unleſs they are taken notice of by the mind, as we ſee in thoſe who are intently buſied in the contemplation of certain objects. It ought alſo to be obſerved, that the ideas we receive by perception are often altered by the judgment, without our taking notice of it; ſo that we take that for the perception of our ſenſes, which is but an idea formed by the judgment: thus, a man who reads, or hears, without attention, takes little notice of the characters or ſounds, but of the ideas excited in him by them. See JUDGMENT.

The faculty of perception ſeems to be that which conſtitutes the diſtinction between the animal kingdom and the inferior parts of nature. Perception is alſo the firſt ſtep towards knowledge, and the inlet of all the materials of it; ſo that the fewer ſenſes a man has, and the duller the impreſſions that are made by them are, the more remote he is from that knowledge which is to be found in other men. See KNOWLEDGE.

PERCH, or PEARCH, *Pica*, the name of a fiſh diſtinguiſhed by ſeveral tranſverſe ſtreaks, and by having the belly-fins red: it grows in ſome places to a foot and an half in length, and is conſiderably thick in proportion, but its more uſual ſize is eight or nine inches in length: its noſtrils are large and patulous, and nearer the eyes than the extremity of the ſnout.

PERCH, a meaſure of length. See MEASURE.

PERCHANT, among fowlers, denotes a decoy-bird, which being faſtened by the foot, flutters about the place to draw other birds to it.

PERCUSSION, the act of ſtriking. See the article MOTION.

Center of PERCUSSION *of a Body or Figure in Motion* is that point in which all the forces of the ſame are conſidered as united together in one; ſo that if the ſaid figure meets any obſtacle contrary to the motion thereof, it ſtrikes the obſtacle with a greater force than any other point of the figure; and conſequently, if the percutient body revolves round a fixed point, and in its motion ſtrikes any obſtacle with its center of percuſſion, it will, during a ſmall particle of time, preſerve an equilibrium about that point.

Let the inflexible right line PB (pl. XCVIII. *fig.* 10.) with two given weights A, B, appended at the points A and B, revolve about the fixed point P, as a center; and let it be required to determine the center of percuſſion C, of the ſaid weights.

Put $BC = x$; then $CA = BA - x$. The velocity with which B revolves, is as PB; therefore its force may be expreſſed by $PB \times B$; and by the ſame way of reaſoning, the force of A may be expounded by $PA \times A$; therefore, by the above definition of the center of percuſſion, we have $PB \times B \times x = \overline{BA - x} \times PA \times A$; hence $x = \frac{PB \times PA \times A}{\overline{PB \times B + PA \times A}}$; ſubtract this from PB, and we have

PC,

PC, or the distance of the center of percussion from the point of suspension P, equal to $\frac{PA^2 \times A + PB^2 \times B}{PA \times A + PB \times B}$. If there were three, or a greater number of weights, affixed to the rod P B, the distance of their center of percussion from the point of suspension would, in like manner, be found by first multiplying each weight into the square of its distance from the point of suspension, and dividing the sum of those products by that of the products arising from the multiplication of each weight, into its respective distance from the point of suspension. Hence it appears that the center of percussion is the same with the center of oscillation.

PERENNIAL, in botany, is applied to those plants whose roots will abide many years, whether they retain their leaves in winter or not; those which retain their leaves are called ever greens; but such as cast their leaves are called deciduous, or pedisols. Some of these have annual stalks, which die to the root every autumn, and shoot up again in the spring; to which Jungius gives the title of radix restibilis.

PERETERION, a name which chirurgical writers give to the perforating part of the trepan. See the article TREPAN.

PERFECT, something to which nothing is wanting; or that has all the requisites of its nature and kind.

PERFECT, in arithmetic. Perfect number is that, all whose aliquot parts added together, make the same number with the number of which they are such parts.

PERFECT PRETERIT TENSE, in grammar. See PRETERIT.

PERFECT, in music, denotes something that fills and satisfies the mind and the ear: in which sense we say, perfect cadence, perfect concord, &c.

PERFECTION, the state or quality of a thing perfect.

PERFORANS MANUS, in anatomy, a muscle of the fingers, being the flexor of the third phalanx, called also profundus; which, arising at the upper part of the middle of the ulna, and dividing into four tendons, perforates the tendons of the perforatus manus, and is inserted into the beginning of the third phalanx of the four fingers. See PERFORATUS, &c.

PERFORANS PEDIS, in anatomy, a muscle of the toes, being the flexor of the third phalanx: its origin is from the hinder surface of the upper part of the tibia: towards the middle it is divided into four tendons, and these perforate the tendons of the perforatus pedis, and are afterwards terminated in the third phalanx.

PERFORATUS MANUS, in anatomy, a muscle of the fingers, called also sublimis, being the flexor of the second phalanx, arising from the internal condyle of the humerus, and the radius: it is divided into four tendons, which are inserted into the second phalanges of the four fingers. See FLEXOR, &c.

PERFORATUS PEDIS, in anatomy, a muscle of the toes, being the flexor of the second phalanx, arising from the lower and inner surface of the calcaneum. It is divided into four tendons, which are perforated, and is terminated in the bones of the second phalanx.

PERFUME, *Suffitus*, an agreeable artificial odour, affecting the organ of smelling. The generality of perfumes are made up of musk, ambergrise, civet, rose and cedar-woods, orange-flowers, jasmin, jonquils, tuberoses, and other odoriferous flowers: those drugs, commonly called aromatics, such as storax, frankincense, benzoin, cloves, mace, &c. enter the composition of a perfume: some are also composed of aromatic herbs or leaves, as lavender, marjoram, sage, thyme, hyssop, &c.

PERIANTHIUM, in botany, expresses that sort of cup of a flower which either consists of several leaves, or else of one leaf divided into several segments, and surrounds the lower part of the flower.

PERIAGOGE, or PERIBOLE, in rhetoric, is used where many things are accumulated into one period which might have been divided into several.

PERICARDIUM, in anatomy, a membranaceous bag, loosely including the heart, and situated in the middle and lower part of the thorax, between the two lobes of the lungs. See HEART.

The figure of the pericardium is Conic, like that of the heart itself. Its size is such as can conveniently contain the heart without pressing upon it. It is connected with the mediastinum, with a great part of the diaphragm, and with the large vessels of the heart, which, together with this covering, sustain also the heart itself in its place. In beasts of most kinds, the heart is not at all connected with the diaphragm by its pericardium.

The pericardium is composed of a double membrane; the exterior one is common with the pleura and mediastinum; the interior one is proper, lubricous, and is continuous with the coats of the larger vessels. This membrane, when expanded upon the finger, frequently discovers a great number of foraminula, or little apertures. The arteries and veins of the pericardium are from those of the mediastinum and diaphragm, and its nerves are also from the diaphragmatics. Its lymphatics all run to the thoracic duct.

The uses of the pericardium are, 1. To support the heart in a pendulous state, especially when we lie down. 2. To defend the heart from the cold air taken in at the lungs. 3. To preserve it from being injured by water, by matter, or any other extraneous fluid in the cavity of the thorax; and, 4. To contain the liquor of the pericardium, as it is called, which serves to facilitate the motions of the heart.

The liquor of the pericardium is a fluid, resembling in appearance water, in which raw flesh had been washed. The anatomical writers, in general, deduce this fluid from certain glands, situated either in the pericardium, or in the heart itself; but as these glands are not to be found, Heister thinks it more rational to suppose that it is expressed out of the auricles of the heart in its systole. The pericardium is found sometimes in long hectics to co-here with the substance of the heart; and there are accounts of its having been wholly wanting.

PERICARPIUM, among botanists, a covering or case for the seeds of plants. It is the germen of the pistil enlarged.

PERICRANIUM, in anatomy, a thick solid coat, or membrane, covering the outside of the cranium or skull.

Some call it by the name of periosteum, because of its adhering to the bone: others divide it into two membranes, the under one of which immediately investing the skull they call periosteum, and the upper pericranium. In effect, it is one double membrane, consisting, as most others do, of two coats. It is supposed to have its origin from the dura mater, which passing through the sutures of the skull, by means of several filaments, forms this thick membrane; at least it is found connected to the dura mater, by fibres transmitted from it to the membrane through the sutures. About the origin of the temporal muscles, the coats of the pericranium part; the outer passing over those muscles; and the inner still adhering close to the cranium. See PERIOSTEUM.

PERIDROME, *Peridromus*, in ancient architecture, the space, gallery, alley, or the like, in a periptere, between the columns and the wall.

PERIGÆUM, PERIGEE, in astronomy, that point of the sun's or moon's orbit, wherein they are at their least distance from the earth, in which sense it stands opposed to apogee. See APOGEE.

In the ancient astronomy, perigee denotes that point in a planet's orbit, wherein the center of its epicycle is at the least distance from the earth.

PERIGRAPHE, a word usually understood to express a careless or inaccurate delineation of any thing; but in Vesalius it is used to express the white lines or impressions that appear in the musculus rectus of the abdomen.

PERIHELIUM, in astronomy, that point of a planet's or comet's orbit, wherein it is in its least distance from the sun; in which sense it stands in opposition to aphelium.

The ancient astronomers, on account of their supposing the earth in the center of the system, instead of this term used that of perigæum.

PERIMETER, in geometry, the bounds or limits of any figure or body.

The perimeter of surfaces or figures are lines, those of bodies are surfaces. In circular figures, instead of perimeter, we say circumference, or periphery.

PERINÆUM, or PERINEUM, in anatomy, the space between

between the anus and the parts of generation, divided into two equal lateral diviſions, by a very diſtinct line, which is longer in males than females. The perinæum is ſubject to laceration in a difficult birth. In this part an operation is performed, called a puncture of the perinæum, or perforation made into the urethra and bladder, to diſcharge the urine when it is ſuppreſſed. See the articles DELIVERY, ISCHURY, PARACENTESIS, and PUNCTURE.

PERIOD, in aſtronomy, the time taken up by a ſtar or planet in making a revolution round the ſun; or the duration of its courſe till it returns to the ſame point of its orbit.

The periodical times of the planets round the ſun are as follow:

The period of	days.	hours.	min.	ſeconds
Mercury — — —	87	23	15	53
Venus — — — —	224	16	49	24
The earth — — —	365	6	9	14
Mars — — — —	686	23	27	30
Jupiter — — — —	4332	12	20	25
Saturn — — — —	10759	6	36	26

See MERCURY, VENUS, &c.

There is a wonderful harmony between the diſtances of the planets from the ſun, and their periods round him; the great law whereof is, that the ſquares of the periodical times of the primary planets, are to each other as the cubes of their diſtances from the ſun; and likewiſe, the ſquares of the periodical times of the ſecondaries of any planet, are to each other as their cubes of their diſtances from that primary. This harmony among the planets is one of the greateſt confirmations of the Copernican hypotheſis. See COPERNICAN.

PERIOD, in chronology, denotes a revolution of a certain number of years, or a ſeries of years, whereby, in different nations, and on different occaſions, time is meaſured; ſuch are the following.

Calippic PERIOD, a ſyſtem of ſeventy-ſix years.

The Calippic period comprehends 48 common year, and 28 intercalary ones, 940 lunations, and 22759 day. See the article CYCLE.

Conſtantinopolitan PERIOD. See the article JULIAN *Period.*

Dionyſian PERIOD, or *Victorian* PERIOD, a ſyſtem of 532 lunæ ſolar and Julian years, which being elapſed, the characters of the moon fall again upon the ſame day and feria, and revolve in the ſame order, according to the opinion of the ancients.

This period is otherwiſe called the great paſchal cycle, becauſe the Chriſtian church firſt uſed it, to find the true time of the paſcha, or Eaſter. The ſum of theſe years ariſe by multiplying together the cycles of the ſun and moon. See the article EASTER.

Hipparchus's PERIOD, a ſyſtem of 304 years, both lunar and ſolar, which, being elapſed, Hipparchus thought that the reckoning by the lunar motion would coincide again with the ſolar meaſures. This period comprehends 3760 lunar months, or 111039 days; the ſum of which ariſes from the multiplication of the Calippic period by 4, ſubtracting unity from the product.

Julian PERIOD. See JULIAN.

Metonic PERIOD, that invented by Meton, being the ſame with the cycle of the moon.

PERIOD, in grammar, denotes a ſmall compaſs of diſcourſe, containing a perfect ſentence, and diſtinguiſhed at the end by a point, or full ſtop, thus (.); and its members or diviſions marked by commas, colons, &c. See the articles POINT and SENTENCE.

The celebrated definition of Ariſtotle is, that a period is a diſcourſe which has a beginning, a middle, and an end, all viſible at one view. And De Colonia defines a period a ſhort but perfect ſentence, conſiſting of certain parts or members, depending one upon another, and connected together by ſome common vinculum.

PERIOD is alſo uſed for the character (.) wherewith the periods of a diſcourſe are terminated, or expreſſed, being commonly called a full ſtop or point. See PUNCTUATION.

PERIOD, in numbers, a diſtinction made by a point, or comma, after every ſixth place or figure; and is uſed in numeration for the readier diſtinguiſhing, and naming the ſeveral figures or places.

PERIOD *of a Diſeaſe*, in medicine, is the time betwixt the acceſs of one fit, or paroxyſm, and that of the next, including the entire exacerbation, decline, and intermiſſion, or remiſſion.

PERIODIC, or PERIODICAL, ſomething that terminates and comprehends a period; ſuch is a periodic month, being the ſpace of time wherein the moon diſpatches her period.

PERIOECI, περιοικοι, in geography, ſuch inhabitants of the earth as have the ſame latitudes, but oppoſite longitudes; or live under the ſame parallel, and the ſame meridian, but in different ſemi-circles of that meridian, or in oppoſite points of the parallel. Theſe have the ſame common ſeaſons throughout the year, and the ſame phænomena of the heavenly bodies; but when it is noonday with the one, it is midnight with the other, there being twelve hours between them in an eaſt or weſt direction. Theſe are found on the globe, by the hour index, or by turning the globe half round, that is 180 degrees either way.

PERIOSTEUM, or PERIOSTIUM, in anatomy, a nervous vaſculous membrane, endued with a very quick ſenſe, immediately ſurrounding, in every part, both the internal and external ſurfaces of all the bones in the body, excepting only ſo much of the teeth as ſtand above the gums, and the peculiar places on the bones, in which the muſcles are inſerted. It is hence divided into the external and internal perioſteum, and where it externally ſurrounds the bones of the ſkull, it is generally called the pericranium.

This membrane ſerves to conſtitute the firſt rudiments of the bones in a fœtus in utero. It is the organ of ſecretion for the bony matter, as the membrana adipoſa is for the fat: all the bones, during the time of their growth, receiving from it their matter of accretion, and afterwards their nutriment. The blood veſſels of the perioſteum penetrate in innumerable places into the bones themſelves, as is evidently ſeen in the freſh bones of children. The ſenſibility in the bones is wholly owing to this membrane; for when diveſted of this, they may be ſawed, cut, or burnt without pain. It gives the determination and figure to bones, as is evident from this, that when it is wounded, exoſtoſes, tophi, and caries ariſe in the part. The perioſteum is of different thickneſs in different parts, but in general the internal is vaſtly thinner than the external, and ſerves to nouriſh that part of the bones. It receives alſo nerves and blood-veſſels from the outſide, through certain canals in the ſubſtance of the bones, which it communicates to the marrow in ſuch as have any. It is generally ſaid to ariſe from the dura mater of the brain; but Heiſter thinks this opinion ſcarce right, as the perioſteum is evidently formed at the ſame time with the dura mater in the fœtus.

PERIPATETIC PHILOSOPHY, that ſyſtem taught and eſtabliſhed by Ariſtotle, and maintained by his followers, the Peripatetics, called alſo Ariſtotelians.

The greateſt and beſt part of Ariſtotle's philoſophy, he is ſaid to have borrowed from his maſter Plato. Serranus affirms confidently, and ſays that he is able to demonſtrate it, that there is nothing exquiſite in any part of Ariſtotle's philoſophy, dialectics, ethics, politics, phyſics, or metaphyſics, but is found in Plato; and of this opinion are many of the ancient authors, Clemens Alexandrinus, &c. Ariſtotle's philoſophy preſerved itſelf *in puris naturalibus*, a long time, none of his followers or commentators having dared to make any innovation therein, till the beginning of the thirteenth century, when it began to be new modelled. A reformed ſyſtem of peripateticiſm was firſt introduced into the ſchools in the univerſity of Paris, from whence it ſoon ſpread throughout Europe, and has ſubſiſted in the univerſities to this day, under the name of ſchool philoſophy; the foundation whereof is Ariſtotle's doctrine frequently miſunderſtood, and oftener miſapplied: but of theſe, at different times, have ſprung ſeveral branches, as the Thomiſts, Scotiſts, Nominaliſts, &c. See THOMIST, &c.

PERIPETIA, περιπετεια, in the drama, that part of a tragedy, wherein the action is turned, the plot unravelled, and the whole concludes. See CATASTROPHE.

PERIPHERY, in geometry, the circumference of a circle, ellipſis, or any other regular curvilinear figure. See the article CIRCUMFERENCE, CIRCLE, &c.

PERIPHRASIS, in rhetoric, the ſame with circumlocution. See the article CIRCUMLOCUTION.

PERIPNEUMONY, in medicine, an inflammation of the lungs, attended with a weight on the lungs, a difficulty of breathing, and an oppreſſion of the breaſt, with a purulent ſpitting, and a fever accompanied with a cough. When the inflammation affects both the lobes, and the whole body of the lungs, the caſe is deſperate.

The peripneumony is diſtinguiſhed into two kinds; one of which has its ſeat at the extremity of the pulmonary artery, and is called the true peripneumony; and the other is ſituated in the bronchial arteries, and is called the ſpurious or baſtard peripneumony.

The true peripneumony is often cured by a critical reſolution and concoction of the morbific matter, which is either attenuated, ſo as to be returned into the channels in the common courſe of circulation; or expectorated by coughing; which may be eaſily known by an abatement of the ſymptoms, and the patient's falling into gentle breathing ſweats.

Copious bleeding is the moſt effectual remedy in the beginning of this diſeaſe; but not ſo proper when expectoration goes on ſucceſsfully, becauſe it ſometimes ſuppreſſes it, and in that caſe ſudorifics thicken the matter which is expectorated. The motions of nature ought to be followed: the aliment ought to be more ſlender and thin than in any other inflammatory diſeaſe whatſoever; common whey is ſufficient to preſerve the ſtrength of the patient; relaxing aliments are proper, of which barley, and all its preparations, are the beſt. Diuretics that have not much acrimony are uſeful: and for this intention, an infuſion of fennel-roots in warm water, with milk, is good. If nature relieves by a diarrhœa, without ſinking the ſtrength of the patient, it ought to be promoted by emollient clyſters. But if the patient is neither relieved nor dies in eight days, the inflammation will end in a ſuppuration, and an abſceſs of the lungs, and ſometimes in ſome other part of the body: in this caſe bleeding muſt be forborne; the diet muſt be mild, ſoft, incraſſating, and more plentiful; and tepid vapours ſhould be taken into the lungs, from decoctions of proper ingredients. When, by the ſymptoms and time, the impoſthume may be judged to be ripe, the vapour of vinegar, and any thing that creates a cough, are proper; for the ſooner it is broke, the leſs danger will the lungs be in. In the ſtate which is not abſolutely deſperate, the aliment ought to be milk, and the drink milk and barley-water, with gentle anodynes, that the patient may have ſome reſt.

Spurious, or *Baſtard*-PERIPNEUMONY, a diſeaſe of the lungs, which generally ariſes from a heavy pituitous matter generated in the blood, and caſt upon the lungs. In this diſorder the patient is hot and cold by turns, is giddy upon the leaſt motion, and complains of a rending pain of the head whenever he coughs; he vomits up every thing that he drinks; the urine is turbid and red, and the whole thorax full of pain. In this diſorder the patient ſhould be let blood from a large orifice; and then give him the following clyſter, which muſt be repeated daily, till the ſymptoms evince that the lungs are relieved: Take of honey, three ounces; of nitre, one dram; one yolk of an egg; and eight ounces of barley-water; make them into a clyſter. Let the patient's diet be very ſlender, ſuch as weak broths, ſharpened a little with orange or lemon-juice; and he may drink a weak mixture of honey and water; the ſteams of warm water may be taken in at the mouth, and the following decoction given him: Take of the roots of fennel, two ounces; of the roots of graſs, four ounces; of the leaves of pellitory, and agrimony, each an handful and a half; of the bruiſed ſeeds of white poppy, one ounce; and of liquorice, one ounce and an half; boil them, for a quarter of an hour, in two pints and a half of water; of which let the patient drink two ounces every two hours. Likewiſe let his legs and feet be bathed, and large bliſters applied.

PERIPTERE, in the ancient architecture, a building encompaſſed on the outſide with a ſeries of inſulated columns, forming a kind of portico all around; ſuch were the portico of Pompey, the ſeptizon of Severus, and the baſilica of Antoninus.

The peripteres were properly temples, which had columns on all the four ſides, by which they were diſtinguiſhed from the proſtyle and amphiproſtyle, the laſt of which had no columns before, and the firſt none on the ſides.

M. Perault obſerves, that periptere, in the general ſenſe of the word, is the name of a genus, including all the ſpecies of temples, which have porticos of columns all around, whether the columns be diptere, or pſeudodiptere, or ſimply periptere, which is a ſpecies that bears the name of a genus, and which has its columns diſtant from the wall, the breadth of an intercolumniation.

PERISCII, in geography, the inhabitants of either frigid zone, between the polar circles and the poles; where the ſun, when in the ſummer-ſigns, moves only round about them, without ſetting, and conſequently their ſhadows, in the ſame day, turn to all the points of the horizon.

PERISTALTIC, in medicine, a vermicular ſpontaneous motion of the inteſtines, performed by the contraction of the circular and longitudinal fibres, of which the fleſhy coats of the inteſtines is compoſed; by means whereof the chyle is driven into the orifices of the lacteal veins, and the fæces are protruded towards the anus. See CHYLIFICATION.

When this motion comes to be depraved, and its direction changed, ſo as to proceed from below upwards, it produces what is called the iliac paſſion. See the article ILIAC PASSION.

PERISTAPHYLINUS, in anatomy, a name which ſome give to a muſcle of the uvula, more properly denominated pterygoſtaphylinus. See the article UVULA and PTERYGOSTAPHYLINUS.

PERISTYLE, in ancient architecture, a building encompaſſed with a row of columns on the inſide: ſuch was the hypæthre temple of Vitruvius, and ſuch are now ſome baſilicas in Rome, ſeveral palaces in Italy, and moſt cloiſters of religious.

Periſtyle is alſo uſed by modern writers, for a range of columns, either within or without a building: thus we ſay, the Corinthian periſtyle of the portal of the Louvre, &c.

PERISYSTOLE, in medicine, the interval of reſt between the two motions of the heart, viz. that of the ſyſtole, or contraction, and that of the diaſtole, or dilatation.

PERITONÆUM, in anatomy, is a thin, ſmooth, and lubricous membrane, inveſting the whole internal ſurface of the abdomen, and containing moſt of the viſcera of that part, as it were in a bag. It lies immediately under the tranſverſe muſcles of the abdomen, and adheres to them, and alſo coheres with the diaphragm, and with all the viſcera lodged in this part. It entirely incloſes the ſtomach, the inteſtines, the meſentery, the omentum, the liver, the ſpleen, and the pancreas: as to the kidneys, ureters, and ſmaller veſſels of the abdomen, it covers them only on the anterior part, and the urinary bladder only on the poſterior. The peritonæum is compoſed of a double membrane, or lamella; the exterior one has longitudinal and ſlender fibres, and the interior tranſverſe and more robuſt ones. There are alſo ligaments formed from it, viz. that which ſuſpends the liver, and the two ligamenta lata of the uterus in women. Its proceſſes, ſent out of the abdomen, are two, and theſe ſerve to ſurround and incloſe the ſpermatic veſſels and the teſticles.

The arteries and veins of the peritonæum are ſupplied from the epigaſtric, mammary, lumbar, and diaphragmatic veſſels; and the nerves are propagated from thoſe of the diaphragm, back, loins, and os ſacrum.

The uſes of the peritonæum are, 1. To incloſe the contents of the abdomen; for when this part is dilated, rounded, or broken, they fall out of their due places, and ruptures are formed. 2. To give an external covering to almoſt all the parts contained in the abdomen, which are therefore generally ſaid to have their external membrane from the peritonæum. And, 3. To form the proceſs of the peritonæum, and the tunica vaginalis of the teſtes.

PERITROCHIUM, in mechanics, denotes a wheel, or circle, concentric with the baſe of a cylinder, and moveable together with it, about an axis. See AXIS IN PERITROCHIO.

PERJURY, in law, the crime of ſwearing falſely, where a lawful oath is adminiſtered by one in authority, in a matter relating to the iſſue or cauſe in queſtion, whether it be a perſon's own wilful act, or done by the ſubornation of others.

In order to make an offence perjury, it muſt appear to be wilful and deliberate, and not done through ſurpriſe or inadvertency: it muſt be direct and poſitive, and not where a perſon ſwears as he thinks or believes: but in caſe a perſon ſwears to what he is ignorant of, it is a falſe oath, even though what he ſwears ſhould happen to be true; thus, a plaintiff cauſed two perſons to ſwear to the value of goods, which they never ſaw, when, notwithſtanding they ſwore what was true, it was adjudged to be perjury in them. At the common law, perjury, and the ſubornation of it, are puniſhable by fine, impriſonment, pillory, tranſportation, &c.

PERMANENT, in general, ſomething that continues the ſame, whether in nature or ſituation, and other circumſtances: thus air, generated by fermentation, is ſaid to be permanent, becauſe it continues to ſhew all the natural properties of common air.

Thus alſo thoſe cups of flowers are called permanent, which remain after the flower-leaves are fallen.

PERMEABLE, a term applied to bodies of ſo looſe and porous a ſtructure, as to let ſomething paſs through them.

PERMUTATION, in commerce, the ſame with bartering. See BARTERING.

In the canon law, permutation denotes the actual exchange of one benefice for another.

PERMUTATION *of Quantities*, in algebra, the ſame with combination.

PERNANCY, in law, ſignifying taking or receiving, is peculiarly applied to tithes taken in kind.

PERNIO, in ſurgery, a chilblain or kibe, generally produced in the hands and feet by violent cold. See the article COLD.

Chilblains are accompanied with inflammation, heat, redneſs, pricking pain, and immobility of that limb; ſometimes they are of a livid or leaden colour, and ſometimes they break out with ſcabs, or elſe with chops, or ſlits, which afterwards penetrate deeper, and become ulcerous. The humour which they diſcharge is a little fœtid, and pretty much reſembles pus or ſanies; and they terminate in either diſperſion, ſuppuration, or gangrene and ſphacelus.

While the chilblains are yet tumified and red, and the part retains its ſenſe and motion, without any great heat and pain, the diſorder is then of the mildeſt kind; on the contrary, when they are livid, occaſion the limb to become ſtiff and inſenſible, or excite pricking pains therein, there is then danger of a worſe conſequence, leſt it ſhould degenerate into a gangrene, or at leaſt a deep exulceration. There being no room to doubt but that cold is the cauſe of chilblains, it readily follows, that the cure muſt conſiſt chiefly in reſtoring the blood to its former fluidity and free circulation as ſoon as poſſible; for which purpoſe an external as well as internal treatment is neceſſary. In the external treatment, the patient being expoſed in a temperate air, ſhould, according to Heiſter, exerciſe his limbs as much as poſſible, in order to advance him ſtill to a greater warmth or heat; but when he is too weak to exerciſe himſelf, it will be proper to bathe the parts affected with ſnow, or cold water; after which, when the limb becomes ſenſible, comfortable medicines may be applied, ſuch as ſpirit of wine, either pure, or with theriaca, rock-oil, balſam of ſulphur, &c. When the parts affected have been well rubbed or bathed with theſe, the patient may then be advanced towards the fire, or be put to bed, endeavouring afterwards to excite a gentle ſweat.

In the internal treatment, great ſervice will be had from a few glaſſes of hot wine, wherein has been boiled ſome cinnamon and ſugar; though it may not be improper to give with this alternately, a ſmall quantity of ſome ſudorific mixture. If the wine be not at hand, good ale boiled with cinnamon, cloves, and ſugar, may well enough ſupply its place. It ſhould be continued ſo as to keep up a ſweat for a whole hour, for half an hour, or according to the ſeveral circumſtances: but if the diſorder is much ſlighter, this method is then not ſo directly neceſſary; it may then be laid aſide; though, in the opinion of Heiſter, it is much preferable to any other method. When chilblains tend to a ſuppuration, then it is proper to treat them like other abſceſſes.

If a patient has before been troubled with chilblains, which are uſed to return every year in the winter, the preſervative againſt the diſorder is to anoint the parts affected with petroleum, or oil of turpentine, before and after the ſeverity of the winter comes on; but when the diſorder has begun to ſhew itſelf again by tumour, inflammation, and pain, the heel or finger may be wrapped up in a ſwine's bladder, dipped in the forementioned oil, and the cold itſelf ſhould always be carefully avoided by proper cloths or coverings.

PERONE, in anatomy, the ſame with fibula. See FIBULA.

PERONÆUS, in anatomy, an epithet applied to ſome of the muſcles of the perone or fibula. 1. The peronæus anticus, is a muſcle that ariſes at the anterior part of the middle of the fibula, and terminates at the exterior metatarſal bone; the office of this muſcle is to draw the foot upwards. 2. Peronæus poſticus is a muſcle that ariſes at the upper part of the fibula, but its tendon is turned back under the tarſus, and is inſerted into that bone of the metatarſus, which ſupports the great toe. There is uſually in old ſubjects a ſeſamoide bone in the tendon of this muſcle, where it paſſes under the os cuboides. Its office is alſo to pull the foot upwards.

PERFORATION, *Perforatio*, in rhetoric, the epilogue, or laſt part of an oration, wherein what the orator had inſiſted on through his whole diſcourſe is urged afreſh with greater vehemence and paſſion.

PERPENDICULAR, in geometry, a line falling directly on another line, ſo as to make equal angles on each ſide, called alſo a normal line. Thus the line I G (plate XCIX. *fig.* 1.) is perpendicular to the line K H, and makes right and equal angles therewith.

To erect a PERPENDICULAR *on a given Line*, as A B, from any aſſigned point as B (*fig.* 2.) Upon any point, taken at an adventure, out of the given line, as at C, deſcribe ſuch a circle as will paſs through the point from whence the perpendicular muſt be raiſed, as at B, viz. make C B radius; and from the point where the circle cuts the given line as at A, draw the circle's diameter A C D. Then from the point D draw the right line D B, and it will be the perpendicular, as was required.

To let fall a PERPENDICULAR *on a given Line*, as A B, (*fig.* 3) from any aſſigned points, as C. Upon the given point C deſcribe ſuch an arch of a circle as will croſs the given line A B in two points, as at *d* and *f*; then biſſect the diſtance between thoſe two points *d* and *f*, as at *x*. Draw the right line C *x*, and it will be the perpendicular required.

PERPENDICULAR *to a Parabola* is a right line cutting the parabola in the point in which any other right line touches it, and is alſo itſelf perpendicular to that tangent.

PERPENDICULARITY *of Plants*, in natural hiſtory, a quality obſerved in all plants, which though they riſe a little crooked, yet the ſtems ſhoot up, and the roots ſink down as much as poſſible in a perpendicular direction. This curious phænomenon was firſt obſerved by M. Dodart, who publiſhed an expreſs eſſay on the affectation of perpendicularity obſerved in the ſtems or ſtalks of all plants, in the roots of many, and even in their branches. He obſerves, that ſuch plants, or parts of plants, as by the declivity of the ſoil come out inclined, or ſuch as are diverted out of the perpendicular by any violent means, again redreſs and ſtraighten themſelves, and recover their perpendicularity by making a ſecond or contrary bend or elbow without rectifying the firſt.

PERPETUAL, ſomething that endures always, or laſts for ever.

PERPETUAL GLANDS, in anatomy, are thoſe which are natural, thus diſtinguiſhed from the adventitious ones.

PER-

PERPETUAL MOTION, in mechanics, a motion which is ſupplied from itſelf, without the intervention of any external cauſe.

This famous problem has given riſe to an infinite number of ſchemes, which have all proved equally abortive. What has given riſe to the belief of a perpetual motion is the following mechanical principle.

The momentums of the weight and power are as the quantities of matter in each multiplied by their reſpective celerities, and the celerities are as the diſtances from the center of motion, and alſo as the ſpaces paſſed through in a perpendicular direction in the ſame time; it muſt follow that there will be an equilibrium between the weights, when they are to each other reciprocally as the diſtances from the center, or as the celerities of the motions, or as the perpendicular aſcent or deſcent in the ſame time; and this univerſally in all mechanical powers whatever, which is therefore the fundamental principle of all mechanics. — The nature of this propoſition, not being underſtood by ſmatterers in mechanics, gave them occaſion to imagine the poſſibility of a perpetual motion from one part of it, which they did not ſee was utterly impoſſible from another part of it.

What ſeems to promiſe the poſſibility of ſuch a movement, is this, viz. that the momenta of equal bodies are as their diſtances from the center of motion. Hence ſay the perpetual motion men, if a wheel were conſtructed of the form of that in the figure A B C D (plate XCIX. *fig.* 4.) with circular cells going from the inner part E F G H to the outer, containing equal balls, C, D, E, F; then upon turning the wheel they muſt move towards the center N on one part, as the ball E; and from it on the oppoſite part, as the ball C; and by this means the ball C will have a greater momentum than the ball F, and ſo will determine the wheel to move round; and ſince this muſt be the caſe of all the balls E and C that come into the ſituation E C, the wheel muſt neceſſarily move continually, becauſe it will bring two balls into that ſituation. It is true, were there but two balls E and C, the ball C would by this contrivance move the wheel $\frac{1}{4}$ round, viz. while it deſcended from C to D; and by this means would raiſe the ball E to F, and there they will abide in the ſituation D F; but, ſay the men of this perſuaſion, two other balls, ſucceeded to the places E and C, will ſtill keep the wheel moving. Yes, ſo they would, if the balls at D and E could be taken away the moment they come into that poſition, not elſe; for the balls C and E, in order to move the wheel, muſt move the balls D and F, which have equal momenta, as being at the ſame diſtance each from the center, as are the other two reſpectively, which is abſurd by the general propoſition.

The abſurdity of a perpetual motion will ſtill farther appear, if we conſider that the momenta of bodies are always proportioned to the perpendicular deſcent or aſcent to or from the center of the earth. Since, therefore, in the wheel the bodies are all equal by ſuppoſition, and the perpendicular ſpaces through which they deſcend and aſcend, above and below the horizontal line or diameter A C, are equal; it follows, that an equilibrium muſt neceſſarily enſue. Thus, ſo far is this wheel from producing a perpetual motion, that it admits of none at all.

PERPETUITY, in law, is when an eſtate is intended to be ſo ſettled in law, &c. that it may not poſſibly be undone, or made void.

PERQUISITE, in law, is any thing gotten by a man's own induſtry, or purchaſed with his money; in contradiſtinction to what deſcends to him from his father or other anceſtor.

PERQUISITES *of Courts*, are the profits which caſually accrue to a lord of the manor from his courts-baron, by fines for copyholds, eſcheats, heriots, amercements, &c.

PERRON, in architecture, the ſteps in the front of a building, raiſed before the doors of great houſes, and leading to the firſt ſtory, when raiſed above the level of the ground.

Perrons are made of different forms and ſizes, according to the ſpace and height they are to lead to: ſometimes the ſteps are round, or oval, but more uſually they are ſquare. Where a perron is thirteen or fifteen ſteps high, their range ought to be interrupted by one or two landing places, that there may not be too many ſteps to mount ſucceſſively, and that the eye may not be diſpleaſed by viewing ſo great a height without reſts. A perron ſhould always be confined to the height of the zocle, or foot of the whole building.

PERRY, a drink made of pears, in the ſame manner as cyder is made from apples. See CYDER.

The pears muſt be perfectly ripe, and to give the liquor a greater degree of tartneſs, ſome mix crabs with them. The beſt fruit for making perry, are ſuch as are leaſt fit for eating, as the choak-pear, boreland-pear, horſe-pear, and the barberry-pear.

PER SE, in the ſchools, is ſometimes oppoſed to per accidens; in which ſenſe, a thing is ſaid to agree with another per ſe, when the agreement is not owing to any accidental event, but is found in the intrinſic principles of things themſelves.

Among chemiſts, when a body is diſtilled ſingly, and without the uſual addition of any other matter to raiſe it, it is ſaid to be diſtilled per ſe.

PERSECUTION is any pain or affliction which a perſon deſignedly inflicts upon another; and, in a more reſtrained ſenſe, the ſufferings of Chriſtians on account of their religion.

Hiſtorians uſually reckon ten general perſecutions, the firſt of which was under the emperor Nero, thirty one years after our Lord's aſcenſion; when that emperor having ſet fire to the city of Rome, threw the odium of that execrable action on the Chriſtians, who under that pretence were wrapped up in the ſkins of wild beaſts, and worried and devoured by dogs; others were crucified, and others burnt alive. The ſecond was under Domitian, in the year 95. In this perſecution St. John the apoſtle was ſent to the iſle of Patmos, in order to be employed in digging in the mines. The third began in the third year of Trajan, in the year 100, and was carried on with great violence for ſeveral years. The fourth was under Antoninus the philoſopher, when the Chriſtians were baniſhed from their houſes, forbidden to ſhew their heads, reproached, beaten, hurried from place to place, plundered, impriſoned, and ſtoned. The fifth began in the year 197, under the emperor Severus. The ſixth began with the reign of the emperor Maximinus in 235. The ſeventh, which was the moſt dreadful perſecution that had ever been known in the church, began in the year 250, in the reign of the emperor Decius, when the Chriſtians were in all places driven from their habitations, ſtripped of their eſtates, tormented with racks, &c. The eighth began in the year 257, in the fourth year of the reign of the emperor Valerian. The ninth was under the emperor Aurelian, A. D. 274, but this was very inconſiderable: and the tenth began in the nineteenth year of Diocleſian, A. D. 303. In this dreadful perſecution, which laſted ten years, houſes filled with Chriſtians were ſet on fire, and whole droves were tied together with ropes, and thrown into the ſea.

PERSEVERANCE, in theology, a Chriſtian virtue, by which we are enabled to perſiſt in the way of ſalvation to the end.

PERSEUS, in aſtronomy, a conſtellation of the northern hemiſphere, which, according to the catalogues of Ptolemy and Tycho, contains twenty-nine ſtars; but in the Britannic catalogue, ſixty-ſeven.

PERSIA, a large kingdom of Aſia, 1200 miles long, and almoſt as much broad; ſituated between 45° and 67° of eaſt longitude, and between 25° and 45° of north latitude; bounded by Circaſſian Tartary, the Caſpian Sea, and the river Oxus on the north; by India, on the eaſt; by the Indian ocean, and the gulphs of Ormus and Perſia, on the ſouth; and by the Turkiſh empire on the weſt.

PERSIAN-WHEEL, an engine, or wheel, turned by a rivulet, or other ſtream of water, and fitted with open boxes at its cogs, to raiſe water for the overflowing of lands, or other purpoſes.

It may be made of any ſize, according to the height the water is to be raiſed to, and the ſtrength of the ſtream by which it is turned. This wheel is placed ſo, that its bottom only is immerſed in the ſtream, wherein the open boxes at its cogs are all filled one after another

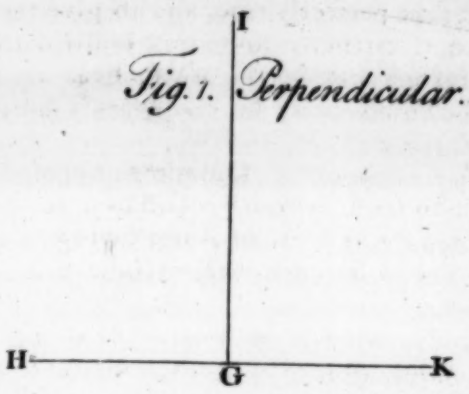


Fig. 1. Perpendicular.

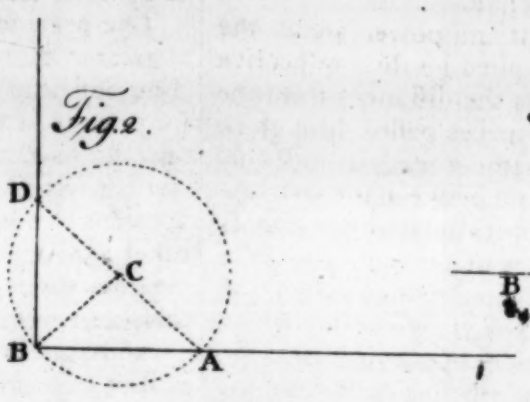


Fig. 2.

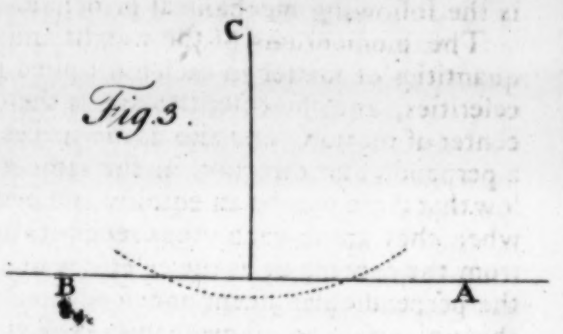


Fig. 3.

Fig. 4. Perpetual Motion.

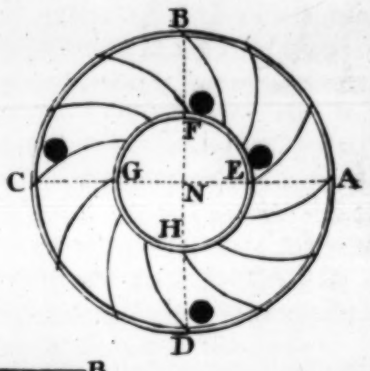


Fig. 5. Petard.

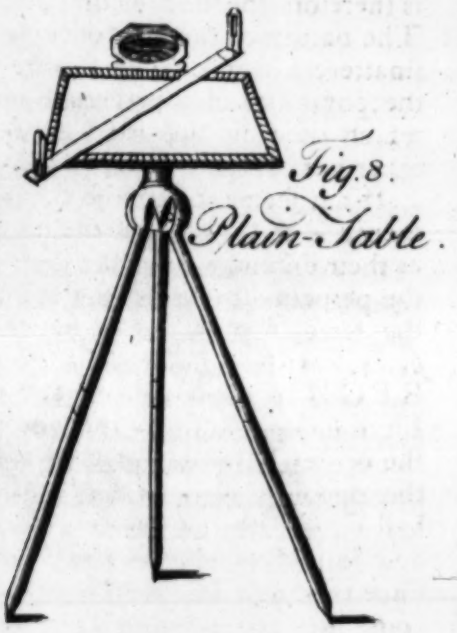


Fig. 8. Plain-Table.

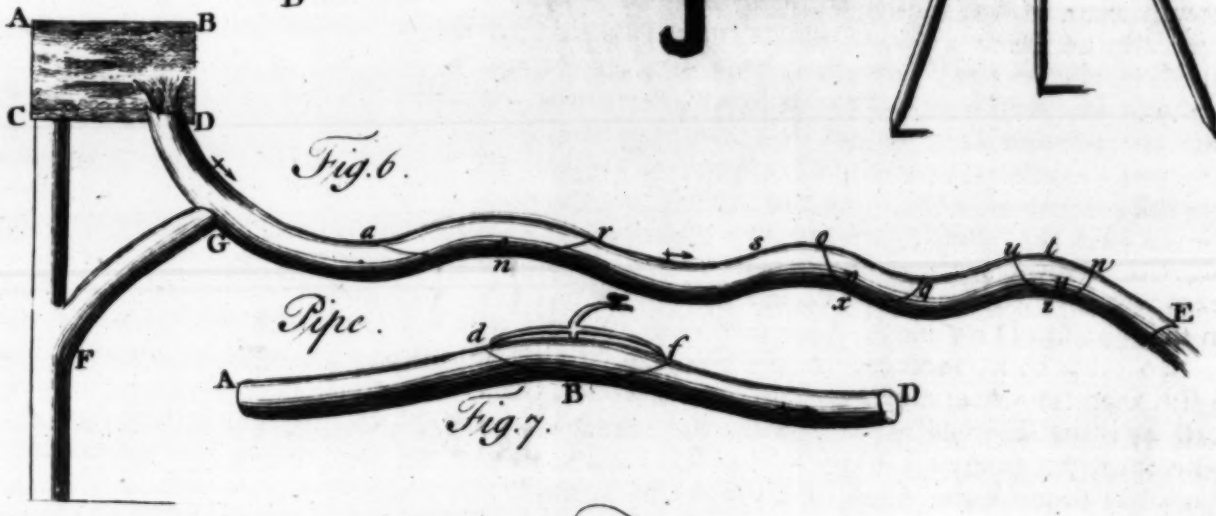


Fig. 6.

Pipe.

Fig. 7.

Fig. 11. Plain-Table.

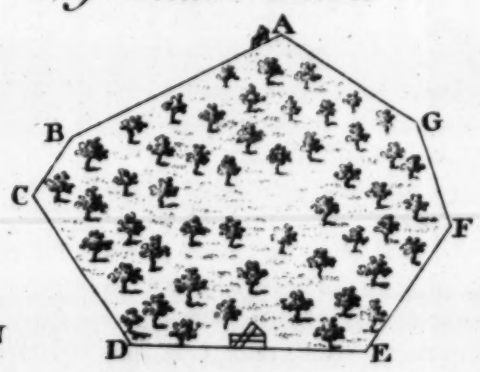


Fig. 10. Plain-Table.

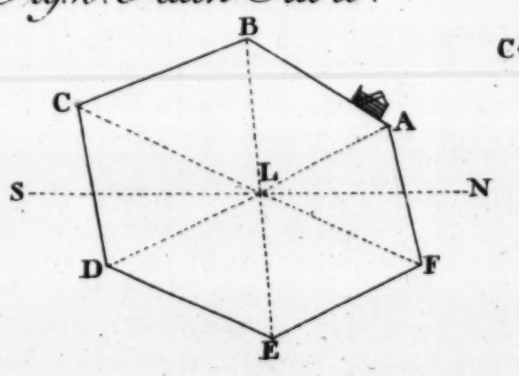
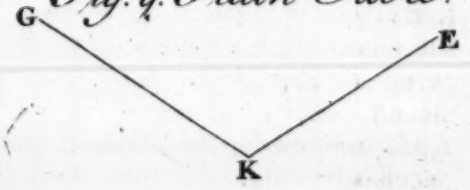


Fig. 9. Plain-Table.



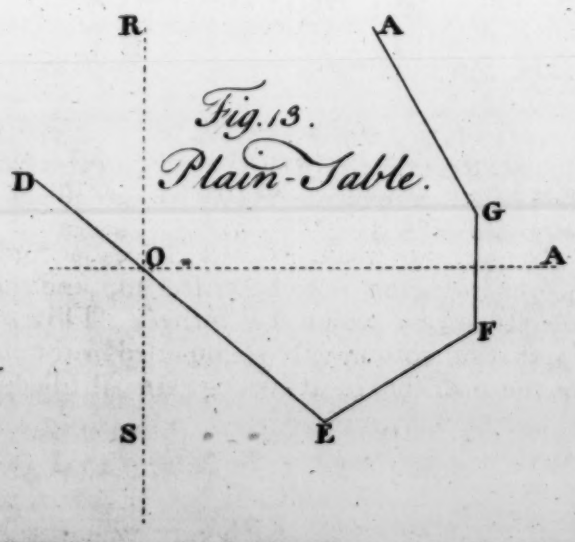


Fig. 13. Plain-Table.

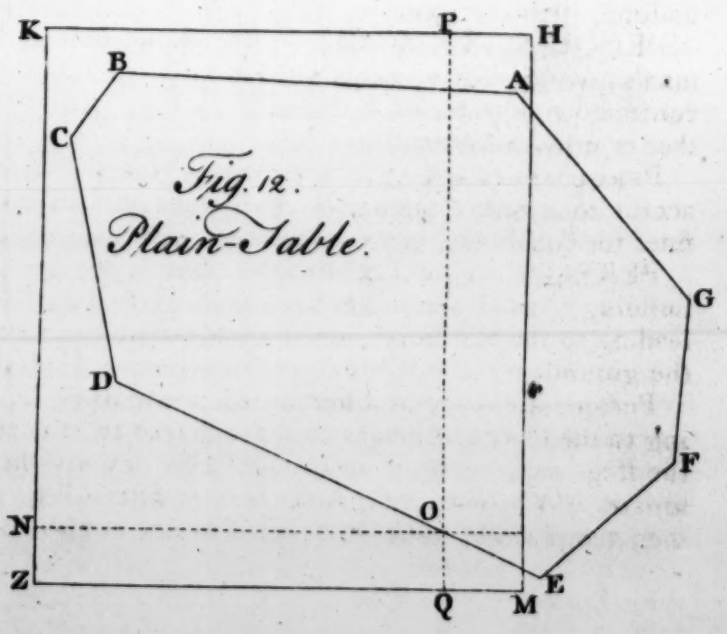


Fig. 12. Plain-Table.

5 JA 59

other with water, which is raiſed with them to the upper part of the wheel's circuit, and then naturally empties itſelf into a trough which carries it to the land.

PERSICA, the peach. See PEACH.

PERSICARIA, in botany, a genus of arſmart plants, with a monopetalous flower, divided into five oval ſegments, alternately patent and connivent: there is no pericarpium; the ſeed, which is ſingle, and of an oval compreſſed figure, being contained in the flower-petal, which is permanent.

There is great irregularity in this genus, there being in ſome ſpecies only five ſtamina; and in others ſix, or eight.

The mild or ſpotted arſmart is ſaid to be a good vulnerary and antepileptic: and the biting arſmart is a good ſtimulating medicine, and diuretic: its freſh leaves are alſo uſed by farriers for cleanſing old ulcers.

PERSON, an individual ſubſtance of a rational or intelligent nature. Thus we ſay, an ambaſſador repreſents the perſon of his prince; and that in law, the father and ſon are reputed the ſame perſon.

In theology, the godhead is divided into three perſons; but here the word perſon is deſigned to convey a peculiar idea, very different from that attached to it every where elſe; it being only uſed for want of another term more pertinent and expreſſive.

PERSON, in dramatic poetry, the character aſſumed by an actor, or he who is repreſented by the player.

PERSON, in grammar, a term applied to ſuch nouns or pronouns, as being either prefixed or underſtood, are the nominatives in all inflexions of a verb; or it is the agent or patient in all finite and perſonal verbs.

PERSONABLE, in law, ſignifies the being able to maintain a plea in court; eſpecially in the caſe of an alien, who may be made perſonable by act of parliament.

It is alſo uſed to ſignify a capacity to receive any thing granted or given.

PERSONAL, any thing that concerns, or is reſtrained to, the perſon: thus it is a maxim in ethics, that all faults are perſonal.

PERSONAL ACTION, in law, is an action levied directly and ſolely againſt the perſon; in oppoſition to a real or mixed action.

PERSONAL GOODS, or CHATTELS, in law, ſignifies any moveable thing belonging to a perſon, whether alive or dead.

PERSONAL TYTHES are tythes payable out of the profits obtained by a man's perſonal labour and induſtry, as in buying, ſelling, handicraft, &c.

PERSONAL VERB, in grammar, a verb conjugated in all the three perſons: thus called, in oppoſition to an imperſonal verb, or that which has the third perſon only. See IMPERSONAL VERB.

PERSONALITY, in the ſchools, that which conſtitutes an individual a diſtinct perſon.

PERSONATED FLOWERS, among botaniſts, are flowers which reſemble the gaping mouths of certain living creatures. See FLOWER.

PERSONIFYING, or PERSONALIZING, the giving an inanimate being the figure, ſentiments, and language of a perſon.

PERSPECTIVE, the art of delineating viſible objects on a plain ſurface, ſuch as they appear at a given diſtance upon a tranſparent plane, placed perpendicular to the horizon, between the eye and the object.

The word is derived from the Latin, *perſpicio*, to ſee plainly.

Perſpective conſiſts of two parts, ſpeculative and practical.

The ſpeculative part, or theory, makes a conſiderable branch of direct optics, in regarding the appearances of all viſible objects, as they exhibit themſelves to the naked eye, and reducing thoſe appearances to mathematical rules and theorems.

The practical part is an application of theſe rules to the actual deſcription of thoſe appearances, the doing of which in a moſt eaſy and uniform manner, for all different caſes, is all that can be expected from it.

But as this part is purely mathematical, its aſſiſtance towards drawing is only what can be performed by rule and compaſs, and can therefore ſtrictly ſerve only for finding the images of points, of which they are compoſed; and as theſe are infinite, it is endleſs to find them all by the ſtrict rules; whence it becomes neceſſary, after a ſufficient number of them are found, to complete the image by the help of drawing, to the better effecting of which theſe points ſerve as a guide. Thus, when a circle is to be deſcribed, the practical rules ſerve to find a ſufficient number of points in the circumference; which, being neatly joined by hand, will perfect the image, ſo that, in ſtrictneſs, nothing in this image is found by mathematical rules, ſave the few particular points; the reſt owes its being to the hand of the drawer.

Thus alſo, if any complicated figure be propoſed, it may not be eaſy to apply the practical rules to the deſcription of every minute part, but by incloſing that figure in a regular one, properly ſubdivided and reduced into perſpective, that will ſerve as a help, whereby a perſon, ſkilled in drawing, may with eaſe deſcribe the object propoſed: upon the whole, where the boundaries of the propoſed objects conſiſt of ſtraight lines, and plain ſurfaces, they may be deſcribed directly by the rules of perſpective; but when they are curvilinear, either in their ſides or ſurfaces, the practical rules can only ſerve for the deſcription of ſuch right-lined caſes as may conveniently incloſe the objects, and which will enable the deſigner to draw them within thoſe known bounds, with a ſufficient degree of exactneſs.

It is therefore in vain to ſeek, by the practical rules of perſpective, to deſcribe all the little hollows and prominencies of objects, the different light and ſhade of their parts, or their ſmaller windings and turnings; the infinite variety of the folds in drapery; of the boughs and leaves of trees, or the features and limbs of men and animals; much leſs to give them that roundneſs and ſoftneſs, that force and ſpirit, that eaſineſs and freedom of poſture, that expreſſion and grace which are requiſite to a good picture: perſpective muſt content itſelf with its peculiar province of exhibiting a kind of rough draught to ſerve as a groundwork, and to aſcertain the general proportions and places of the objects, according to their ſuppoſed ſituations, leaving the reſt to be finiſhed, beautified, and ornamented by a hand ſkilful in drawing.

It is true, perſpective is of moſt uſe where it is moſt wanted, and where a deviation from its rules would be the moſt obſervable; as in deſcribing all regular figures, pieces of architecture, and other objects of that ſort, where the particular tendency of the ſeveral lines is moſt remarkable; the rule and compaſs, in ſuch caſes, being much more exact than any deſcription made by hand: but ſtill the figure, deſcribed by the perſpective rules, will need many helps from drawing; the capitals, and other ornaments of pillars, and their entablatures, the ſtrength of light and ſhade, the apparent roundneſs and protuberance of the ſeveral parts, muſt owe their beauty and finiſhing to the deſigner's hand; but, with regard to ſuch objects as have no conſtant and certain determinate ſhape or ſize, ſuch as clouds, hills, trees, rivers, uneven grounds, and the like, there is a much larger latitude allowable, provided the general bulk, or uſual natural ſhape of thoſe objects, be in ſome meaſure obſerved, ſo as not to make them appear unnatural or monſtrous. See the article DRAWING.

But, although the ſtrict practical rules of perſpective are in a great meaſure confined to the deſcription of right-lined figures, yet the knowledge of the general laws of that ſcience is of great and neceſſary uſe to inform the judgment, after what manner the images of any propoſed lines ſhould run, which way they ſhould tend, and where terminate; and thereby enables it the better to determine what appearance any objects ought to put on, according to their different ſituations and diſtances: it accuſtoms the eye to judge, with greater certainty, of the relations between real objects and their perſpective deſcriptions, and the hand to draw the ſame accordingly; and directs the judgment readily to diſcover any conſiderable error therein, which might otherwiſe eſcape notice. Beſides that, when the ground, or general plan, and the principal parts of a picture are firſt laid down according to the rules, every thing elſe will more naturally fall in with them, and every remarkable deviation from the juſt rules

will be the more readily perceived, and the eaſier avoided or rectified; ſo that although it may be infinitely tedious, or abſolutely impracticable, to deſcribe every minute part of a picture, by the ſtrict mechanical rules; yet the employing them, where they can be the moſt commodiouſly uſed, will give the picture in general ſuch a look, as will guide the artiſt in drawing the other parts without any obvious inconſiſtency.

Without the knowledge of perſpective, a picture is drawn as it were by gueſs, without any certain determinate points, or lines, or any other rule than the judgment of the painter's eye to guide him; here the ſhape and ſituation of his objects are not previouſly determined, but left at large to be modelled as they happen in the progreſs of his work to appear to ſtand beſt: this indeed is the too common way in painters work, as it allows them all kinds of latitude in their deſigns, or rather permits them to paint without any ſettled deſign at all, but as it ſhall happen. If a figure, on examination, appears too large for its diſtance, it is by a ſtroke of a pencil brought to ſtand on nearer ground; mountains are removed from place to place, by raiſing or lowering their foundations, till at laſt the painter fixes them as ſuits beſt with their bulk, and ſtrength of colour which he firſt gave them: as he has no fixed deſign to work by, all he can do is to make his eye the judge, and to correct what, on view, appears to him amiſs; but often, not knowing how to do it, he makes it worſe, and is obliged, after many repeated unſucceſsful trials, to hide that part under a veil, or blot it quite out, and put ſomething elſe in its place that may look better: as he is not ſure of what he really intends, he is obliged to keep others as much in the dark as himſelf, by induſtriouſly avoiding all regular figures and ſtraight lines, and leaving the boundaries of his objects as uncertain as may be; and thus at length the piece is finiſhed, and the painter almoſt as ignorant of the true original, or model of his performance, as the greateſt ſtranger; and, if in this manner it can be completed, without any obvious and groſs faults in it, he is much more beholden to chance and good fortune, than to the rules of the art he profeſſes.

On the other hand a picture, drawn by the rules, may be eaſily reduced to its model; nothing is ambiguous or uncertain in it, but what is ſo in nature; the true diſtance, height, and breadth of every object may be meaſured by a line; the ground and buildings may be reduced to their original plan, and from thence a new picture may be drawn of the ſame things, in any other view. A painter, working by theſe rules, knows what he is about, and lets the ſpectator know it too; he is in no danger of falling into abſurdities, nor does he ſtand in need of blinds and ſhifts to cover his ignorance: if any part of his work hath not a good effect, he knows the fault lies in his model, or deſign, and how, and where, to correct it; and has the pleaſure of working with certainty, without the ſlavery of being obliged to grope out every ſtep of his way, not knowing in the end whether he be right or wrong.

We ſhall now give ſuch rules as are of moſt general uſe in the practice of perſpective. 1. Let every line, which in the object, or geometrical figure, is ſtraight, perpendicular, or parallel to its baſe, be ſo alſo in its ſcenographic delineation. 2. Let the lines, which in the object return at right angles from the fore-right ſide, be drawn ſcenographically from the viſual point. 3. Let all ſtraight lines, which in the object return from the fore-right ſide, run in a ſcenographic figure into the horizontal line. 4. Let the object you intend to delineate, ſtanding on your right-hand, be placed alſo on the right-hand of the viſual point; and that on the left-hand, on the left-hand of the ſame point; and that which is juſt before, in the middle of it. 5. Let thoſe lines which are (in the object) equidiſtant to the returning line, be drawn in the ſcenographic figure, from that point found in the horizon. 6. In ſetting off the altitude of columns, pedeſtals, and the like, meaſure the height from the baſe-line upward, in the front or fore-right ſide; and a viſual ray down that point in the front ſhall limit the altitude of the column or pillar, all the way behind the fore-right ſide, or orthographic appearance, even to the viſual point. This rule you muſt obſerve in all figures, as well where there is a front or fore-right ſide, as where there is none. 7. In delineating ovals, circles, arches, croſſes, ſpirals, and croſs-arches, or any other figure in the roof of any room, firſt draw ichnographically, and ſo with perpendiculars from the moſt eminent points thereof, carry it up unto the ceiling; from which ſeveral points, carry on the figure. 8. The center in any ſcenographic regular figure is found by drawing croſs lines from oppoſite angles; for the point where the diagonals croſs, is the center. 9. A ground-plane of ſquares is alike, both above and below the horizontal line; only the more it is diſtant above or beneath the horizon, the ſquares will be ſo much the larger or wider. 10. In drawing a perſpective figure, where many lines come together, you may, for the directing of your eye, draw the diagonals in red; the viſual lines in black; the perpendiculars in green, or other different colour, from that which you intend the figure ſhall be of. 11. Having conſidered the height, diſtance, and poſition of the figure, and drawn it accordingly, with ſide or angle againſt the baſe; raiſe perpendiculars from the ſeveral angles, or deſigned points, from the figure to the baſe, and transfer the length of each perpendicular, from the place where it touches the baſe, to the baſe on the ſide oppoſite to the point of diſtance; ſo will the diametrals drawn to the perpendiculars in the baſe, by interſection with the diagonals, drawn to the ſeveral transferred diſtances, give the angles of the figures, and ſo lines drawn from point to point will circumſcribe the ſcenographic figure. 12. If in a landſkip there be any ſtanding-waters, as rivers, ponds, and the like, place the horizontal line level with the fartheſt ſight or appearance of it. 13. If there be any houſe, or the like, in the picture, conſider their poſition, that you may find from what point in the horizontal lines to draw the front and ſides thereof. 14. In deſcribing things at a great diſtance, obſerve the proportion, both in magnitude and diſtance, in draught, which appears from the object to the eye. 15. In colouring and ſhadowing of every thing, you muſt do the ſame in your picture, which you obſerve with your eye, eſpecially in objects lying near; but, according as the diſtance grows greater and greater, ſo the colours muſt be fainter and fainter, till at laſt they loſe themſelves in a darkiſh ſky-colour. 16. The catoptrics are beſt ſeen in a common looking-glaſs, or other poliſhed matter; where, if the glaſs be exactly flat, the object is exactly like its original; but, if the glaſs be not flat, the reſemblance alters from the original; and that more or leſs, according as the glaſs differs from an exact plane. 17. In drawing catoptric figures, the ſurface of the glaſs is to be conſidered, upon which you mean to have the reflection: for which you muſt make a particular ichnographical draught, or projection; which on the glaſs muſt appear to be a plane full of ſquares, on which projection transfer what ſhall be drawn on a plane, divided into the ſame number of like ſquares; where though the draught may appear very confuſed, yet the reflection of it on the glaſs will be very regular, proportional, and regularly compoſed. 18. The dioptric, or broken beam, may be ſeen in a tube thro' a cryſtal or glaſs, which hath its ſurface cut into many others, whereby the rays of the object are broken. For to the flat of the cryſtal, or water, the rays run ſtraight; but then they break and make an angle, which alſo by the refracted beams is made and continued on the other ſide of the ſame flat. 19. When theſe faces on a cryſtal are returned towards a plane placed directly before it, they ſeparate themſelves at a good diſtance on the plane; becauſe they are all directed to various far diſtant places of the ſame. See the articles REFLECTION and REFRACTION.

PERSPECTIVE alſo denotes a kind of painting frequently ſeen in gardens, at the ends of galleries, &c. expreſsly deſigned to deceive the ſight.

PERSPECTIVE-GLASS, in optics, differs from a teleſcope in this: inſtead of the convex eye glaſs placed behind the image, to make the rays of each pencil go parallel to the eye, there is placed a concave eye-glaſs as much before it; which opens the converging rays, and makes them emerge parallel to the eye.

The quantity of objects taken in at one view with this inſtrument,

inſtrument, does not depend upon the breadth of the eye glaſs, as in the aſtronomical teleſcope, but upon the breadth of the pupil of the eye.

PERSPECTIVE PLANE, is a glaſs or other tranſparent ſurface ſuppoſed to be placed between the eye and the object, perpendicular to the horizon.

Such is the plane H I (plate XCIV. *fig.* 5.) between the eye O and the object A B C, cutting the optic rays in *a*, *b*, *c*; this is ſometimes called the ſection, table, or glaſs.

PERSPIRATION, in medicine, the evacuation of the juices of the body through the pores of the ſkin. Perſpiration is diſtinguiſhed into ſenſible and inſenſible: and here ſenſible perſpiration is the ſame with ſweating, and inſenſible perſpiration, that which eſcapes the notice of the ſenſes; and this laſt is the idea affixed to the word perſpiration, when uſed alone. The veſſels thro' which perſpiration is performed, lie obliquely under the ſcales of the ſcarf-ſkin, and are ſo inconceiveably ſmall, that from a calculation made by Liewenhoeck, it appears that the mouths of an hundred and twenty-five thouſand of them may be covered with a common grain of ſand. The matter of inſenſible perſpiration is a fine ſubtile fluid, which exhales from the body in the form of a vapour, and proceeds from the whole ſurface and from every cavity: it is of an aqueous and ſaline nature, and ſeems to have a great analogy with urine; becauſe in a healthy ſtate, the increaſe of the one diminiſhes the other. Many experiments prove its exiſtence. If you paſs your finger over a looking glaſs, or any other poliſhed body, it will leave a track of moiſture. If you put your naked head near a white wall, expoſed to the ſun, the ſhadow of the vapours which proceed from the pores of the ſkin, may be plainly ſeen: or if you breathe upon glaſs, you may perceive it covered with ſmall drops of water; and the vapours which proceed from the lungs, are in winter condenſed by the cold, and form a kind of bluiſh miſt, proceeding from the mouth. Other experiments ſhew that the matter evacuated this way, is at leaſt in ſome countries more than equal to all the other evacuations by ſtool, urine, &c. Sanctorius found in Italy, under the circumſtances of a moderate diet, middle age, and eaſy life, that the matter inſenſibly perſpired was five-eighths of that taken in for food: ſo that there only remained three-eighths for nutrition, and for the excrements of the noſe, ears, inteſtines, bladder, &c. The ſame author ſhews, that as much is evacuated by perſpiration in one day, as by ſtool in fourteen days.

But Dr. Bryan Robinſon, of Dublin, has found the caſe very different, both in England and Ireland, and even in South Carolina, in all which places he found that the quantity of urine exceeds that of perſpiration, and that if the meat and drink of one day be four pounds and a half, the perſpiration of that day will be two pounds, the urine two pounds five ounces, and the ſtool three ounces.

The matter of ſweat is ſeparated from the blood by the miliary glands, and is therefore much more groſs than that of inſenſible perſpiration; for as there are no glands which ſerve for the excretion of this laſt fluid, it is ſuppoſed to proceed from the extremities of the capillary arteries.

The uſe of perſpiration is to preſerve the ſuppleneſs of the papillæ of the ſkin; to carry the ſaline particles off from the blood, and by this means to render it more pure; to preſerve the body from various diſeaſes, and to contribute to the cure of the moſt dangerous diſtempers. It may be promoted by exerciſe, by dry frictions with a coarſe linnen-cloth, or a fleſh-bruſh, by warm baths, and waſhing the hands, feet, head, &c.

PERU, formerly a powerful empire in South America, but now a province of Spain, is ſituated between the ſixtieth and eighty-firſt deg. of weſt long. and between the equator and the twenty-fifth of ſouth latitude; being near two thouſand miles in length from north to ſouth, and from two hundred to five hundred broad: it is bounded by Popayan, on the north; by the mountains of Andes, on the eaſt; by Chili and La Plata, on the ſouth; and by the Pacific Ocean on the weſt.

PES FORESTÆ, the foreſt foot, an Engliſh long meaſure, containing eighteen inches.

PESADE, or PESATE, in the manege, is a horſe's raiſing his fore quarters, and bending his feet up to his body without ſtirring his hind feet.

PESSARY, in medicine, a ſolid ſubſtance compoſed of wool, lint, or linen, mixed with powders, oils, wax, &c. made round and long like a finger, in order to be introduced into the exterior neck of the matrix, for the cure of ſeveral diſorders incident to the uterus.

This name is alſo ſometimes given to pieces of cork, or other matters thruſt up the noſtrils, &c. to prevent the entrance of ſtrong infectious ſteams.

PEST-HOUSE, the ſame with lazaretto or lazar-houſe. See LAZAR-HOUSE.

PESTILENCE, in medicine, an epidemical, contagious, and malignant diſeaſe, popularly known by the name of plague. See PLAGUE.

PESTILENTIAL FEVERS, ſuch as are attended with ſome malignant quality, and approach to the nature of the plague. See BILIOUS and HOSPITAL-FEVER.

PETAL, among botaniſts, an appellation given to the flower-leaves, in oppoſition to the folia, or common leaves of the plant.

According to the number of petals in each flower it is ſaid to be monopetalous, or to conſiſt of a ſingle petal; dipetalous, when it has two; tripetalous, when three, &c. See FLOWER.

PETARD, in the art of war, a metalline engine, ſomewhat reſembling a high crowned hat.

The petard may be conſidered as a piece of ordnance; it is made of copper mixed with braſs, or of lead with tin: its charge is from five to ſix pounds of powder, which reaches to within three fingers-breadth of the mouth; the vacancy is filled with tow, and ſtopped with a wooden tampion, the mouth being ſtrongly bound up with cloth tied very tight with ropes. It is covered up with a madrier, or wooden plank, that has a cavity to receive the mouth of the petard, and faſtened down with ropes, as repreſented in plate XCIX. *fig.* 5.

Its uſe is in a clandeſtine attack to break down gates, bridges, barriers, &c. to which it is hung; and this it does by means of the wooden plank. It is alſo uſed in countermines to break through the enemy's galleries, and give their mines vent.

The invention of petards is aſcribed to the French Huguenots, in 1579, who with them took Cahors, as D'Aubigné tells us.

PETARDEER, a perſon who loads, fixes, and fires petards.

PETECHIÆ, in medicine, denote ſpots in the ſkin like flea bites, which come out in malignant fevers, hence called petechial, or ſpotted fevers.

PETER, or *Epiſtles of St.* PETER, two canonical books of the New Teſtament, written by the apoſtle St. Peter, and addreſſed to thoſe Jewiſh converts who were ſcattered throughout Pontus, Galatia, &c. not only upon the perſecution raiſed at Jeruſalem, but upon former diſperſions of the Jews into thoſe places. The firſt of theſe epiſtles is principally deſigned to comfort and confirm them under thoſe fiery trials they were then ſubject to; and to direct them how to behave in the ſeveral ſtates and relations, both of the civil and the Chriſtian life. In the ſecond epiſtle, the apoſtle proſecutes the ſame ſubject, to prevent their apoſtacy from the faith, and guard them againſt the corrupt principles of the Gnoſtics, and thoſe who ſcoffed at the promiſe of Chriſt's coming.

St. PETER'S DAY, a feſtival of the Chriſtian church, obſerved on the twenty-ninth of June.

PETER-PENCE, an ancient tax of a penny on each houſe, paid to the pope.

PETIOLE, *Petiolum*, in botany, the ſlender ſtalk that ſupports the leaves of a plant.

Some alſo uſe the word petiole for the middle rib of a leaf; the branches of which are called rami, and the ſubdiviſions of theſe ſurculi.

PETITIO PRINCIPII, in logic, the taking a thing for true, and drawing concluſions from it as ſuch; when it is really falſe, or at leaſt wants to be proved, before any inferences can be deduced from it.

PETITION, a formal ſupplication or requeſt made by an inferior to a ſuperior, eſpecially to one having ſome juriſdiction.

PETRE,

PETRE, or SALT-PETRE, the ſame with nitre. See NITRE.

PETRIFACTION, in phyſiology, denotes the converſion of wood, bones, and other ſubſtances into ſtone.

PETROBRUSSIANS, in church-hiſtory, a religious ſect which aroſe in France and the Netherlands, about the year 1126, ſo called from their leader Peter Bruys.

They denied that children, before the uſe of reaſon, can be juſtified by baptiſm.

They alſo condemned all places of public worſhip, croiſes, crucifixes; and are ſaid to have rejected the ſacrament of the euchariſt, and prayers for the dead.

PETROLEUM, alſo called oil, or oil of petre, is an extremely ſubtile and penetrating fluid, and is by much the thinneſt of all the native bitumens.

Petroleum is found in rivers, in wells, and trickling down the ſides of hills along with little ſtreams of water. In ſhort, it is the moſt frequent of all the liquid bitumens, and is perhaps the moſt valuable of them all in medicine. It is to be choſen the pureſt, lighteſt, and moſt pellucid that can be had, ſuch as is of the moſt penetrating ſmell, and is moſt inflammable.

It is principally uſed externally, in paralytic caſes, and in pains of the limbs.

PETRONEL, a ſort of harquebuſs, or hand-gun. See HARQUEBUSS.

PETROSA OSSA, in anatomy, a name given to the fourth and fifth bones of the cranium, called alſo oſſa temporum, and oſſa ſquamoſa; the ſubſtance whereof, as their firſt and laſt names expreſs, is ſquamoſe and very hard.

PETTY-BAG, an office in chancery, the three clerks of which record the return of all inquiſitions out of every county, and make all patents of comptrollers, gaugers, cuſtomers, &c.

PETTY-FOGGER, a little, tricking ſolicitor or attorney, without either ſkill or conſcience.

PETUNSE, in natural-hiſtory, one of the two ſubſtances of which the porcelain or china ware is made.

The petunſe is a coarſe kind of flint or pebble, the ſurface of which is not ſo ſmooth, when broken, as that of our common flint.

PEWTER, a factitious metal, uſed in making domeſtic utenſils, as plates, diſhes, &c.

The baſis of this metal is tin, which is converted into pewter, by mixing at the rate of an hundred weight of tin with fifteen pounds of lead and ſix pounds of braſs.

Beſide this compoſition, which makes the common pewter, there are other kinds compounded of tin, regulus of antimony, biſmuth and copper, in ſeveral proportions.

PHÆNOMENON, in philoſophy, an extraordinary appearance in the heavens or earth, either by obſervation of the celeſtial bodies, or by phyſical experiments, whoſe cauſe is not obvious.

The word is Greek, and derived from φαινω, to appear.

Such are meteors, comets, earthquakes, effects of the magnet, &c.

Sir Iſaac Newton ſhews, that all the phænomena of the heavenly bodies follow from the attraction of gravity, and almoſt every phænomenon of the leſſer bodies from the attraction and repulſion between their particles. See ATTRACTION.

PHAGEDÆNA, φαγεδαινα, in ſurgery, denotes a corroding ulcer. See ULCER.

PHAGEDÆNIC MEDICINES, thoſe uſed to eat off fungous or proud fleſh; ſuch are all the cauſtics.

PHALANX, in Grecian antiquity, a ſquare battalion, conſiſting of eight thouſand men, with their ſhields joined, and pikes croſſing each other; ſo that it was next to impoſſible to break it.

PHALEUCIAN VERSE, in ancient poetry, a kind of verſe which conſiſts of five feet, the firſt of which is a ſpondee, the ſecond a dactyl, and the three laſt trochees.

PHANATIC, a term of reproach formerly given to the diſſenters, from a falſe ſuppoſition that they pretended to viſions, &c.

PHANTASM, φαντασμα, a term ſometimes uſed in a ſynonymous ſenſe with idea, or the notion retained in the mind of an external object. See IDEA.

PHANTASTIC STYLE, in muſic, denotes a free and eaſy manner of compoſition, proper for inſtruments.

PHANTASY, or FANCY, the ſame with imagination. See IMAGINATION.

PHARISEES, a famous ſect of the Jews, who diſtinguiſhed themſelves by their zeal for the traditions of the elders, which they derived from the ſame fountain with the written word itſelf; pretending that both were delivered to Moſes from Mount Sinai, and were therefore both of equal authority. From their rigorous obſervance of theſe traditions, they looked upon themſelves as more holy than other men, and therefore ſeparated themſelves from thoſe whom they thought ſinners or prophane, ſo as not to eat or drink with them; and hence, from the Hebrew word *pharis*, which ſignifies to ſeparate, they had the name of Phariſees, or ſeparatiſts.

Their pretences to extraordinary piety drew after them the common people, who held them in the higheſt eſteem and veneration. They held a reſurrection from the dead, and the exiſtence of angels and ſpirits; but, according to Joſephus, this was no more than a Pythagorean reſurrection, that is, of the ſoul only, by its tranſmigration into another body, and being born anew with it. From this reſurrection they excluded all who were notoriouſly wicked, being of opinion, that the ſouls of ſuch perſons were tranſmitted into a ſtate of everlaſting woe: but as to leſſer crimes, they imagined they were puniſhed in the bodies which the ſouls of thoſe who committed them were next ſent into.

According to this notion it was, that Chriſt's diſciples aſked him, concerning the blind man, "Who did ſin, "this man or his parents, that he was born blind?" With the Eſſenes, they held abſolute predeſtination; and with the Sadducees, free-will: but how they reconciled theſe ſeemingly incompatible doctrines, is no where ſufficiently explained.

PHARMACEUTICA, pharmaceutics, that part of medicine, which gives the deſcription of remedies, and teaches the method of rightly exhibiting them.

The word is Greek, and formed of φαρμακευω, to uſe purging medicines.

PHARMACOCHEMIA, that part of chemiſtry which teaches the preparation of chemical medicines, by way of diſtinction from the ſpagirical part, which treats of the tranſmutation of metals.

PHARMACOLOGY, *Pharmacologia*, a treatiſe of medicines, of the art of preparing them, judging of them, &c.

The word is formed of the Greek, φαρμακον, medicine, and λογος, account of.

PHARMACOPOEIA, a diſpenſary, a treatiſe deſcribing the preparations of the ſeveral kinds of medicines, with their uſes, manner of application, &c.

The word is formed of the Greek, φαρμακον, medicine, and ποιεω, to make.

We have various Pharmacopæias, but Quincy's *Pharmacopæia Officinalis & Extemporanea* is reckoned the beſt.

PHARMACOPOLA, an apothecary, or perſon who prepares and ſells medicines.

The word is formed of the Greek, φαρμακον, medicine, and πωλεω, to ſell.

PHARMACY, the art or ſcience which teaches the election, preparation, and mixtures of medicines; conſtituting one part of the therapeutic branch of medicine, the objects of which are all natural bodies.

PHAROS, or PHARE, a light-houſe. See the article LIGHT-HOUSE.

PHARYNX, in anatomy, the upper part of the œſophagus. See OESOPHAGUS.

The muſcles of the pharynx ſerve to open or ſhut the œſophagus: theſe are in number three pair, viz. the ſtylopharyngæus, the pterygopharyngæus, and the œſophagæus.

PHASES, φασεις, in aſtronomy, the ſeveral appearances or quantities of illumination of the moon, Venus, Mercury, and the other planets; or the ſeveral manners

wherein they appear illuminated by the ſun. See the articles MOON, MERCURY, VENUS, &c.

PHASMATA, in phyſiology, certain appearances ariſing from the various tinctures of the clouds, by the rays of the heavenly luminaries, eſpecially the ſun and moon. Theſe are infinitely diverſified by the different figures and ſituation of the clouds, and the appulſes of the rays of light.

PHEASANT, *Phaſianus*, in ornithology, a genus of birds of the order of the gallinæ, with the ſpace about the eyes naked, and no wattles.

PHELLANDRIUM, WATER-HEMLOCK, in botany, a genus of plants, the general corolla whereof is nearly uniform; the ſingle flowers are unequal; they are compoſed each of five acuminated cordato-inflex petals; the fruit is naked, ſmooth, and coronated with the perianthium and piſtils; it is ſeparable into two parts: the ſeeds, are two, oval and ſmooth.

PHEONS, in heraldry, the barbed heads of darts, arrows, or other weapons.

PHIAL, a ſmall thin glaſs-bottle, vulgarly called a vial.

PHILIPPICS, φιλιππικοι λογοι, in literature, a name given to the orations of Demoſthenes againſt Philip king of Macedon; being eſteemed the maſter-pieces of that great orator.

Philippic is alſo a term applied to the fourteen orations of Cicero againſt Mark Antony.

PHILIPPINES, a religious ſociety of young women, at Rome; ſo called from their taking St. Philip de Neri for their protector: they conſiſt of an hundred poor girls, who are brought up till they are of age to be married, or become nuns, under the direction of ſome religious women, who teach them to read, write, and work; and inſtruct them in the duties of Chriſtianity. They wear a white veil, and a black croſs on their breaſts.

PHILLYREA, or PHYLLYREA, in botany, a genus of plants, the corolla whereof conſiſts of a ſingle petal, divided into four ſhort ſegments at the limb; the fruit is a globoſe berry, with only one cell, in which is a ſingle large ſeed, of the ſame ſhape.

The leaves and bark of this ſhrub are ſaid to be aſtringent, and good in ulcers of the mouth; but they are little regarded in the preſent practice.

PHILOLOGY, an aſſemblage of ſeveral ſciences, conſiſting of grammar, rhetoric, poetry, antiquities, hiſtory, and criticiſm.

The word is formed of the Greek, φιλος, lover, and λογος, diſcourſe.

It is a kind of univerſal literature converſant about all the ſciences, their riſe, progreſs, authors, &c. being what the French call the belles lettres. It is called in the univerſities *humanities*, or *literæ humaniores*.

Eratoſthenes, library-keeper at Alexandria, under Ptolemy Philadelphus, was the firſt, according to Suetonius, that was called philologus, or critic, according to Clemens Alexandrinus.

PHILOMATHES, a lover of learning or ſcience.

The word is formed of the Greek, φιλος, lover, and μανθανω, to learn.

PHILONIUM, in pharmacy, a kind of ſomniferous anodyne opiate, taking its name from Philo the inventor.

PHILOSOPHER, a perſon well verſed in philoſophy, or who applies himſelf to the ſtudy of nature and morality.

The word is formed from the Greek, φιλοσοφος, which is compounded of φιλος, a lover, and σοφος, wiſdom.

PHILOSOPHERS-STONE, in alchemy, a long ſought for preparation, which is to tranſmute or exalt impurer metals, ſuch as tin, lead, and copper, into gold and ſilver.

There are three ways whereby the alchemiſts have attempted to arrive at the making of gold; the firſt by ſeparation, the ſecond by maturation, and the third by tranſmuting or turning of all metals readily into pure gold, by melting them in the fire, and caſting a little quantity of a certain preparation into the fuſed matter, upon which the fæces are volatilized and burnt, and the reſt of the maſs turned into pure gold. Whether this third method be poſſible, is very hard to ſay. One natural argument will ſuffice to ſhew the vain pretences of making gold by art. Very plain receipts have been laid down on this ſubject, but, after ten thouſand experiments according to theſe directions, they have always failed of ſucceſs; or, if there was any little gold found, the quantity was ſo ſmall, that it did not near anſwer the trouble and expence, nor give any encouragement to repeat the operation.

PHILOSOPHIC, or PHILOSOPHICAL, ſomething that relates to philoſophy.

PHILOSOPHIC CHEMISTRY is defined by Shaw, an art of dividing or reſolving all the bodies in our power, by means of all the inſtruments that can be procured, and that as well into integrant as into conſtituent parts, and joining theſe parts together again, ſo as to diſcover the principles, relations, and changes of bodies, make various mixtures and compoſitions, find out the phyſical cauſes of phyſical effects; and hence improve the ſtate of natural knowledge, and the arts depending on it. See the article CHEMISTRY.

PHILOSOPHICAL EGG, among chemiſts, a thin glaſs-body, or bubble, of the ſhape of an egg, with a long neck or ſtem, uſed in digeſtions.

PHILOSOPHY, φιλοσοφια, the knowledge or ſtudy of nature and morality, founded on reaſon and experience.

Philoſophy, among the ancients, was uſed in various ſenſes: for, 1. It ſometimes was taken for univerſal knowledge, viz. of all things human and divine. 2. In a ſtricter notion, for the contemplation of nature only; and in this ſenſe a philoſopher was called by Plato φιλος της φυσεως, i. e. a friend and lover of nature. 3. Sometimes for ethics, or the doctrine of manners, which we call moral philoſophy. 4. It included alſo the mathematical arts and diſcipline, eſpecially arithmetic and geometry. 5. The doctrine of exiſtence, or *being* in the abſtract, called metaphyſics. 6. For the knowledge της πρωτης καλης, i. e. of the prime or chief good, viz. God; and this was their prima philoſophia, or theology. 7. It was ſometimes applied to logics or dialectics, which gave rules for reaſoning about the nature of things.

Philoſophy may be divided into three parts, intellectual, moral, and phyſical.

The intellectual part comprizes logics and metaphyſics; the moral part contains the laws of nature and nations; and, laſtly, the phyſical part comprehends the doctrine of bodies animate or inanimate. Theſe, with their various ſubdiviſions, will take in the whole of philoſophy. See LOGICS, METAPHYSICS, ETHICS, POLITICS, &c.

Wolfius makes the three parts of philoſophy to be the doctrine of God, the human ſoul, and of bodies: however, when he ſubdivides, and comes to treat of the ſeveral branches ſeparately, his diviſions readily come under the three heads, intellectual, moral, and phyſical, beforementioned.

For the method of philoſophizing, or the rules for that purpoſe, as eſtabliſhed by Sir Iſaac Newton, ſee the article EXPERIMENTAL PHILOSOPHY.

From the firſt broachers of new opinions, and the firſt founders of ſchools, philoſophy is become divided into innumerable ſects, ſome ancient, others modern; ſuch are the Platoniſts, Peripatetics, Epicureans, Stoics, Pyrrhonians, and Academics; and ſuch are the Carteſians, Newtonians, &c. See the riſe and doctrines of each ſect under its proper head, PLATONIC, PERIPATETIC, EPICUREAN, STOIC, PYRRHONIAN, ACADEMIC, CARTESIAN, NEWTONIAN, &c.

PHILTER, FILTER, in pharmacy. See the article FILTER.

PHILTER, or PHILTRE, φιλτρον, is more particularly uſed for a love-potion, or medicine to excite love. See the article PROVOCATIVES.

PHIMOSIS, in medicine, a diſorder of the penis, in which the prepuce is rendered ſo ſtrict or tenſe, that it cannot be drawn back over the glans.

The general cauſe of a phimoſis is, by phyſicians, rightly aſcribed to impure coition; for while the virulent matter, which had been lodged in the ſinuſes of the vagina, continues between the ſkin and glans, the prepuce, eſpecially if it be long or tight, can hardly eſcape being ſwelled with an inflammation, and a phimoſis muſt

be induced. Some, however, have the foreſkin naturally ſo long, and ſo ſtraight, that the glans can either be not at all or very little uncovered; but as this neither occaſions trouble in diſcharging the urine, nor any impediment in procreation, it requires no aid from the ſurgeon, unleſs it be attended with inflammation, violent pain, or any remarkable inconvenience in coition.

PHLEBOTOMY, in ſurgery, the opening a vein with a proper ſharp-edged and pointed inſtrument of ſteel in order to let out a proper quantity of blood, either for the preſervation or recovery of a perſon's health.

Phlebotomy, or bleeding, appears to be not only one of the moſt uſeful, but one of the moſt ancient operations in ſurgery, and is frequently performed in different parts of the body, as the foot, the forehead, temples, neck, tongue, penis, and the other parts, yet is moſt generally performed in that vein of the inſide of the arm, which lies near the joint of the cubit, and therefore we ſhall begin with ſhewing the method of opening this vein. See VEIN.

The ſurgeon having tied on a fillet, about a hand's breadth above the bend of the cubit; and the veins being compreſſed and enlarged, by the blood's being ſtopped in its return, he is to examine which vein lies faireſt, and is therefore moſt proper to be opened. In the arm are three principal veins; the firſt or uppermoſt of which is called the cephalic vein, the undermoſt the baſilic vein, and that in the middle the median. And here it is obſerved, that the median and baſilic veins, as they are larger than the cephalic, diſcharge a greater quantity of blood, but are attended with more danger in the operation; for a conſiderable artery and the brachial nerve lie under the baſilic vein, and the tendon of the biceps muſcle under the median; but as they lie fairer to the eye, it is ſafer for the unexperienced ſurgeon to open the cephalic, or at leaſt the median vein; but ſometimes the veins are ſo ſituated as to deprive him of all choice. When the veins are not riſen, it will be proper to rub the arm below the bandage, to drive up the blood, and render the veins more turgid: while this is doing, the ſurgeon ſhould lay his thumb on the vein he intends to open, to prevent the blood from flowing back, and to keep the vein from rolling; and then holding the lancet, ſo that the thumb and firſt finger may be fixed about the middle of the blade, the other fingers ſhould reſt gently upon the patient's arm, to prevent his hand from ſlipping. The lancet is now to be puſhed lightly and carefully forward by the thumb and fore-finger, till it has penetrated through the coats of the vein, and at that inſtant to be raiſed a little upwards in order to enlarge the orifice of the wound, and give a freer paſſage to the blood. When there ſeems to be a ſufficient quantity of blood diſcharged, the ligature muſt be immediately taken off, from above the elbow, and the ſkin about the orifice muſt be gently preſſed together, by which means the lips of the divided vein are eaſily cloſed, and the little blood that may remain between the orifice and the vein diſcharged: one or two compreſſes are then put on, which the ſurgeon preſſes gently on the orifice with his left thumb, till the bandage is laid acroſs it, which is afterwards faſtened by turning it round the arm, both above and below the elbow, and tying both together.

In bleeding in the foot, it muſt be obſerved, that the veins proper for this operation, are the ſaphena and cephalica, the laſt of which extends itſelf from the internal ancle to the great toe; and the firſt, from the external malleolus to the ſmaller toes: bleeding in each of which is attended with the ſame effect: but if the veins upon the metatarſus, or inſtep, do not fully appear, it may be convenient to open one of thoſe at the ancle, or about the calf or ham of the leg, where the phlebotomiſt is not ſo liable to injure any of the tendons, as in the metatarſus. For the more eaſy apertion of theſe veins, the patient muſt firſt waſh both feet in warm water; and the ſurgeon having fixed upon the particular foot and vein, which appears moſt turgid, he applies a ligature about two fingers-breadth, above the ancle, or where he intends to open the vein, and puts it in the warm water again, while he takes out his lancet. Then kneeling down on one knee, he takes out the foot, and, it being wiped dry, places it on the other knee, or upon a board laid over the veſſel of warm water, and, ſecuring the vein from ſlipping with the thumb of his left hand, makes the orifice; but if the patient does not bleed freely, puts the foot again in the warm water, till he judges, by its colour, and the ſtrength of the patient, that a ſufficient quantity of blood has been drawn; the orifice is then to be cloſed by the thumbs, and, after drying the foot with a napkin, to be ſecured by compreſſes and a bandage.

In bleeding in the jugular veins of the neck, a ſtricture muſt be made round the lower part of the neck, with a neck-cloth or handkerchief, or the common ligature, to make the vein turgid or conſpicuous, and then either of the jugular veins being ſecured by the thumb, the inciſion muſt be made, and the requiſite quantity of blood being taken away, the ligature muſt be removed, and the orifice compreſſed with the thumb, if the blood does not ſtop without, while the neck is wiped clean; after which the compreſs and circular bandage muſt be applied. It is to be obſerved, that if the diſorder lies in the whole head, or in the neck and fauces, the orifice may be made either in the right or left ſide indifferently; but when only one ſide of the head, or one eye is affected, the vein ought to be opened on that ſide in which the diſorder lies.

In bleeding in the veins of the forehead, temples, and occiput, a ſtricture muſt be made round the neck, and the ſame method uſed as in opening the jugular veins; only obſerving that the patient muſt hold down his head, to prevent the blood trickling into his eyes, &c.

In bleeding in the veins called ranulæ under the tongue, a ſtricture muſt be made round the neck, as before; you then elevate the apex of the tongue with your left hand, while with the lancet in your right hand, you circumſpectly open firſt one, and then the other, on each ſide; becauſe the apertion of one only will hardly ever diſcharge blood enough to give any conſiderable relief. When you judge that a ſufficient quantity of blood has run out of the mouth into the veſſel, remove the ligature from the neck, upon which the flux uſually ſtops of itſelf; but if it ſhould ſtill continue, let the patient take a little vinegar or Frontiniac wine in his mouth, and hold it there till the hæmorrhage ceaſes, which cannot be dangerous, even without ſuch topics. In bleeding in the vena dorſalis penis, which runs along the upper ſide of the penis, and is generally pretty much diſtended, and conſpicuous in an inflammation of this part, it is to be obſerved that it muſt be opened about the middle, and kept bleeding till the member becomes flaccid, and a ſufficient quantity of blood is diſcharged; which done, you muſt apply a compreſs, and the bandage proper for the penis. But you muſt carefully endeavour to avoid injuring the arteries or nerves which enter the penis near this vein; as alſo not to make your bandage too ſtrict; for by this means, the inflammation and ſymptoms may turn out worſe than before.

PHLEGM, φλεγμα, in the animal œconomy, one of the four humours whereof the ancients ſuppoſed the blood to be compoſed. See BLOOD.

PHLEGMAGOGUES, in pharmacy, ſuch medicines as purge off phlegm, ſuch are hermodactyls, agaric, turbith, jalap, &c. See HYDRAGOGUES.

PHLEGMATIC, among phyſicians, an appellation given to that temperament, or habit of the body, wherein phlegm is predominant; which gives riſe to catarrhs, coughs, &c.

PHLEGMON, in ſurgery, denotes an external inflammation and tumour, attended with a burning heat, &c. See the article INFLAMMATION.

The word is Greek, φλεγμονη, which is derived from the Greek, φλεγω, to burn.

PHLYCTÆNÆ, in medicine, ſmall eruptions on the ſkin, ariſing from an hot or acrimonious humour. Hippocrates ſometimes repreſents them as reſembling thoſe puſtules which appear after ambuſtions.

PHOCA, the ſea-calf, in zoology, a genus of quadrupeds of the order of the feræ: the fore-teeth in the upper jaw are ſix, thoſe in the under jaw are only four: the feet have each five toes, and are palmated, and made for ſwimming; there are no ears.

PHOENIX, in aſtronomy, one of the conſtellations of the ſouthern hemiſphere unknown to the ancients, and inviſible in our northern parts. This conſtellation is ſaid to conſiſt of thirteen ſtars. It took its name from that of a bird

a bird famous among the ancients, but generally looked upon by the moderns as fabulous. The ancients ſpeak of this bird as ſingle, or the only one of its kind: they deſcribe it as of the ſize of an eagle; its head finely creſted with a beautiful plumage, its neck covered with feathers of a gold colour, and the reſt of its body purple, only the tail white, and the eyes ſparkling like ſtars; they hold that it lives five or ſix hundred years in the wilderneſs; that when thus advanced in age, it builds itſelf a pile of ſweet wood and aromatic gums, and fires it with the waſting of its wings, and thus burns itſelf; and that from its aſhes ariſes a worm, which in time grows up to be a phoenix.

PHOENIX, the great palm, or date-tree, in botany, a genus of plants, the characters of which are not yet perfectly aſcertained: the male and female flowers are on diſtinct plants, or on the ſame ſpadix. In the male flowers the general ſpatha is compoſite; the ſpadix is ramoſe; the corolla is deeply divided into three hollow oval ſegments; the ſtamina are three ſlender filaments. In the female flowers the calyx is the ſame as in the male; the corolla is divided into three principal ſegments, with as many very ſmall laciniæ: the fruit is an oval berry, having only one cell, and in that a ſingle oſſeous ſeed, of a ſub-oval figure, with a longitudinal furrow.

PHOLAS, a ſhell-fiſh of the multivalve-kind, compoſed of five pieces, three of which are very ſmall, ſo that they ſeem to a ſuperficial obſerver to be made up of only two ſhells.

The animal inhabiting the pholas is called tethys. They inhabit holes made in ſtones and other ſolid bodies, as corals, the bottoms of ſhips, &c. whence all ſhell-fiſh living in this manner have been commonly called pholades, ſince there are muſcles and chamæ found lodged in the ſame manner.

PHONICS, φωνιχη, the doctrine or ſcience of ſounds, otherwiſe called acouſtics. See SOUND.

PHOSPHORUS, in phyſiology, a denomination given to all bodies which ſhine and ſeem to burn, without having any degree of heat.

Chemiſtry, ſays Dr. Shaw, hath ſcarce afforded any thing more ſurpriſing than the common phoſphorus. To ſee letters traced with this matter become luminous in the dark, images and the bodies of men to blaze with light, and abundance of the like experiments performed by means of phoſphorus, muſt awaken the curioſity of thoſe who have ſeen theſe experiments, and render them deſirous of being acquainted with the method of preparing it. The preparation, even to this day, is kept as a ſecret in few hands, and the matter ſold at a very great price; whence we apprehend it would be no unacceptable preſent to the world, to render this commodity cheaper, and diſcover its farther uſes.

The ſucceſsful method of preparing the phoſphorus of urine is this: Evaporate any quantity of freſh urine over a gentle fire, to a black and almoſt dry ſubſtance; then, with two pounds thereof, thoroughly mix twice its weight of fine ſand; put this mixture into a ſtrong coated ſtone long-neck; and having poured a quart or two of clear water into a large receiver, join it to the long-neck, and work it in a naked fire: let the heat be ſmall for the firſt two hours; then increaſe it gradually to the utmoſt violence; and continue this for three or four hours ſucceſſively: at the expiration of which time, there will paſs into the receiver a little phlegm and volatile ſalt, much black and fœtid oil, and, laſtly, the matter of phoſphorus, in form of white clouds, which either ſtick to the ſides of the receiver, like a fine yellow ſkin, or fall to the bottom in form of ſmall ſand. Now let the fire go out, but let the receiver continue till all be cold, leſt the phoſphorus take fire on the admiſſion of the air. To reduce theſe ſmall grains into one piece, put them into a little tin ingot-mould, with water; heat the ingot to make the grains melt together; then add cold water, till the matter is congealed into one ſolid ſtick, like bees-wax; which being cut into ſmall pieces, fit to enter the mouth of a vial, may be preſerved by water, and keeping the glaſs cloſe ſtopped. If the glaſs were not to be ſtopped, the phoſphorus would turn black on its ſurface, and at length be ſpoiled.

The cautions required to make this proceſs ſucceed, are, 1. To evaporate the urine, while it is recent. 2. To prevent its boiling over, and by that means loſing the moſt unctuous part. 3. To let the matter afterwards ferment in the cold. 4. To mix the black matter with the ſand, to prevent its melting and running over. 5. To uſe a ſtone long-neck, thoſe of earth being too porous, and ſuffering the phoſphorus to tranſude ſooner than paſs into the receiver. 6. To have the receiver very large, and with a very long-neck, to prevent its breaking and over-heating, which would either evaporate the white vapour wherein the phoſphorus conſiſts, or elſe prevent its coagulating. 7. To put water into the receiver, for keeping it cool, and quenching the phoſphorus, as it falls to the bottom. 8. To make the fire ſmall at firſt, that the long-neck may be preſerved, and the black matter gradually dried; which would otherwiſe ſwell and run over in a black froth. 9. Laſtly, it is found neceſſary, that the urine for the operation be of ſuch as drink malt-liquors, rather than wine. All theſe circumſtances being required for obtaining the phoſphorus to advantage, it is no wonder that ſo many of thoſe who attempted it, miſcarried.

This operation may be greatly ſhortened, by freezing and concentrating freſh urine; afterwards evaporating it with care; then digeſting it in the manner above-mentioned. When thoroughly digeſted, commit the matter, in a large quantity, to an iron-pot, with an earthen head, as the chemiſts uſually do for making ſpirit of hartſhorn, or the ſpirit and ſalt of urine: and when, by this method, all the ſalt and oil are obtained, let the caput mortuum be taken out, and mixed with twice its own weight of alum. The matter may now be put into well-coated long-necks, and worked with care in a reverberatory furnace, into very large receivers filled with water, and connected to the long-necks by adopters, the lower ends whereof may enter the water, as in diſtilling of quickſilver; the operation being continued eight or ten hours. And this is apprehended to be the beſt way, hitherto known, of procuring phoſphorus to advantage.

PHOTINIANS, a ſect of Chriſtians in the fourth century, ſo called from Photinus, their chief, who was biſhop of Sirmich, and maintained that Jeſus Chriſt was true man, but not true God, nor born before all ages; and that he only began to be Chriſt when the Holy Spirit deſcended upon him in the river Jordan. Theſe doctrines were condemned in ſeveral aſſemblies, and particularly by the Arians in a ſynod held at Sirmich in the year 351.

PHRASE, φραϛις, in grammar, a manner of ſpeech peculiarly adapted to certain occaſions, arts, languages, &c.

Sometimes the word phraſe is uſed for a ſhort ſentence. See SENTENCE.

PHRASEOLOGY, in matters of literature, a collection of the phraſes, and elegant expreſſions, in any language.

PHRENES, φρενες, in anatomy, the name by which Hippocrates, and the ancient phyſicians, called the diaphragm, as ſuppoſing it to be the ſeat of the rational ſoul. See the article DIAPHRAGM.

PHRENETIC VESSELS, in anatomy, the nerves, arteries, and veins which are ſpread over the diaphragm. The phrenetic nerves ariſe from the cervical ones; the phrenetic arteries ariſe out of the deſcending aorta, and are diſtributed through the diaphragm and pericardium; and the two phrenetic veins diſcharge their contents into the vena cava.

PHRENSY, φρενιτις, in medicine, an inflammation of the membranes of the brain, attended with an acute fever and delirium.

This diſeaſe, ſays Arbuthnot, requires the ſpeedieſt applications of all others; profuſe hæmorrhages of the noſe often reſolve it; and copious bleeding in the temporal arteries, is the moſt efficacious remedy. The diet ſhould be water-gruel, acidulated; and the drink barley-water, ſmall beer, or the decoction of tamarinds.

According to Boerhaave, varices of the veins, or the bleeding piles, are beneficial: a looſeneſs is likewiſe good; and a violent cough, or hæmorrhage, often put an end to the diſeaſe. He therefore adviſes plentiful bleeding, through a large orifice, or to open ſeveral veins

the ſame time, as the jugular, frontal, and a vein in the foot.

Hoffman, from experience, prefers bleeding at the noſe, procured by thruſting up a ſtraw, a pen, or a ſkewer. But if this diſeaſe proceeds from a ſuppreſſion of the lochia or menſes, ſpeedy and copious bleeding in the foot is neceſſary; and if from a ſtoppage of the bleeding piles, leeches muſt be applied to the hæmorrhoidal veins. After bleeding, cathartics are proper; among which, the following is preferable to all others: take of manna, four ounces; of cream of tartar, two drams; of nitre, half a dram; of oil of ſweet almonds, an ounce: all which are to be taken in a pound of whey. The drink alſo ſhould be freſh whey. Emulſions of the four cold ſeeds with barley-water, adding to every quart two ſcruples of nitre, are alſo convenient.

Externally, warm baths are proper for the feet; or linnen-cloths may be dipped in hot-water, and applied to the feet. But eſpecially let the head be ſhaved all over, and embrocated with a mixture of the beſt vinegar, two ounces; camphorated ſpirit of wine, two drams; purified nitre, two ſcruples; and oil of rhodium-wood, twenty drops. Antiphlogiſtic clyſters are alſo proper.

But if all theſe means fail, recourſe muſt be had to cupping in the lower parts, to opiates and mild bliſters: though Hoffman thinks the two latter hurtful; and Boerhaave adviſes the phyſician to conſider well, if the caſe be ſymptomatical, how far the foregoing method, or any part of it, is conſiſtent with the primary diſeaſe.

PHTHIRIASIS, φθειριασις, in medicine, the pedicularis morbus, or louſy diſeaſe, is moſt incident to children, though adults are not wholly exempt from it.

Cleanneſs and wholeſome food are beſt for preventing this diſorder, which may be cured by waſhing the body with a lixivium of wormwood, ſtaves-acre, leſſer centaury, and oak-aſhes; adding ſome common ſalt. All the bitters, ſour and ſalt things, are here recommended; as is alſo mercury, which infallibly deſtroys theſe vermin; but it ought to be uſed with great caution, even by adults, and ſhould never be uſed in applications to children.

PHTHISIS, φθισις, a ſpecies of conſumption ariſing from an ulcer of the lungs. See the article CONSUMPTION.

The ſigns of an approaching phthiſis, according to Morton, is a dry cough, which may continue for ſome months; whereas a ſimple catarrh is attended with ſpitting, and is but of ſhort duration. Vomiting, or a diſpoſition to vomit after eating, excited by the above-mentioned cough, is a moſt certain ſign of a phthiſis.

In the firſt ſtage of a conſumption, when the patient is afflicted with a continual cough, eſpecially in the night time, the defluxion upon the lungs is to be ſtopped by bleeding, by repeated draughts of oxymel of ſquills and oil of ſweet almonds, of each an ounce, to be taken in large draughts of poſſet-drink; after which an opiate, made of two ounces of the ſimple elxiterial water, half an ounce of ſimple cinnamon-water, and ſix drams of the ſyrup of poppies will be proper; or the patient may take ſix or ten of the ſtorax pills. It will alſo be convenient to carry down the impurities by ſtool, with a gentle cathartic. Diaphoretics likewiſe are not to be neglected; nor muſt thoſe remedies that ſoften, lubricate, thicken, and concoct the phlegm be omitted; as ſugar-candy, barley-ſugar, old conſerve of roſes, liquorice-juice, the white and black troches of the London-diſpenſatory, freſh butter, in water-gruel, ſweet oil of ſweet almonds, and eſpecially linſeed oil cold drawn, of which the patient may take a ſpoonful every hour, unleſs there is a diarrhœa, or other ſymptom that forbids it. He may alſo eat raiſins and figs, and uſe the other medicines commonly preſcribed for coughs. See COUGH.

In the ſecond ſtage, when the vomica is formed, but not ſuppurated, evacuations of all kinds are pernicious. The patient ſhould continue the uſe of the pectoral medicines, and eſpecially the balſamic pills, milk-diet, and the chalybeate-waters; of which he ſhould drink only four, or at moſt ſix pints in a day, and a little at a time: and this courſe ſhould be continued for ſeveral years.

But whether a milk-diet be uſed alone, or mixed with mineral waters, Hoffman thinks it highly neceſſary to attend to the following particulars: 1. We ought diligently to enquire whether the ſtrength of the ſtomach is ſufficient to digeſt and again expel this ſpecies of medicine. 2. It is expedient that, before the uſe of the milk, the primæ viæ ſhould be well cleanſed from viſcid and acid humours; which intention is moſt effectually anſwered by a laxative infuſion of manna, whoſe virtue is augmented by adding a ſufficient quantity of tartar. 3. On the firſt days, it is expedient every morning about ſix or ſeven, and every afternoon, about five o'clock, to drink ſix or eight ounces of women's or aſſes-milk, and afterwards gradually to increaſe the quantity. 4. After the patient has for ſix or eight days drank the milk in this manner, a gentle laxative medicine, and ſuch as has a tendency to evacuate the ſordes, is to be interpoſed and repeated every ſixth day. 5. He ought never to uſe wine or malt-liquors for drink, but rather ptiſans of barley, hartſhorn, and citron-peel. He muſt alſo carefully abſtain from aliments of hard digeſtion, and ſuch as generate bad juices. On the contrary, broth prepared of tortoiſes, cray-fiſh, veal, fowls, lettuce, and garden ſuccory, are of ſingular ſervice. 6. In order to augment the concoctive force of the ſtomach, which in a phthiſis is very languid, it is expedient between meals to exhibit ſome balſamic pectoral, and ſtomachic elixir, ſuch as that made of the beſt myrrh, ſaffron, nutmegs, orange-peel, marſh-trefoil, and liquorice root.

As to the pectoral and vulnerary balſams, the forms recommended by the moſt celebrated phyſicians, are, according to the ſame author, the following ones.

Take of the oil of St. John's wort, two ounces; of ſperma-ceti, ſix drachms; of the beſt Venice-turpentine, three drachms; of dragon's blood, one drachm; and of laudanum opiatum, ſix grains: mix all together, and let the doſe be from one to two drachms.

Nor, ſays he, have I found the following balſam leſs efficacious: take of the oil of ſweet almonds, two ounces: and of the flowers of ſulphur, ſublimed by quick-lime, two drachms: boil over a gentle fire; then add, of the balſam-capivi, one drachm; of ſperma-ceti and bees-wax, each half an ounce; of the extract of ſaffron, half a drachm; and of the oils of aniſe, fennel and mace, each ten drops.

Another balſam for anſwering the ſame end may be prepared thus. Take of the beſt Pruſſian honey and mountain-diacodium, each one ounce; of the aqueous eſſence of myrrh inſpiſſated, half an ounce; of the flowers of ſulphur, and the extract of the tops of yarrow, each two drachms; of the extract of ſaffron, half a drachm; and of the oils of mace and ſaſſafras-wood, each eight drops.

Theſe noble and efficacious balſams, when their uſe is indicated, cannot be exhibited in a better or more proper vehicle, than a ſufficient quantity of the milk of aſſes, goats, or cows.

In colliquative ſweats, Morton recommends the free uſe of pearl-julep; to which may be added chalk, coral, dragon's blood, or other abſorbents: the patient ſhould not be allowed to ſleep too long, and the bed-cloths ſhould be lighter.

PHYGETHLON, in ſurgery, a broad, but not much elevated tumour, of the ſame nature with the bubo. See BUBO.

PHYLACTERY, in antiquity, a charm, or amulet, which being worn, was ſuppoſed to preſerve people from certain evils, diſeaſes, and dangers.

The Jews were remarkable for wearing phylacteries of parchment, in the form of ſlips or rolls, wherein were written certain paſſages of the law: theſe they wore upon their foreheads, and upon the wriſts of their left arms. The modern Jews think themſelves under an obligation to this practice, which they obſerve only at morning prayers.

PHYSIC, φυσικη, the ſame with medicine. See MEDICINE.

PHYSICAL, ſomething relating to nature. See NATURE and NATURAL PHILOSOPHY.

PHYSICIAN, a perſon who profeſſes medicine, or the art of healing diſeaſes. See the article MEDICINE and DISEASE.

For an account of the college of phyſicians in London, ſee COLLEGE.

PHYSICS, a denomination ſometimes given to natural philoſophy. See the article NATURAL PHILOSOPHY.

PHYSIOGNOMONICS, among phyſicians, denote ſuch ſigns as being taken from the countenance, ſerve to indicate the ſtate, diſpoſition, &c. both of the body and mind: and hence the art of reducing theſe ſigns to practice is termed phyſiognomy, than which nothing can be more precarious, in ſo far as it reſpects the characters of people, accuſtomed by education and practice to diſſemble their ſentiments.

PHYSIOLOGY properly denotes a diſcourſe of nature, and natural bodies; or, it is that part of natural philoſophy which treats of the various phænomena of nature in a ſcientifical and ſpeculative way; in which ſenſe, neither chemiſtry nor experimental philoſophy are included under it.

If we take a view of the ſeveral phænomena, and compare them together, we may obſerve ſome likeneſs and conformity between them. For example, in the falling of a ſtone to the ground, in the riſing of the ſea towards the moon, in a coheſion and cryſtallization, there is ſomething alike; namely, an union or mutual approach of bodies: ſo that any one of theſe, or the like phænomena, may not ſeem ſtrange or ſurpriſing to a man who has nicely obſerved and compared the effects of nature: for that only is thought ſo which is uncommon, or a thing by itſelf, and out of the ordinary courſe of our obſervation. That bodies ſhould tend towards the center of the earth is not thought ſtrange, becauſe it is what we perceive every moment of our lives; but that they ſhould have a like gravitation towards the center of the moon, may ſeem odd and unaccountable to moſt men, becauſe it is diſcerned only in the tides; but a philoſopher, whoſe thoughts take in a larger compaſs of nature, having obſerved a certain ſimilitude of appearances, as well in the heavens as the earth, that argue innumerable bodies to have a mutual tendency towards each other, which he denotes by the general name attraction, whatever can be reduced to that he thinks juſtly accounted for; and thus he explains the tides by attraction. See ATTRACTION and TIDE.

If therefore we conſider the difference there is betwixt natural philoſophers and other men, with regard to their knowledge of the phænomena, we ſhall find it conſiſts only in a greater largeneſs of comprehenſion; whereby analogies, harmonies, and agreements are diſcovered in the works of nature, and the particular effects explained; that is, reduced to general rules, which rules, grounded on the analogy and uniformneſs obſerved in the production of natural effects, are moſt agreeable and ſought after by the mind; for that they extend our proſpect beyond what is preſent and near to us, and enable us to make very probable conjectures touching things that may have happened at very great diſtances of time and place, as well as to predict things to come; which ſort of endeavour towards omniſcience, is much affected by the mind.

Among phyſicians, the term phyſiology denotes the hiſtory of the human body and its ſeveral conſtituent parts, with their relations and functions.

PIA MATER, in anatomy, the third tunic or membrane of the brain, placed immediately under the tunica arachnoides, and cloſely and firmly connected to the brain: it not only extends over the whole ſurface of the brain, but inſinuates itſelf into all its cavities, and is carried down to the bottom of all its furrows. It covers alſo the ſpinal marrow, and all the nerves, and adheres alſo to the tunica arachnoides very cloſely and firmly, in the upper part of the head; but much leſs ſo below, with the dura mater.

PIAZZA, in building, a portico, or covered walk, ſupported by arches. See the article PORTICO.

PICA, in medicine, a depravation of appetite, which makes the patient long for what is unfit for food, or incapable of nouriſhing, as chalk, aſhes, coals, plaſter, lime, &c.

PICARDS, a ſect ſo called from their leader, one Picard, a Fleming, who, about the beginning of the fifteenth century, improved upon the error of the Adamites, in reſpect to nakedneſs; and who pretended that he was ſent into the world, as another Adam, to reſtore the law of nature, which, he ſaid, conſiſted principally of two things, a community of women, and a nakedneſs of all the parts of the body.

PICAGE, or PICCAGE, an ancient cuſtom or duty paid at fairs and markets, for breaking the ground, and pitching up ſtalls or ſtandings.

PICKLE, a brine or liquor, commonly compoſed of ſalt, vinegar, &c. ſometimes with the addition of ſpices, wherein meat, fruit, and other things are preſerved and ſeaſoned. The ſame name is alſo given to any vegetable production prepared in pickle.

PIQUEERING, PICKEERING, or PICKEROONING, a flying war or ſkirmiſh made by ſoldiers detached from two armies for pillage, or before a main battle begins.

PICTURE, a piece of painting, or a ſubject repreſented in colours, on wood, canvas, paper, or the like. See PAINTING.

PIECE, in commerce, ſignifies ſometimes a whole, and ſometimes a part of the whole. In the firſt ſenſe, we ſay a piece of cloth or velvet, &c. meaning a certain quantity of yards regulated by cuſtom; being yet entire, and not cut. In the other ſignification, we ſay a piece of tapeſtry, meaning a diſtinct member wrought a-part, which, with ſeveral others, make one hanging.

PIECE, in matters of money, ſignifies ſometimes the ſame thing with ſpecies; and ſometimes by adding the value of the pieces, it is uſed to expreſs ſuch as have no other particular name.

PIECE, in heraldry, denotes an ordinary or charge.

PIECES, in the military art, includes all ſorts of great guns and mortars. Battering pieces are the larger ſort of guns uſed at ſieges for making the breaches; ſuch are the twenty-four pounders, and culverine, the one carrying twenty-four, and the other an eighteen pound ball. Field-pieces are twelve-pounders, demi-culverines, ſix-pounders, ſakers, minions, and three-pounders, which march with the army, and encamp always behind the ſecond line, but in day of battle are in the front. A ſoldier's firelock is likewiſe called his piece.

PIEDOUCHE, in architecture, a pier or ſquare kind of pillar, part of which is hid within a wall. The only thing wherein it differs from a pilaſter is, that the latter has a regular baſe and capital, which the other wants. See PILASTER.

This term is alſo uſed for part of the ſolid wall annexed to a door or window, comprehending the door-poſt, chambranle, tableau, leaf, &c.

PIEPOWDER COURT, or PEDES PULVERISATI, a court held in fairs for doing juſtice to buyers and ſellers, and redreſſing diſorders there committed.

It is ſo called, as being moſt uſually held in the ſummer, when the ſuitors to the court have duſty feet, &c. This is a court of record, incident to every fair, and is to be held only during the time the fair is kept.

PIER, or PEER, in building, denotes a maſs of ſtone, &c. oppoſed by way of fortreſs againſt the force of the ſea, or a great river, for the ſecurity of ſhips that lie at harbour in any haven.

It is alſo uſed in architecture for a kind of pilaſter, or buttreſs, raiſed for ſupport, ſtrength, and ſometimes for ornament.

PIERCED, PERCE', in heraldry, is when any ordinary is perforated, or ſtruck through, ſhewing, as it were, a hole in it, which muſt be expreſſed in blazon, as to its ſhape: thus if a croſs have a ſquare hole, or perforation in the center, it is blazoned ſquare-pierced, which is more proper than quarterly-pierced, as Leigh expreſſes it. When the hole or perforation is round, it muſt be expreſſed round-pierced; if it be in the ſhape of a lozenge, it is expreſſed pierced lozenge-ways. All piercings muſt be of the colour of the field, and when ſuch figures appear on the centre of a croſs, &c. of another colour, the croſs is not to be ſuppoſed pierced, but that the figure on it is a charge, and muſt be accordingly blazoned.

PIERCING, among farriers. To pierce a horſe-ſhoe lean, is to pierce it too near the edge of the iron: to pierce it fat, is to pierce it farther in.

PIETISTS, a religious ſect ſprung up among the proteſtants of Germany, ſeeming to be a kind of mean between the Quakers of England, and the Quietiſts of the Romiſh church.

They deſpiſe all ſorts of eccleſiaſtical polity, all ſchool theology, and all forms and ceremonies, and give themſelves up to contemplation and the myſtic theology.

PIG, in zoology, the young of the hog kind. See HOG.

PIGEON, in ornithology. See COLUMBA.

There are two kinds of pigeons, the wild and the tame; the latter differ from the former only in bigneſs and familiarity: the wild uſually perch upon trees, being ſeldom ſeen on the ground. Pigeons are of various ſorts, ſuch as carriers, powters, runts, turbets, &c. See CARRIERS, &c.

There are two ſeaſons when you may eaſily procure a ſufficient ſtock of pigeons, viz. May and Auguſt: for at theſe ſeaſons there are a great number of young pigeons, which may then be purchaſed very reaſonably.

PIGEON HOUSE, a houſe erected full of holes within for the keeping, breeding, &c. of pigeons, otherwiſe called a dove cote.

Any lord of a manor may build a pigeon-houſe on his land, but a tenant cannot do it without the lord's licence. When perſons ſhoot at or kill pigeons within a certain diſtance of the pigeon-houſe, they are liable to pay a forfeiture.

In order to erect a pigeon-houſe to advantage, it will be neceſſary, in the firſt place, to pitch upon a convenient ſituation, of which none is more proper than the middle of a ſpacious court-yard, becauſe pigeons are naturally of a timorous diſpoſition, and the leaſt noiſe they hear frightens them. With regard to the ſize of the pigeon-houſe, it muſt depend entirely upon the number of birds intended to be kept; but it is better to have it too large than too little; and as to its form, the round ſhould be preferred to the ſquare ones; becauſe rats cannot ſo eaſily come at them in the former as in the latter. It is alſo much more commodious; becauſe you may, by means of a ladder turning upon an axis, eaſily viſit all the neſts in the houſe, without the leaſt difficulty; which cannot ſo eaſily be done in a ſquare-houſe.

In order to hinder rats from climbing up the outſide of the pigeon-houſe, the walls ſhould be covered with tin plates to a certain height, about a foot and a half will be ſufficient; but they ſhould project out three or four inches at the top, to prevent their clambering any higher.

The pigeon-houſe ſhould be placed at no great diſtance from water, that the pigeons may carry it to their young ones; and their carrying it in their bills will warm it, and render it more wholeſome in cold weather.

The boards that cover the pigeon-houſe ſhould be well joined together, ſo that no rain may penetrate through it. And the whole building ſhould be covered with hard plaſter, and white-waſhed within and without, white being the moſt pleaſing colour to pigeons. There muſt be no window, or other opening, in the pigeon-houſe to the eaſtward; theſe ſhould always face the ſouth, for pigeons are very fond of the ſun, eſpecially in winter.

The neſts or covers in a pigeon houſe, ſhould conſiſt of ſquare holes made in the walls, of a ſize ſufficient to admit the cock and hen to ſtand in them. The firſt range of theſe neſts ſhould not be leſs than four feet from the ground, that the wall underneath being ſmooth, the rats may not be able to reach them. Theſe neſts ſhould be placed in quincunx order, and not directly over one another. Nor muſt they be continued any higher than within three feet of the top of the wall: and the upper row ſhould be covered with a board projecting a conſiderable diſtance from the wall, for fear the rats ſhould find means to climb the outſide of the houſe.

This deſcription of a pigeon-houſe will be more eaſily underſtood, from the figure we have given of it on plate C. The upper compartment of which repreſents a farmer's yard, where I is the farm-houſe. P, the paſſage from the yard. Q, the cellar and ſtore-houſe. R, entrance to the preſs. H, the cyder preſs. G, plan of an outhouſe for holding apples, &c. adjoining to the preſs. F, dairy. E, paſſage into the yard. D, C, cow-houſes. B, L, M, ſtables. A, the pigeon-houſe. K, the horſe-pond. T, the barn. N, the great door of the barn. O, cart-houſe, &c.

The lower compartment.

Fig. 1. A trough for feeding a great number of calves, lambs, &c. A B, the trough. C D F F, ſtaves for ſeparating the trough, that the lambs may feed without diſturbing one another. C D, F F, tranſverſe pieces, to keep the upper part of the ſtaves at a proper diſtance from ea h other.

Fig. 2. A treſſel for ſupporting the trough. K, the treſſel on which the bottom of the trough reſts. G, H, pieces of wood mortiſed into the treſſel, in an oblique poſition, for keeping the trough ſteady.

Fig. 3. Part of the ſtable wall, into which the piece of wood L is faſtened. Into this another, M N, is mortiſed for ſupporting the rack *a b*, for holding the hay, &c. for the horſes, &c.

Fig. 4. A vertical ſection of the pigeon-houſe, in order to ſhew the inſide of it. H, K, arches ſupporting the pigeon-houſe. A B, axis of the turning-ladders L L, M M. C, D, are openings by which the pigeons paſs out and into the pigeon-houſe. The neſts or holes are ranged in quincunx order. E, the upper boundary of the neſts, projecting over the holes, in order to prevent the rats or other vermin from getting down to deſtroy the pigeons. F, G, the cinctures, or places where the ſtones project on the outſide, in order to prevent any vermin from climbing up the outſide of the houſe.

Fig. 5. an elevation of three rows of holes, and a plan of one of the three ranks, drawn on a larger ſcale.

PIKE, an offenſive weapon, conſiſting of a ſhaft of wood, twelve or fourteen feet long, headed with a flat-pointed ſteel, called the ſpear. The pike was a long time in uſe among the infantry, to enable them to ſuſtain the attack of the cavalry, but it is now taken from them, and the bayonet, which fixes on at the end of the carabine, is ſubſtituted in its place: yet the pike ſtill continues the weapon of foot-officers, who fight pike in hand, ſalute with the pike, &c.

PIKE, in ichthyology, the ſame with lucius. See the article LUCIUS.

PILASTER, in architecture, a ſquare column, ſometimes inſulated, but more frequently let within a wall, and only ſhewing a fourth or fifth part of its thickneſs.

The pilaſter is different in different orders; it borrows the name of each, and has the ſame proportions, and the ſame capitals, members, and ornaments, with the columns themſelves. Pilaſters are however uſually made without either ſwelling or diminution, and as broad at top as at the bottom; though ſome of the modern architects, as M. Manſard, &c. diminiſh them at the top, and even make them ſwell in the middle, like columns, particularly when placed behind columns.

Mr. Perrault obſerves, that pilaſters, like columns, become of different kinds, according to the different manner in which they are applied to the wall. Some are wholly detached, and theſe Vitruvius calls paraſtatæ; others have three faces clear out of the wall; others two; and others only one; theſe Vitruvius calls antæ. Inſulate pilaſters are but rarely found in the antique; for the chief uſe the ancients made of them, was to give the greater ſtrength to the extremities of porticoes.

There are four things to be principally regarded in pilaſters; their projecture out of the wall; their diminution; the diſpoſition of the entablature, when it happens to be common to them and to a column; and their flutings and capitals. 1. then, The projecture of pilaſters that have only one face out of the wall, ought to be one eighth of their breadth, or at moſt one ſixth; but when they receive impoſts againſt their ſides, the projecture may be a quarter of their diameter. 2. Pilaſters are ſeldom diminiſhed when they have only one face out of the wall: indeed when they ſtand in the ſame line with columns, and the entablature is continued over both, without any break, the pilaſters are to have the ſame dimenſions with the columns. 3. Pilaſters are ſometimes fluted, though the columns that accompany them are not ſo; and on the contrary, the columns are ſometimes fluted, when the pilaſters that accompany them are not. The flutings of pilaſters are always odd in number, except in half pilaſters, which meet at inward angles, where four flutings are made for three, &c. 4. The proportions of the capitals

of

of pilaſters, are the ſame as to height with thoſe of columns; but they differ in breadth, the leaves of pilaſters being much broader; becauſe pilaſters, though of equal extent, have only the ſame number of leaves for their girt, viz. eight. Their uſual diſpoſition is to have two in each face in the lower row, one in the middle, and two halves in the angles, in the turns of which they meet. Add to this, that the rim of the vaſe, or tambour, is not ſtrait, as the lower part is; but a little circular and prominent in the middle. See FLUTINGS.

In pilaſters that ſupport arches, the proportions, according to Palladio, ſhould be regulated by the light they are placed in; and at the angles by the weight they are to ſuſtain: they muſt not be too tall and ſlender, leſt they reſemble pillars, nor too dwarfiſh and groſs, leſt they appear like the piers of bridges. In private buildings they ought not to be narrower than one third, nor broader than two thirds of the vacuity, or interſpace between pilaſter and pilaſter; but as for thoſe that ſtand at the corners, they may have a little more latitude allowed them, to give the greater ſtrength to the angles. Palladio obſerves, that in the theatres and amphitheatres, and ſuch maſſive works, they have been as broad as the half, and ſometimes as the whole vacuity or interſpace. He alſo aſſerts, that their true proportion ſhould be an exact ſquare; but for leſſening of expence, they are uſually made narrower in flank than in front.

PILCHARD, *Pilchardus*, in ichthyology, a ſpecies of clupea, with the upper jaw bifid, and ſpotted on each ſide with black.

PILE, in antiquity, a pyramid built of wood, on which the bodies of the deceaſed were laid in order to be burnt.

PILE, in building, is uſed for a large ſtake rammed into the ground in the bottom of rivers, or in marſhy land, for a foundation to build upon.

PILE is alſo uſed among architects for a maſs of building.

PILE, in coinage, denotes a kind of puncheon, which in the old way of coining with the hammer, contained the arms, or other figure and inſcription to be ſtruck on the coin.

PILE, in heraldry, an ordinary in form of a wedge, contracting from the chief, and terminating in a point towards the bottom of the ſhield.

PILES, in medicine, the ſame with hæmorrhoids. See HÆMORRHOIDS.

PILGRIMAGE, a kind of religious diſcipline, which conſiſts in taking a journey to ſome holy place, in order to adore the relics of ſome deceaſed ſaint. Pilgrimages began to be made about the middle ages of the church; but they were moſt in vogue after the end of the eleventh century, when every one was for viſiting places of devotion, not excepting kings and princes themſelves; and even biſhops made no difficulty of being abſent from their churches on the ſame account. The places moſt viſited were Jeruſalem, Rome, Compoſtella, and Tours; but the greateſt numbers now reſort to Loretto, in order to viſit the chamber of the bleſſed Virgin, in which ſhe was born, and brought up her ſon Jeſus, till he was twelve years of age. This chamber, it is pretended, was carried by angels into Dalmatia, about the year 1291, and afterwards in the ſame manner tranſported to Loretto, where a magnificent cathedral is built over it. In this chamber, is the image of the bleſſed Virgin, almoſt covered with pearls and diamonds, and round the ſtatue is a kind of rainbow formed of precious ſtones of various colours. Five hundred thouſand pilgrims ſometimes reſort to this houſe in one year, in order to pay their devotions before this glorious image.

PILL, in pharmacy, a form of medicine reſembling a little ball, to be ſwallowed whole, invented in favour of ſuch as cannot take bitter and ill-taſted medicinal draughts, as alſo to keep in readineſs for occaſional uſe without decaying.

PILLAGE, among builders, is a ſquare pillar, ſtanding behind a column to bear up arches.

PILLAR, in architecture, a kind of irregular column, round and inſulated, but deviating from the proportions of a juſt column.

Pillars are always either too maſſive, or too ſlender for regular architecture; ſuch are the pillars which ſupport Gothic vaults, or buildings; and, indeed, they are not reſtrained by any rules, their parts and proportions being arbitrary.

Butting PILLAR, the ſame with buttreſs. See the article BUTTRESS.

Square PILLAR, a maſſive work, called alſo a pier, or piedroit, ſerving to ſupport arches, &c.

PILLORY was anciently a poſt erected in a croſs-road, by the lord of the manor, with his arms upon it, as a mark of his ſeigniory, and ſometimes with a collar to fix criminals to. At preſent, it is a wooden machine, made to confine the head and hands, in order to expoſe criminals to public view, and to render them publicly infamous.

PILOT, a perſon employed to conduct ſhips over bars and ſands, or through intricate channels, into a road or harbour.

PIMENTA, or PIMENTO, in the materia medica, Jamaica pepper, or all-ſpice, the dried aromatic berry of a large tree growing in the mountainous parts of Jamaica, reckoned a ſpecies of myrtle, and called by Sir Hans Sloane, *myrtus arborea aromatica foliis laurinis*; by Linnæus, *myrtus foliis alternis*.

Pimenta is a moderately warm ſpice, of an agreeable flavour, ſomewhat reſembling that of a mixture of cloves, cinnamon, and nutmegs. Diſtilled with water it yields an elegant eſſential oil, ſo ponderous as to ſink in the aqueous fluid, in taſte moderately pungent, in ſmell and flavour approaching to oil of cloves, or rather a mixture of thoſe of cloves and nutmegs: the remaining decoction inſpiſſated, leaves an extract ſomewhat ungrateful, but not pungent, and the berry itſelf is found to be almoſt wholly deprived of its taſte as well as flavour; the warmth of this ſpice reſiding rather in the volatile than in the fixed parts.

This ſpice, at firſt brought over for dietetic uſes, has been long employed in the ſhops as a ſuccedaneum to the more coſtly oriental aromatics; from them it was introduced into our hoſpitals, and is now received both in the London and Edinburgh Pharmacopæias. The college of London directs a ſimple water to be diſtilled from it, in the proportion of a gallon from half a pound: this is ſtrongly impregnated with the flavour of the pimenta, though it is leſs elegant than the ſpirituous water which the ſhops have been accuſtomed to prepare, by drawing off two or three gallons of proof ſpirit from the ſame quantity of the ſpice. The eſſential oil does not ſeem to be much known in practice; though it promiſes to be a very uſeful one, and might, doubtleſs, on many occaſions, ſupply the place of many of the dearer oils. The quantity of oil afforded by the ſpice is very conſiderable: Cartheuſer indeed ſays, that only about half a dram is to be got from ſixteen ounces; a miſtake, which probably has ariſen from inadvertence in copying Neumann's proportion, of half a dram from an ounce, or one ſixteenth: ſo large a proportion as this laſt cannot, however, be collected in its proper form, the oil that remains diſſolved in the diſtilled water being here included.

PIMPLE, in ſurgery, a ſmall puſtule, ariſing chiefly on the face. See the article PUSTULE.

PIN, in commerce, a little neceſſary implement made of braſs wire, uſed chiefly by the women in adjuſting their dreſs.

The perfection of pins conſiſts in the ſtiffneſs of the wire and its whiteneſs, in the heads being well turned, and in the fineneſs of the points. The London pointing and whitening are in moſt repute, becauſe our pin-makers, in pointing, uſe two ſteel-mills, the firſt of which forms the point, and the latter takes off all irregularities, and renders it ſmooth, and as it were poliſhed; and in whitening, they uſe block-tin granulated: whereas in other countries they are ſaid to uſe a mixture of tin, lead, and quick-ſilver; which not only whitens worſe than the former, but is alſo dangerous, on account of the ill quality of that mixture, which renders a puncture with a pin thus whitened, ſomewhat difficult to be cured. The conſumption of pins is incredible, and there is no commodity ſold cheaper. The number of hands employed in this manufacture is very great, each pin paſſing through the hands of ſix different workmen,

between the drawing of the braſs wire, and the ſticking of the pin in the paper.

Pins are ſometimes made of iron-wire, rendered black by a varniſh of linſeed-oil, with lamp-black, which the braſs-wire would not receive: theſe are deſigned for the uſe of perſons in mourning, though not univerſally approved of.

PINCHING, in gardening, a kind of pruning, performed by nipping off the young and tender ſprigs of trees and plants between the nails of the thumb and finger, chiefly practiſed in April or May, and ſometimes in June and July, on the large uſeleſs branches towards the top of a plant or tree, becauſe they conſume a great deal of the ſap. See PRUNING.

PINDARIC, in poetry, an ode formed in imitation of the manner of Pindar. The Pindaric manner is diſtinguiſhed by the boldneſs and height of the flights; the ſuddenneſs and ſurpriſingneſs of the tranſitions; and the ſeeming irregularity, wildneſs, and enthuſiaſm of the whole. The only part remaining of Pindar's works is a book of odes, all in praiſe of the victors at the Olympian, Pythian, Nemæan, and Iſthmian, games; whence the firſt is intitled the Olympians, the ſecond the Pythians, the third the Nemæans, and the fourth the Iſthmians.

PINE, *Pinus*, in botany, a genus of trees, the male flowers of which are collected in a ſcaly conical bunch, having many ſtamina, which are connected at their baſe, terminated by erect ſummits, included in the ſcales, which ſupply the want of petals and empalement. The female flowers are collected in a common oval cone, and ſtand at a diſtance from the male on the ſame tree. Under each ſcale of the cone is produced two flowers, which have no petals, but a ſmall germen, ſupporting an awl-ſhaped ſtyle, crowned by a ſingle ſtigma. The germen afterward becomes an oblong oval nut, crowned with a wing, included in the rigid ſcale of the cone.

There are various ſpecies of the pine-tree; but two only that deſerve cultivating; namely, the Scotch-pine, and the white pine, commonly called in England lord Weymouth's, or New-England pine.

The Scotch-pine, ſo called from its growing naturally on the mountains of Scotland, is the tree that affords the red or yellow deal, which is the moſt durable of any of the kinds yet known. The leaves of this tree are pretty broad and ſhort, of a greyiſh colour, growing two out of each ſheath; the cones are ſmall, pyramidal, and end in narrow points; they are of a light colour, and the ſeeds are ſmall.

This ſort grows well upon almoſt every ſoil; I have planted numbers of the trees upon peat bogs, where they have made great progreſs. I have alſo planted them in clay, where they have ſucceeded far beyond expectation; and upon ſand, gravel, and chalk, they likewiſe thrive as well; but as they do not grow near ſo faſt upon gravel and ſand, as upon moiſt ground, ſo the wood is much preferable; for thoſe trees which have been cut down upon moiſt ſoils, where they have made the greateſt progreſs, when they have been ſawn out into boards, have not been valuable, the wood has been white, and of a looſe texture; whereas thoſe which have grown upon dry gravelly ground, have proved nearly equal to the beſt foreign deals; and I doubt not but thoſe plantations, which of late years have been made of theſe trees, will, in the next age, not only turn greatly to the advantage of their poſſeſſors, but alſo become a national benefit.

The white pine is one of the talleſt trees of all the ſpecies, often growing a hundred feet high, as I have been credibly informed. The bark of this tree is very ſmooth and delicate, eſpecially when young; the leaves are long and ſlender, five growing out of each ſheath; the branches are pretty cloſely garniſhed with them, ſo make a fine appearance; the cones are long, ſlender, and very looſe, opening with the firſt warmth of the ſpring; ſo that if they are not gathered in winter, the ſcales open and let out the ſeeds. The wood of this ſort is eſteemed for making of maſts for ſhips; it is in England called lord Weymouth's, or New-England pine, as hath been already obſerved. As the wood of this tree was generally thought of great ſervice to the navy, there was a law made in the ninth year of queen Anne, for the preſervation of the trees, and to encourage their growth in America; and it is within forty years paſt theſe trees began to be propagated in England in any plenty, though there were ſome large trees of this ſort growing in two or three places long before, particularly at lord Weymouth's at Longleet, ſir Wyndham Knatchbull's in Kent; and it has been chiefly from the ſeeds of the latter that the much greater number of theſe trees now in England have been raiſed; for although there has annually been ſome of the ſeeds brought from America, yet thoſe have been few in compariſon to the produce of the trees in Kent: many of the trees, which have been raiſed from the ſeeds of thoſe trees, now produce plenty of good ſeeds, particularly thoſe in the gardens of the late duke of Argyle at Whitton, which annually produce large quantities of cones, which his grace, when living, moſt generouſly diſtributed to all the curious.

All the ſorts of pines are propagated by ſeeds, which are produced in hard woody cones; the way to get the ſeeds out of theſe cones, which are cloſe, is to lay them before a gentle fire, which will cauſe the cells to open, and then the ſeeds may be eaſily taken out. If the cones are kept entire, the ſeeds will remain good ſome years, ſo that the ſureſt way to preſerve them, is to let them remain in the cones, until the time for ſowing the ſeeds: if the cones are kept in a warm place in ſummer, they will open, and emit the ſeeds, but if they are not expoſed to much heat, many of the ſorts will remain entire ſome years, eſpecially thoſe which are cloſe and compact; and the ſeeds, which have been taken out of cones of ſeven years old, have grown very well, ſo that theſe may be tranſported to any diſtance, provided the cones are well ripened, and properly put up.

The beſt time for ſowing the ſeeds of pines, is about the end of March; when the ſeeds are ſown, the place ſhould be covered with nets to keep off birds, otherwiſe, when the plants begin to appear with the huſk of the ſeed on their tops, the birds will pick off the heads of the plants, and deſtroy them.

Where the quantity of ſeeds to be ſown is not great, it will be a good way to ſow them either in boxes or pots filled with light loamy earth, which may be removed from one ſituation to another, according to the ſeaſon of the year; but if there is a large quantity of the ſeeds, ſo as to require a good ſpace to receive them, they ſhould be ſown on an eaſt or north-eaſt border, where they may be ſcreened from the ſun, whoſe heat is very injurious to theſe plants at their firſt appearance above ground. Thoſe ſeeds, which are ſown in pots or boxes, ſhould alſo be placed in a ſhady ſituation, but not under trees; and if they are ſcreened from the ſun with mats, at the time when the plants firſt come up, it will be a good method to preſerve them.

When the plants appear, they muſt be conſtantly kept clean from weeds, and, in very dry ſeaſons, if they are now and then gently refreſhed with water, it will forward their growth; but this muſt be done with great care and caution, for if they are haſtily watered, it will waſh the tender plants out of the ground, or lay them down flat, which often rots their ſhanks; and when this is too often repeated, it will have the ſame effect; ſo that unleſs it is judiciouſly performed, it will be the beſt way to give them none, but only ſcreen them from the ſun.

If the plants come up too cloſe, it will be a good method to thin them gently about the beginning of July. The plants, which are drawn up, may then be planted on other beds, which ſhould be prepared ready to receive them, for they ſhould be immediately planted as they are drawn up, becauſe their tender roots are ſoon dried and ſpoiled at this ſeaſon of the year. This work ſhould be done, if poſſible, in cloudy or rainy weather, and then the plants will draw out with better roots, and will ſoon put out new fibres again; but if the weather ſhould prove clear and dry, the plants ſhould be ſhaded every day from the ſun with mats, and now and then gently refreſhed with water. In drawing up of the plants, there ſhould be great care taken not to diſturb the roots of the plants left remaining in the ſeed-beds, &c. ſo that if the ground be hard, the beds ſhould be well watered ſome time before the plants are thinned, to ſoften and looſen the earth; and if, after the plants are drawn out, the beds are again

PLATE C.

Facing Pigeon-house.

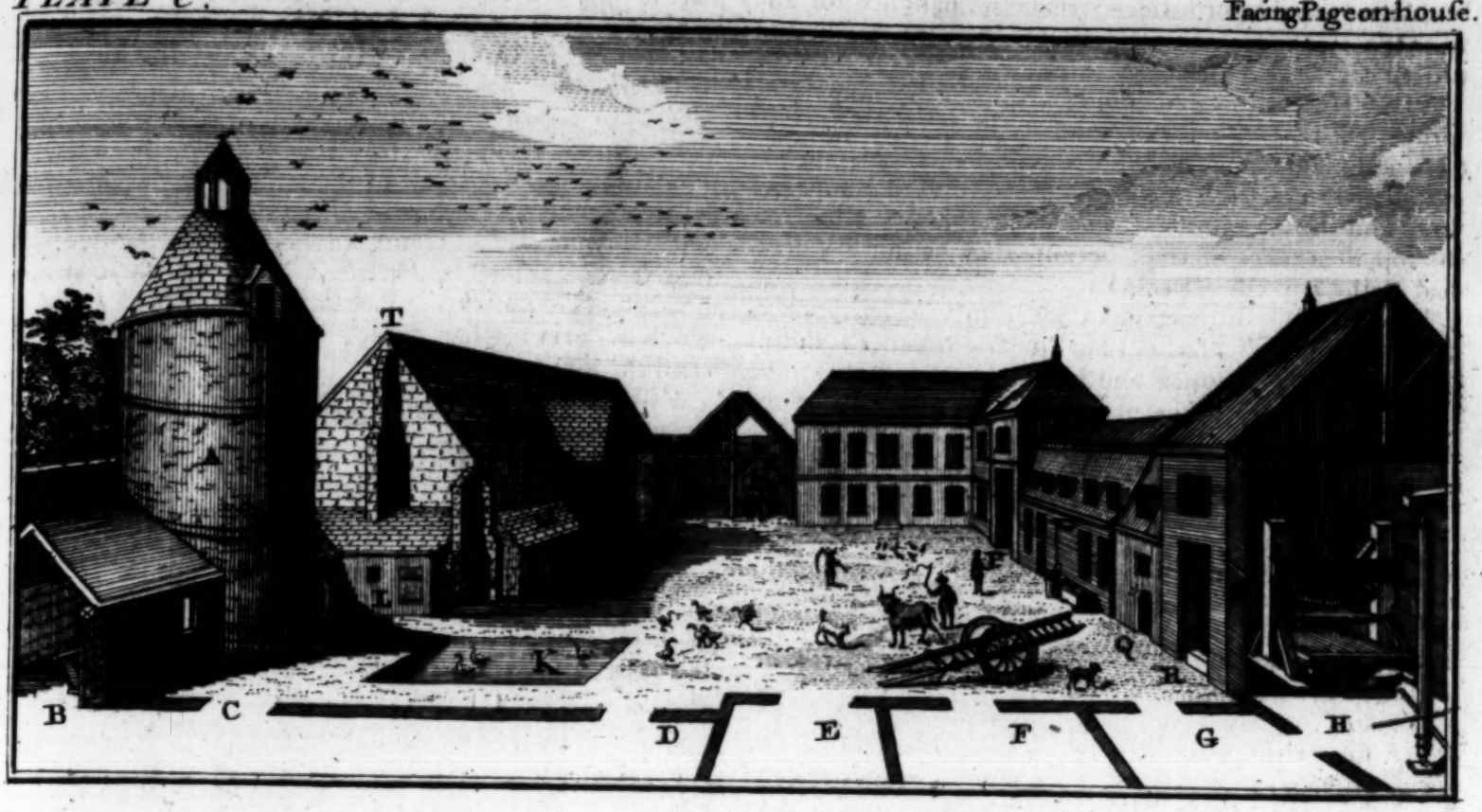


Fig. 4.

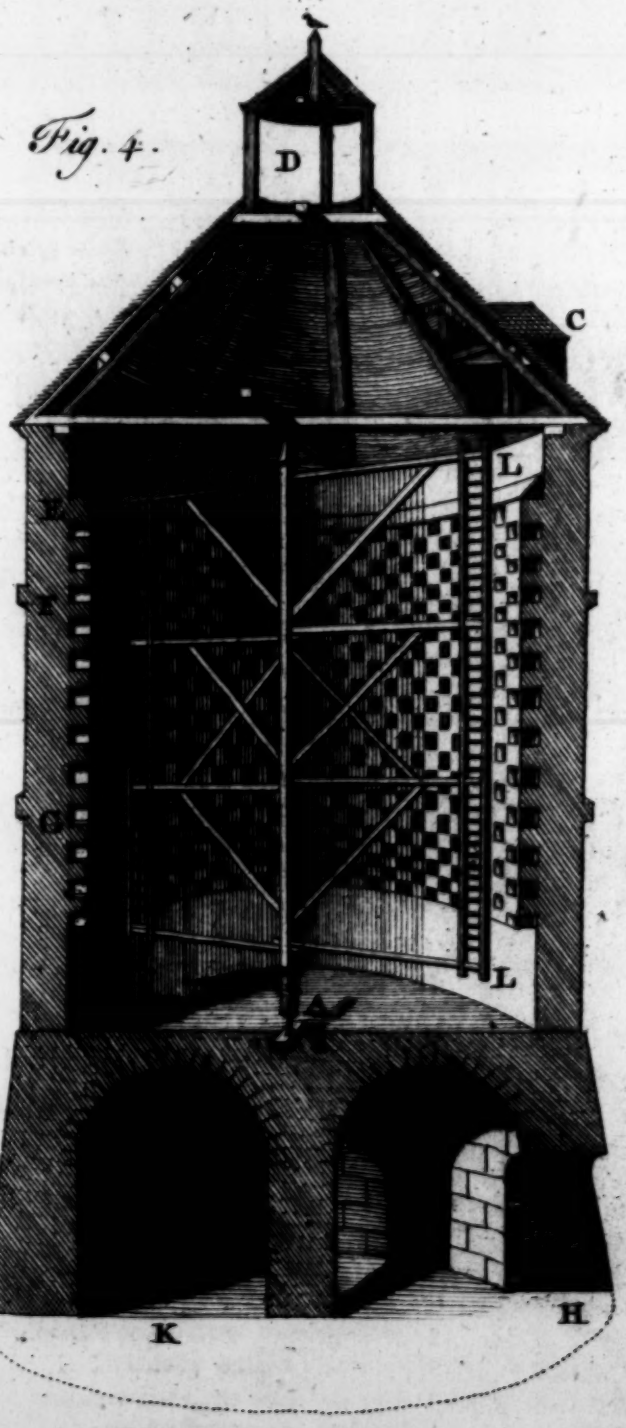


Fig. 1.

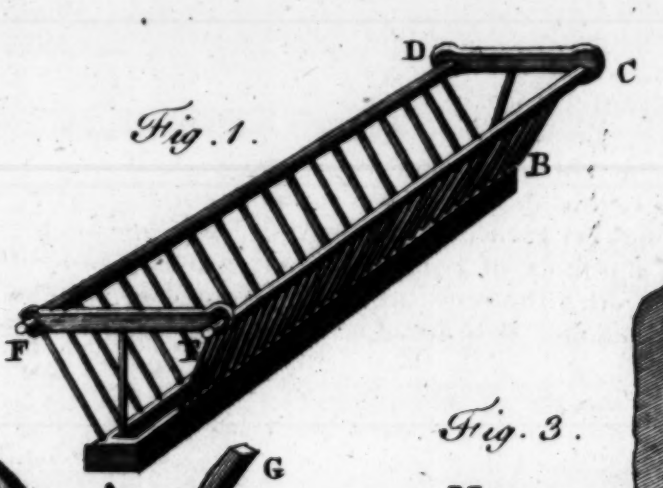
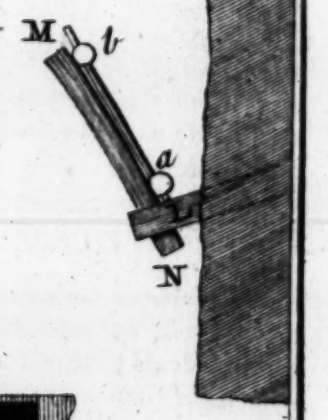


Fig. 2.

Fig. 3.



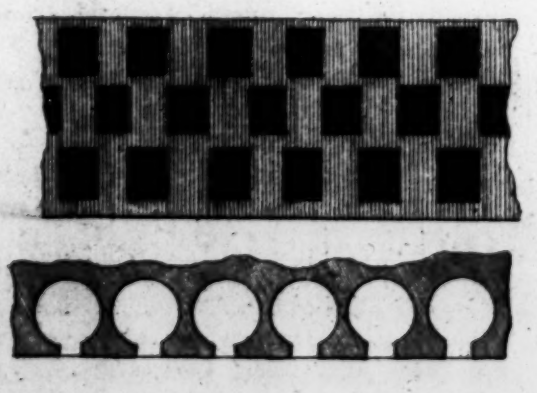
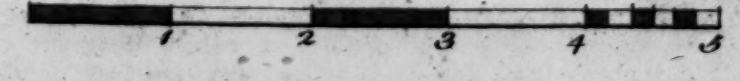
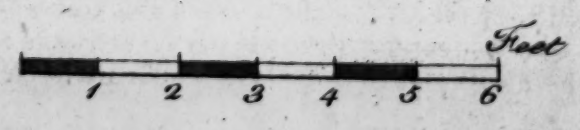


Fig. 5.





5 JA 59

gently watered to ſettle the earth to the roots of the remaining plants, it will be of great ſervice to them; but it muſt be done with great care, ſo as not to waſh out their roots, or lay down the plants. The diſtance, which ſhould be allowed theſe plants, is four or five inches row from row, and three inches in the rows.

In theſe beds the plants may remain till the ſpring twelvemonths after, by which time they will be fit to tranſplant where they are to remain for good; for the younger plants are, when planted out, the better they will ſucceed; for although ſome ſorts will bear tranſplanting at a much greater age, yet young plants planted at the ſame time will in a few years overtake the large ones, and ſoon outſtrip them in their growth; and there is an advantage in planting young, by ſaving the expence of ſtaking, and much watering, which large plants require. I have ſeveral times ſeen plantations of ſeveral ſorts of pines, which were made of plants ſix or ſeven feet high, and at the ſame time others of one foot high planted between them, which in ten years were better trees than the old ones, and much more vigorous in their growth; but if the ground, where they are deſigned to remain, cannot be prepared by the time before-mentioned, the plants ſhould be planted out of the beds into a nurſery, where they may remain two years, but not longer; for it will be very hazardous in removing theſe trees at a greater age.

The beſt ſeaſon to tranſplant theſe pines, is about the latter end of March, or the beginning of April, juſt before they begin to ſhoot; for although the Scotch pine, and ſome of the moſt hardy ſorts, may be tranſplanted in winter, eſpecially when they are growing in ſtrong land, where they may be taken up with balls of earth to their roots, yet this is what I would not adviſe for common practice, having frequently ſeen it attended with bad conſequences, but thoſe which are removed in the ſpring rarely fail.

Where theſe trees are planted in expoſed ſituations, they ſhould be put pretty cloſe together, that they may ſhelter each other, and, when they have grown a few years, part of the plants may be cut down to give room for the others to grow; but this muſt be gradually performed, leſt by too much opening the plantation at once, the air ſhould be let in among the remaining trees with too great violence, which will ſtop their growth.

Wherever large plantations are deſigned to be made, the beſt method will be to raiſe the plants either upon a part of the ſame land, or as near to the place as poſſible, and alſo upon the ſame ſort of ſoil; a ſmall piece of ground will be ſufficient to raiſe plants enough for many acres; but, as the plants require ſome care in their firſt raiſing, if the neighbouring cottagers, who have many of them ſmall incloſures adjoining to their cottages; or, where this is wanting, a ſmall incloſure ſhould be made them for the purpoſe of raiſing the plants, and they be furniſhed with the ſeeds and directions for ſowing them, and managing the young plants, till they are fit for tranſplanting, the women and children may be uſefully employed in this work, and the proprietors of land agreeing with them to take their plants, when raiſed, at a certain price, it would be a great benefit to the poor, and hereby they would be engaged to have a regard for the plantations when made, and prevent their being deſtroyed.

The Scotch pine, as was before obſerved, being the hardieſt of all the kinds, and the wood of it the moſt uſeful, is the ſort which beſt deſerves care. This will thrive upon the moſt barren ſands, where ſcarce any thing elſe except heath and furze will grow; ſo that there are many thouſand acres of ſuch land lying convenient for water carriage, which at preſent is of little benefit to any body, that might, by plantations of theſe trees, become good eſtates to their proprietors, and alſo a national benefit; and as the legiſlators have taken this into their conſideration, and already paſſed ſome laws for the encouraging theſe plantations, as alſo for their preſervation and ſecurity; ſo it may be hoped that this will be undertaken by the gentlemen who are poſſeſſed of ſuch lands in all the different parts of the kingdom, with proper ſpirit; for although they may not expect to receive much profit from theſe plantations in their own time, yet their ſucceſſors may with large intereſt, and the pleaſure which theſe growing trees will afford them, by beautifying the preſent dreary parts of the country, will in ſome meaſure recompenſe them for their trouble and expence, and by creating employment for the poor, leſſen thoſe rates which are now, in many parts of England, ſcarce to be borne.

The expence of making theſe plantations is what moſt people are afraid of, ſo would not engage in it; but the greateſt of the expence is that of fencing them from the cattle, &c. for the other is trifling, as there will be no neceſſity for preparing the ground to receive the plants, and the charge of planting an acre of land with theſe plants, will not be more than thirty ſhillings where labour is dear, excluſive of the plants, which may be valued at forty ſhillings more. I have planted many acres of land with theſe trees, which was covered with heath and furze, and have only dug holes between to put in the plants, and afterward laid the heath or furze, which was cut, upon the ſurface of the ground about their roots, to prevent the ground drying, and few of the plants have failed. Theſe plants were moſt of them four years old from ſeed, nor was there any care taken to clean the ground afterward, but the whole left to ſhift, and in five or ſix years the pines have grown ſo well, as to over-power the heath and furze, and deſtroy it.

The diſtance which I have generally planted theſe plants in all large open ſituations, was about four feet, but always irregular, avoiding planting in rows as much as poſſible; and in the planting, the great care is not to take up the plants faſter than they can be planted, ſo that ſome men have been employed in digging up of the plants, while others were planting. Thoſe who take up the plants, muſt be looked after to ſee they do not tear off their roots, or wound their bark; and as faſt as they are taken up, their roots ſhould be covered to prevent their drying, and put into their new quarters as ſoon as poſſible. In planting them, care ſhould be had to make the holes large enough for their roots, as alſo to looſen and break the clods of earth, and put the fineſt immediately about their roots, then to ſettle the earth gently with the foot to the roots of the plant. If theſe things are duly obſerved, and a proper ſeaſon choſen for performing it, there will be very little hazard of their ſucceeding; but I have ſeen ſome plantations made with plants, which were brought from a great diſtance, and had been ſo cloſely packed up, as to cauſe a heat, whereby moſt of the plants within had their leaves changed yellow, and few of them have grown, which has diſcouraged others from planting, not knowing the true cauſe of their failure.

After the plantations are made, the only care they require for five or ſix years, will be to ſecure the plants from cattle, hares, and rabbits; for if theſe are admitted to them, they will make great deſtruction in a ſhort time, for if the branches are gnawed by hares or rabbits, it will greatly retard the growth of the plants, if not deſtroy them.

In about five or ſix years after planting, the branches of the young trees will have met, and begin to interfere with each other, therefore they will require a little pruning; but this muſt be done with great caution. The lower tier of branches only ſhould be cut off; this ſhould be performed in September, at which time there will be no danger of the wounds bleeding too much, and the turpentine will harden over the wounds as the ſeaſon grows cold, ſo will prevent the wet from penetrating of them. Theſe branches ſhould be cut off cloſe to the ſtem of the plants, and care ſhould be taken in the doing of this, not to break any of the remaining branches of the young trees. This work ſhould be repeated every other year, at each time taking off only the lower tier of branches; for if the plants are much trimmed, it will greatly retard their growth, as it does in general that of all trees; but as theſe trees never put out any new ſhoots where they are pruned, ſo they ſuffer more from amputation than thoſe which do.

In about twelve or fourteen years theſe will require no more pruning, for their upper branches will kill thoſe below where they have not air; but ſoon after this, if the plants have made good progreſs, it may be neceſſary to

thin them; but this ſhould be gradually performed, beginning in the middle of the plantation firſt, leaving the outſide cloſe to ſcreen thoſe within from the cold, ſo by degrees coming to them at laſt, whereby thoſe, which were firſt thinned, will have had time to get ſtrength, ſo will not be in danger of ſuffering from the admiſſion of cold air. When theſe plantations are thinned, the trees ſhould not be dug up; but their ſtems cut off cloſe to the ground, for their roots never ſhoot again, but decay in the earth, ſo there can no harm ariſe by leaving them, and hereby the roots of the remaining plants are not injured. The trees which are now cut, will be fit for many purpoſes; thoſe which are ſtraight, will make good putlocks for the brick-layers, and ſerve for ſcaffolding poles, ſo that there may be as much made by the ſale of theſe, as will defray the whole expence of the planting, and probably intereſt for the money into the bargain.

As the upright growth of theſe trees renders their wood the more valuable, they ſhould be left pretty cloſe together, whereby they will draw each other up, and grow very tall. I have ſeen ſome of theſe trees growing, whoſe naked ſtems have been more than ſeventy feet high, and as ſtraight as a walking cane, and from one of theſe trees there were as many boards ſawed, as laid the floor of a room near twenty feet ſquare. If theſe trees are left eight feet aſunder each way, it will be ſufficient room for their growth; therefore, if at the firſt thinning a fourth part of the trees are taken away, the other may ſtand twelve or fourteen years longer, by which time they will be of a ſize for making ladders, and ſtandards for ſcaffolding, and many other purpoſes; ſo that from this ſale, as much may be made, as to not only pay the remaining part of the expence of planting, if any ſhould be wanting in the firſt, but rent for the land with intereſt, and the ſtanding trees for fortunes of younger children. This may be demonſtrated by figures, and there has been ſeveral examples of late years, where the profits have greatly exceeded what is here mentioned. *Miller's Gard. Dict.*

Pitch, tar, reſin, and turpentine, are all made from theſe trees by a very familiar proceſs. In the ſpring time, when the ſap is moſt free in running, they pare off the bark of the pine-tree, to make the ſap run down into a hole which they cut at the bottom to receive it: in the way, as it runs down, it leaves a white matter like cream, but a little thicker: this is very different from all the kinds of reſin and turpentine in uſe, and it is generally ſold to be uſed in the making of flambeaux, inſtead of white bees wax. The matter that is received in the hole at the bottom, is taken up with ladles, and put in a large baſket; a great part of this immediately runs through, and this is the common turpentine. This is received into ſtone or earthen pots, and is ready for ſale. The thicker matter, which remains in the baſket, they put into a common alembic, adding a large quantity of water; they diſtil this as long as any oil is ſeen ſwimming upon the water; this oil they ſeparate from the ſurface in large quantities, and this is the common oil or ſpirit of turpentine; the remaining matter, at the bottom of the ſtill, is common yellow reſin. When they have thus obtained all that they can from the ſap of the tree, they cut it down, and, hewing the wood into billets, they fill a pit dug in the earth with theſe billets, and, ſetting them on fire, there runs from them, while they are burning, a black thick matter; this naturally falls to the bottom of the pit, and this is the tar. The top of the pit is covered with tiles, to keep in the heat; and there is at the bottom a little hole, out at which the tar runs like oil: if this hole be made too large, it ſets the whole quantity of the tar on fire; but, if ſmall enough, it runs quietly out.

The tar, being thus made, is put up in barrels, and, if it be to be made into pitch, they put it into large boiling veſſels, without adding any thing to it: it is then ſuffered to boil a while, and, being then let out, is found, when cold, to be what we call pitch. *Phil. Tranſ.* N°. 243.

PINE-APPLE, the ſame with ananas. See the article ANANAS

PINEAL GLAND, in anatomy, a gland in the third ventricle of the brain, thus called from its reſemblance to a pine-apple. It is of a greyiſh colour, and its proceſſus and baſe are often medullary: this gland has often by many been ſuppoſed the peculiar ſeat of the ſoul. It is otherwiſe called conoides and conarion. See CONOIDES and CONARION.

PINION, in mechanics, an arbor, or ſpindle, in the body of which are ſeveral notches, which catch the teeth of a wheel that ſerves to turn it round; or it is a leſſer wheel which plays in the teeth of a larger.

In a watch, &c. the notches of a pinion, which are commonly 4, 5, 6, 7, 8, &c. are called leaves, and not teeth, as in other wheels.

PINK, *Caryophyllus*, in botany, the Engliſh name of ſeveral ſpecies of the dianthus. See DIANTHUS.

PINNA, in anatomy. The lateral and inferior part of the noſe is called pinna naſi; and the ſuperior and broad part of the external ear is denominated pinna auris. See EAR and NOSE.

PINNACE, among ſeamen, a ſmall veſſel with two maſts, employed in the coaſting trade, particularly in Newfoundland, and other parts of North-America: alſo the name of a particular kind of boat commonly rowed with eight oars.

PINNATED LEAVES, *pinnata folia*, in botany, leaves formed in manner of a wing, and compoſed of two large ranges, or ſeries of foliola, annexed to the two ſides of one common, oblong petal. Of the pinnated leaves, however, there are ſeveral kinds. 1. The pinnated with an odd one: this expreſſes the pinnated leaf, when beſides the two ſeries juſt mentioned, there is an odd leaf at the extremity of the petiole. 2. The pinnated without an odd leaf. 3. The pinnated abrupt leaf; this expreſſes a pinnated leaf, in which there is neither an odd leaf, nor a tendril at the end of the petiole. 4. The oppoſitely pinnated, which is when the folioles ſtand oppoſite to one another, on the common petiole. 5. The alternately pinnated, when the folioles ſtand not oppoſite, but alternately. 6. The interruptedly pinnated, in which the folioles are irregular and unequal in ſize and ſituation. 7. The cirrhatedly pinnated, wherein the extremity of the petiole has one or more tendrils, inſtead of an odd leaf. 8. The decurrently pinnated, in which the folioles extend beyond their proper baſe, in going down the petiole, and, as it were, make it alated. The membranaceous pinnated, of the ſame form with the laſt, but with the petioles themſelves membranaceous and articulated. 9. The conjugated pinnated leaf, when the whole compound leaf conſiſts only of two folioles, on the petiole: this kind of pinnated leaf may be either abrupt, cirrhated, membranaceous in the petiole, or ſtipulated. 10. Duplicato-pinnatum, or pinnato-pinnatum, expreſſes a leaf compoſed of ſeveral others, each of which is itſelf compoſed of ſeveral ſmaller leaves, or foliola. 11. Triplicato-pinnatum expreſſes a leaf, the petioles of which ſend out three alated ſubdiviſions, before it has any leaves on it. 12. Theſe laſt are terminated ſometimes by two foliola each, and in that caſe, are ſaid to be abrupt; ſometimes by an odd leaf, and are then called triplicato-pinnata cum impari.

PINNING, in building, the faſtening of tiles together, with pins of heart of oak, for the covering of an houſe, &c.

PINT, a veſſel, or meaſure uſed in eſtimating the quantity of liquids, and even ſometimes of dry things. See the article MEASURE.

PINTLE, among gunners, an iron, which ſerves to keep the gun from recoiling.

PINTLES, in ſhip-building, certain pins or hooks of iron bolted to the ſtern-poſt whereon to hang the rudder, which reſts and traverſes upon the pintles. See the article HELM.

PINUS, in botany. See PINE.

PIONEER, in the art of war, a labourer employed in an army to ſmooth the roads, paſs the artillery along, and dig lines and trenches, mines, and other works.

PIONY, in botany. See PÆONIA.

PIP, or PEP, *Pepia*, a diſeaſe among poultry, conſiſting of a white thin ſkin, or film, that grows under the tip of the tongue, and hinders their feeding. It uſually ariſes from want of water, or from the drinking puddle-water, or eating filthy meat. It is cured by pulling off the film with the fingers, andrubbing the tongue with ſalt.

ſalt. Hawks are particularly liable to this diſeaſe, eſpecially from feeding on ſtinking fleſh.

PIPE, in building, &c. a canal, or conduit, for the conveyance of water and other liquids. Pipes for water, water-engines, &c. are uſually of lead, iron, earth, or wood: the latter are uſually made of elm or elder. Thoſe of iron are caſt in forges; their uſual length is about two feet and a half; ſeveral of theſe are commonly faſtened together by means of four ſcrews at each end, with leather or old hat between them, to ſtop the water. Thoſe of earth are made by the potters; theſe are fitted into one another, one end being always made wider than the other. To join them the cloſer, and prevent their breaking, they are covered with tow and pitch: their length is uſually about that of the iron-pipes. The wooden pipes are trees bored with large iron augres, of different ſizes, beginning with a leſs, and then proceeding with a larger ſucceſſively; the firſt being pointed, the reſt being formed like ſpoons, increaſing in diameter, from one to ſix inches or more: they are fitted into the extremities of each other.

Wooden pipes are bored by hand in the ſame manner as common pumps; but as this is both tedious and expenſive, ſeveral machines have been invented for this purpoſe: we have given a draught of that generally uſed for this purpoſe in England on plate CI. *fig.* 1. and 2. where A is the ſhaft of a wheel turned either by water or horſes. Into the extremity of this ſhaft, the ſhank B of the augre C is faſtened; and by its revolution the pipe D is bored. As the augre advances into the pipe, the carriage on which the pipe is faſtened is drawn forwards by means of the wheel H, which the borer, or man who tends the machine, turns round by means of the handles on its circumference. Half this wheel is below the ſurface of the ground, that the rope F I, by which the carriage is pulled forward, may be drawn in a parallel direction. As ſoon as the augre is full, which is known by the noiſe it makes, the carriage, together with the pipe, is pulled backward, by which means the augre comes out of the pipe, and drops its contents into the pit underneath the carriage. This motion is performed by the machine, in the following manner: On the ſhaft A is a cog-wheel K, which revolves with the ſhaft. On each ſide of this cog-wheel are two other wheels of ſomething leſs diameter, fixed in a ſliding frame, and moveable by means of a lever. One of theſe wheels is marked L, and the other M; but the latter cannot be ſeen in *fig.* 1. By puſhing the lever N O towards either ſide, the wheel oppoſite to that ſide towards which the lever is puſhed, ſtrikes into the cog-wheel K. Thus if the man at H draws the lever towards him, the rope Q is drawn up round the axis, and by paſſing through the pulley R, draws back the carriage. As ſoon as the augre is emptied, he puſhes the lever from him, by which means the wheel L ſtrikes into the cogs of K, and by that means draws the carriage forward. In this manner he proceeds till the pipe is bored. T, V, are two ſupports for bearing the weight of the augre and its ſhank. The former is fixed upon the floor, and the latter on the frame which carries the piece.

Leaden pipes are of two ſorts, the one ſodered, the other not ſodered; for the conſtruction of each ſort, ſee the article PLUMBERY.

It appears from what has been ſaid under the article FLUID, that we can not only conduct water into pipes to very great diſtances, but bring it from one mountain to another, in pipes that go down into the interjacent vallies, and come up again, provided the reſervoir into which we bring the water, be ſomething lower than the ſpring from whence it comes, and whence the pipes begin: but it is neceſſary that we ſhould here take notice of ſome impediments that often ariſe in practice, and ſhew how to prevent or remedy them: the chief of theſe impediments ariſes from air in the pipes, by which the water is ſaid to be wind-bound; by theſe means, a pipe of two or three inches bore, will ſometimes not give more water than if it was but of one inch bore. The air may be diſcharged, and the pipe relieved, thus: let A, B, C, D, (pl. XCIX. *fig.* 6) be the ſpring from which a pipe is to bring water to the delivery at E, which ſuppoſe a mile from the ſpring. Now we will ſuppoſe E to be a little lower than D; for example, four or five feet. If the ſurface of the water in the ſpring, comes down to the mouth of the pipe at D, or ſometimes near it, there will be a good deal of air that will run down with the water into the pipe; and wherever the ground riſes in the conduit of the pipe, this air will lodge itſelf in the upper parts of the pipe, as *a o m r*, and thereby diminiſh the water-way of the pipe, ſo as to force the water to paſs between *o* and *n*, a paſſage perhaps ten times leſs than the pipe when free. The way to clear the pipe of this air, is by going from D, along the pipe; when you come to the firſt riſing ground, drive a nail at the higheſt part of the pipe, as at *m*, ſo as to make a hole through it: then taking out the nail, the air will blow out violently till at laſt the water ſucceeds the air: then let the hole be quite ſtopped up; and doing this at every eminence of the pipe, the whole air will be diſcharged, and the full quantity of water will be brought home at E. If the ſpring be very much higher than the place of delivery, the places of the air in the pipe will not be juſt at the higheſt part of the pipe, but a little beyond it; becauſe the water running with greater velocity and force, drives the lodged air forward, as may be ſeen at *o p g*, which otherwiſe would have been at *s*; and therefore the hole muſt be made beyond *s*. If the end E be ſtopped for ſome time, ſo that the water may ceaſe to be in motion, the air will go back gradually, and appear at *u y w t*, where it may be let out.

But Dr. Deſaguliers propoſes to clear the pipes of air, by means of a ſmall pipe, which he calls a rider, laid over the eminent part of the main of a pipe, as *d e f*, (*fig.* 7.) communicating with the main at the top of the eminence, as at *e*, with a little branch and cock C, which being opened when the engine is working, the air, being puſhed forward, is catched at *d*, and diſcharged by the cock. The doctor contrived an invention which he calls a Jack-in-the-box, whereby air-cocks would open and ſhut of themſelves, by the running of the water, and motion of the air only. This contrivance is deſcribed in the Philoſophical Tranſactions, N° 393.

Tobacco-PIPE, a machine uſed in the ſmoaking of tobacco, conſiſting of a long tube, made of earth or clay, having at one end a little caſe, or furnace, called the bowl, for the reception of the tobacco, the fumes whereof are drawn by the mouth through the other end. Tobacco-pipes are made of various faſhions; long, ſhort, plain, worked, white, varniſhed, unvarniſhed, and of various colours, &c. The Turks uſe pipes three or four feet long, made of ruſhes, or of wood bored, at the end whereof they fix a kind of a pot of baked earth, which ſerves as a bowl, and which they take off after ſmoaking.

PIPE alſo denotes a veſſel or meaſure for wine, and things meaſured by wine-meaſure. See the article MEASURE.

PIPE, in mining, is where the ore runs forwards endways in a hole, and doth not ſink downwards, or in a vein.

PIPER, pepper. See PEPPER.

PIQUETTES, among floriſts, a term uſed for a certain ſort of carnations, which have always a white ground and are ſpotted, or, as they call it, pounced with ſcarlet, red, purple, and other colours.

PIRATE, PYRATE, or ROVER, *Pirata*, a perſon, or veſſel, that robs on the high ſeas, without permiſſion or authority of any prince or ſtate.

When a pirate enters into any port or haven, and there robs a merchant's ſhip, this is not held to be piracy, becauſe it is not done on the high ſea; but it is a robbery at the common law. In caſe a ſhip is riding at anchor on the ſea, and it happens that the mariners or ſeamen are part in their boat, and the reſt on ſhore, by which accident none are left in the ſhip; here, if a pirate ſhall attack her, and commit a robbery, the ſame is piracy. Nevertheleſs, the taking, by a ſhip at ſea, in great neceſſity of victuals, cables, ropes, &c. ſuch things out of another veſſel, is not ſo, where that other veſſel can ſpare ſuch things, and the takers pay or give ſecurity for them.

The manner of trying a pirate is by a ſpecial commiſſion, directed to the lord high admiral, &c. and the offence of piracy may be heard and determined, as if the robbery was committed on land; and offenders ſhall ſuffer the like pains of death, loſs of lands and goods, &c. Perſons,

ſons combining to yield up ſhips to pirates, or to lay violent hands on the commanders of ſhips, or that correſpond with any pirate, are adjudged guilty of piracy.

PISCES, in aſtronomy, the twelfth ſign or conſtellation of the zodiac. The ſtars in Piſces, in Ptolemy's catalogue, are 38; in Tycho's, 33; and in the Britannic catalogue, 109.

PISCINA, in antiquity, a large baſon in a public place or ſquare, where the Roman youth learned to ſwim, and which was ſurrounded with a high wall, to prevent caſting of filth into it.

PISCIS VOLANS, in aſtronomy, a ſmall conſtellation of the ſouthern hemiſphere, unknown to the ancients, and inviſible to us in theſe northern regions.

PISSASPHALTUM, earth-pitch, in natural hiſtory, a fluid, opake, mineral body, of a thick conſiſtence, of a ſtrong ſmell, readily inflammable, but leaving a reſiduum of greyiſh aſhes, after burning. It ariſes out of the cracks of rocks, in ſeveral places in the iſland of Sumatra, and in ſome other parts of the Eaſt-Indies, and is much eſteemed there, in paralytic diſorders. It is greatly recommended by the ancients as an emollient, maturant, and digeſtive, and was uſed in cataplaſms for ripening all ſorts of tumours, and againſt the ſciatica, and other pains of the limbs.

PISSELÆUM INDICUM, Barbadoes tar, in natural hiſtory, a mineral fluid, of the nature of the thick bitumens, and of all others the moſt approaching, in appearance, colour, and conſiſtence, to the true piſſaſphaltum, though differing from it in other reſpects. It is very frequent in many parts of America, where it is found trickling down the ſides of mountains in large quantities, and ſometimes floating on the ſurface of the waters: but it ſeems to be almoſt loſt at this time in the iſland of Barbadoes, from whence it was originally named. It has been greatly recommended internally in coughs and other diſorders of the breaſt and lungs; but it is ſeldom to be met with genuine.

PISTACHIA, in botany, a genus of plants, whoſe fruit is an oblong, pointed nut, about the ſize of a filberd; including a kernel of a pale greeniſh colour, covered with a reddiſh ſkin. It is the produce of a large tree, with winged leaves reſembling thoſe of the aſh, which grows ſpontaneouſly in the Eaſtern countries, and bears the colds of our own.

Piſtachia nuts have a pleaſant ſweetiſh unctuous taſte, reſembling that of ſweet almonds; their principal difference from which conſiſts in their having rather a greater degree of ſweetneſs, accompanied with a light grateful flavour; and in being more oily, and hence ſomewhat more emollient, and perhaps more nutritious. They have been ranked among the principal analeptics, and greatly eſteemed by ſome in certain weakneſſes and emaciations. They are taken chiefly in ſubſtance, their greeniſh hue rendering them unſightly, in the form of an emulſion. They are very liable to grow rancid in keeping.

PISTIL, among botaniſts, denotes the female organ of generation in plants; it conſiſts of three parts, the germen, ſtyle, and ſtigma: the germen ſupplies the place of an uterus in plants, and is of various ſhapes, but always ſituated at the bottom of the piſtil, and contains the embryo-ſeeds: the ſtyle is a part of various forms alſo, but always placed on the germen: and the ſtigma is alſo of various figures, but always placed on the top of the ſtyle, or, if that be wanting, on the top of the germen.

PISTOL, the ſmalleſt piece of fire-arms, borne at the ſaddle-bow, on the girdle, and in the pocket.

PISTOLE, a gold-coin ſtruck in Spain, and in ſeveral parts of Italy, Switzerland, &c.

The piſtole has its augmentations and diminutions, which are quadruple piſtoles, double piſtoles, and half-piſtoles.

PISTON, *Embolus*, in pump-work, is a ſhort cylinder of metal, or other ſolid ſubſtance, fitted exactly to the cavity of the barrel or body of the pump. See the article PUMP.

PISUM, pea, in botany, a genus of plants, producing papilionaceous flowers; the vexillum is broad, heart-ſhaped, reflexed, emarginated, and ending in a point; the alæ are roundiſh, connivent, and ſhorter than the vexillum; the carina is compreſſed, ſemilunulated, and ſhorter than the alæ; the fruit is a large, long, unilocular, and bivalve pod, containing ſeveral globoſe ſeeds. The ſtalks of the pea plant are long, hollow, and of a ſea-green colour; the leaves are oblong, and of the ſame colour; and ſome are ſo placed that the ſtalks ſeem to run through them, while others grow by pairs on the ribs, that are terminated by tendrils, which lay hold of every thing they meet with.

The common white pea ſucceeds beſt in a light land, ſomewhat rich; the time of ſowing them is in the middle of April. Three buſhels are the common allowance for an acre; and they kill the weeds the land is ſubject to, better than any other crop. In Staffordſhire they ſow the garden rouncivals in fields, and they grow and yield very well, though they are left trailing upon the ground without any ſupport of ſticks.

The white and rouncival peaſe are only to be ſown with a broad caſt, and harrowed in; but the common grey pea, which is more frequently ſown in fields than either of them, muſt be ſown under furrow, and delights moſt in a cold wet clay. Theſe are to be ſown in February; and the common quantity of ſeed is two buſhels to an acre. The blue pea is the beſt kind for light ſandy land, and is to be early ſown; all peaſe love land manured with lime or with marle. In Suffolk they plow up their lays in the beginning of March, and, turning the turf well, they have a croſs ſtick ſet with iron pegs, which they ſtrike down with their feet: theſe pegs make holes at equal diſtance; into which they have boys and girls following to drop the peaſe ſingly, till all the land is ſet. As ſoon as this crop is cut, they plow the land acroſs, and, harrowing it well, they plow it again, and ſow it about Michaelmas with wheat, and the next year with barley, then with oats; after which the land requires new improvement. *Mortimer's Huſbandry.*

PITCH, a tenacious oily ſubſtance, drawn chiefly from pines and firs, and uſed in ſhipping, medicine, and various other arts: or it is more properly tar, inſpiſſated by boiling it over a ſlow fire. See the article PINE.

Pitch acquires different names, according to its different preparations, colours, and qualities: as it diſtils from the wood, it is called barras; but afterwards it aſſumes a double name, the fineſt and cleareſt being called galipot, and the coarſer marbled barras. Of the galipot is made what is called white pitch, or Burgundy pitch, which is nothing but the galipot melted with oil of turpentine; though ſome will have it a native pitch, diſtilling from a reſinous tree growing in the mountains of Franche Comte.

PITCHING, in naval affairs, the act of plunging or falling headlong into a ſea, when the wave, by which the ſhip's fore-part is lifted up, is ſuddenly withdrawn from under the prow.

Pitching is often extremely dangerous to a veſſel, as it ſtrains both the hull and the maſts to a great degree, and frequently carries away the latter by a violent jerk.

PITH, in vegetation, the ſoft ſpongy ſubſtance contained in the central parts of plants and trees. As the ſubſtance of the trunk in trees, ſays Boerhaave, become more woody, the pith is compreſſed, and ſtraitened to ſuch a degree, that it wholly diſappears. It is plain from this, that the office of the pith, in vegetation, cannot be very great, ſince it is not of perpetual duration. By its ſpongy ſtructure, it ſeems fitted to receive any ſuperfluous moiſture that might tranſude through the pores of the woody fibres. If by ſuch moiſture, or from any other cauſe, it happens to rot and periſh, as frequently happens in elms, the tree is found to grow full as well without it; a proof it is of no eſſential uſe in vegetation.

PITUITARY GLAND, in anatomy, a gland in the brain, of the ſize of a very large pea, placed under the cella of the os ſphenoides, under the infundibulum, wherewith it communicates, receiving from it a lymph or a juice, which the infundibulum derives from the plexus choroides and pineal gland; and from this lympha does the gland itſelf

The EARTH ⊕

MERCURY ☿

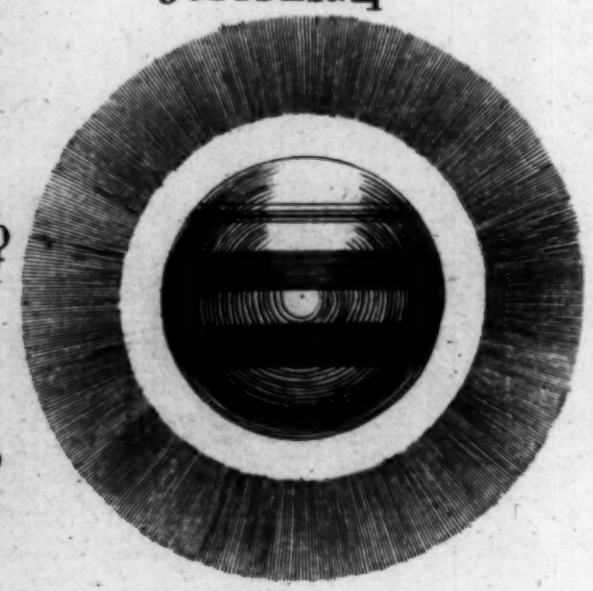
VENUS ♀

MARS ♂

The MOON ☽

Fig. 3. Planets.

JUPITER ♃



SATURN ♄

Fig. 2. Pipe.

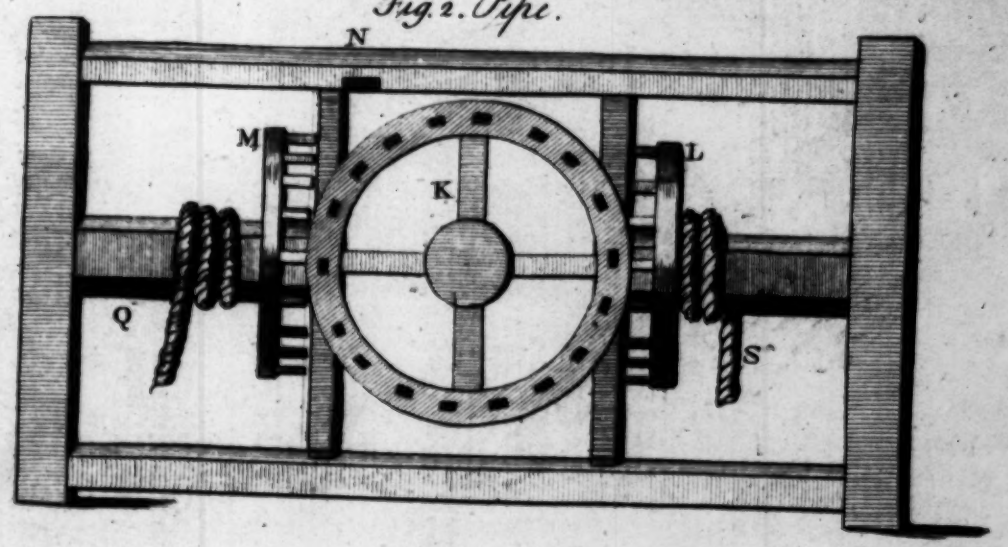
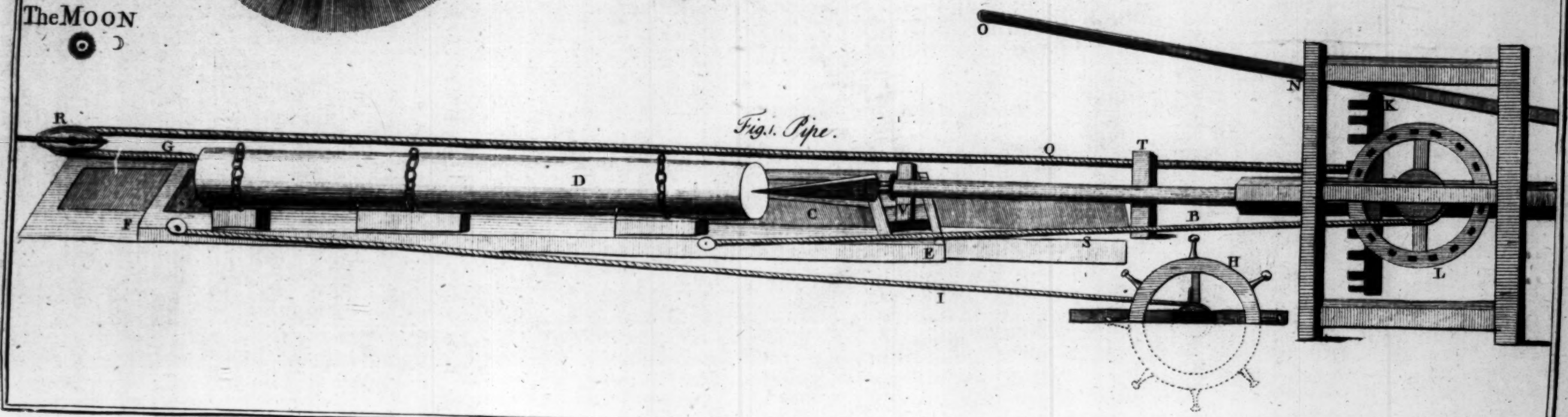


Fig. 1. Pipe.



5 JA 59

itſelf take its name. It alſo filtrates a juice itſelf, ſeparating from the blood a white liquor, very ſubtile, and apparently very ſpirituous.

PIVAT, or PIVOT, a foot or ſhoe of iron, or other metal, uſually conical, or terminating in a point, whereby a body, intended to turn round, bears on another fixed at reſt, and performs its circumvolutions. The pivot uſually bears or turns round in a ſole, or piece of iron or braſs, hollowed to receive it.

PLACARD, or PLACART, among foreigners, ſignifies a leaf or ſheet of paper, ſtretched out, and applied on a wall or poſt, containing edicts, regulations, &c. Among us, placard ſignifies a licence, whereby a perſon is permitted to uſe unlawful games, &c.

PLACARD, in architecture, denotes the decoration of the door of an apartment, conſiſting of a chambranle, crowned with its frieze or gorge, and a corniche, ſometimes ſupported by conſoles. See DOOR.

PLACE, *Locus*, in philoſophy, a mode of ſpace, or that part of immoveable ſpace which any body poſſeſſes. See SPACE.

Place is to ſpace or expanſion, ſays Mr. Locke, as time is to duration. Our idea of place is nothing but the relative poſition of any thing with reference to its diſtance from ſome fixed and certain points. Whence we ſay, that a thing has or has not changed place, when its diſtance either is or is not altered with reſpect to thoſe bodies with which we have occaſion to compare it. That this is ſo, continues that great philoſopher, we may eaſily gather from hence, that we have no idea of the place of the univerſe, though we can of all its parts. To ſay that the world is ſomewhere, means no more than it does exiſt: however, the word place is ſometimes taken to ſignify that ſpace which any body takes up; and in this ſenſe, according to the ſame author, the univerſe may be conceived in a place; but he thinks that this portion of infinite ſpace poſſeſſed by the material world, might more properly be called extenſion.

Ariſtotle, and his followers, conceive place to be the immoveable and contiguous concave ſurface of an ambient body; ſo that, as Mr. Boyle obſerves, it is a kind of veſſel, which every way contains the body lodged in it; only with this difference, that a veſſel is a kind of moveable place: hence it has been uſually affirmed, that what is in no place, is not at all: yet it appears not, ſays the laſt mentioned author, how the outermoſt heaven can be called a place, ſince theſe philoſophers aſſerting the world to be finite, muſt grant there is no ambient body without it to contain it; and if the outermoſt heaven ſhould be impelled by the power of God in a ſtraight line, this or that way, there would enſue a motion without a change of place; for the outermoſt heaven which was in none before, does not by its progreſſion come to be contained by a new ambient body; and, in this caſe, even according to the favourers of Ariſtotle, who approve Des Cartes' definition of local motion, the world may be ſaid to move without changing place; for it does not paſs from the neighbourhood of ſome bodies to that of others; ſince compriſing all bodies, and yet being bounded, there is no body for it to leave behind, nor any beyond for it to approach. See the article MOTION.

Ariſtotle divides ſpace into external and internal; the firſt being that already conſidered, includes or contains the body; and the other, that ſpace or room which the body contains. But Sir Iſaac Newton better and more intelligibly diſtinguiſhes place into abſolute and relative; abſolute or primary place being that part of infinite and immoveable ſpace which a body poſſeſſes; and relative or ſecondary place being the ſpace it poſſeſſes, conſidered with regard to the other adjacent bodies.

Optical PLACE, the point to which the eye refers an object.

The optic place of a ſtar is a point of the ſurface of the mundane ſphere, wherein a ſpectator ſees the center of a ſtar. See PARALLAX.

PLACE *of Radiation*, is the ſpace in a medium or tranſparent body through which any viſible object radiates.

The place of the ſun, ſtar, &c. alſo denotes the ſign and degree of the zodiac which the luminary is in; or the degree of the ecliptic, reckoning from the beginning of Aries, which the planet or ſtar's circle of longitude cuts; and therefore coincides with the longitude of the ſun, planet, or ſtar. As the ſine of the ſun's greateſt declination 23° 30′: to the ſine of any preſent declination given or obſerved, for inſtance, 23° 15′:: ſo is the radius 10: to the ſine of his longitude 81° 52′; which, if the declination were north, would give 20° 52′ of Gemini; if ſouth, 20° 52′ of Capricon for the ſun's place. See DECLINATION, &c.

The place of the moon being that part of her orbit wherein ſhe is found at any time, is of various kinds, by reaſon of the great inequalities of the lunar motions, which render a number of equations and reductions neceſſary before the juſt point be found. The moon's fictitious place is her place once equated; her place nearly true, is her place twice equated; and her true place is her place thrice equated. See MOON.

Excentric PLACE *of a Planet*. See the article EXCENTRIC.

Geocentric PLACE *of a Planet*. See the article GEOCENTRIC.

Heliocentric PLACE *of a Planet*. See the article HELIOCENTRIC.

PLACE, in geometry. See LOCUS.

PLACE, in war, a general name for all kinds of forteſſes where a party may defend themſelves: thus, 1. A ſtrong or fortified place, is one flanked, and covered with baſtions. 2. A regular place, one whoſe angles, ſides, baſtions, and other parts, are equal; and this is uſually denominated from the number of its angles, as a pentagon, hexagon, &c. 3. Irregular place, is one whoſe ſides and angles are unequal. 4. Place of arms, is a ſtrong city or town pitched upon for the chief magazine of an army; or in a city or garriſon, it is a large open ſpot of ground, uſually near the center of the place, where the grand guard is commonly kept, and the garriſon holds its rendezvous at reviews; and in caſes of alarm to receive orders from the governor. 5. Place of arms of an attack, in a ſiege, is a ſpacious place covered from the enemy by a parapet or epaulement, where the ſoldiers are poſted ready to ſuſtain thoſe at work in the trenches againſt the ſoldiers of the garriſon. 6. Place of arms particular, in a garriſon, a place near every baſtion where the ſoldiers ſent from the grand place to the quarters aſſigned them, relieve thoſe that are either upon the guard or in ſight. 7. Place of arms without, is a place allowed to the covert-way for the planting of cannon, to oblige thoſe who advance in their approaches to retire. 8. Place of arms in a camp, a large place at the head of the camp for the army to be ranged in and drawn up in battalia. There is alſo a place for each particular body, troop, or company, to aſſemble in. See the articles CAMP, TROOP, &c.

PLACE, in logic and oratory, denotes the ſeat or ſource of an argument, of which there are two kinds, inartificial and artificial; the firſt is the place of teſtimony, authority, &c. the ſecond, that of reaſon, as when we argue from univerſals, cauſes, &c.

Common PLACE. See COMMON *Place*.

PLACENTA, in anatomy, a ſoft roundiſh maſs found in the womb of pregnant women; which, from its reſemblance to the liver, was called by the ancients hepar uterinum, the uterine liver.

The number of placentæ in human ſubjects, anſwers to that of the fœtuſes; and as theſe are uſually ſingle, the placenta is uſually ſo too: but when there are two or more fœtuſes, there are always as many placentæ; yet in this caſe they often cohere together ſo as to ſeem but one; but even in this caſe, their veſſels do not communicate from one to the other.

The placenta is about eight or nine inches in diameter, and about an inch in thickneſs. Its convex and ſpongy part is connected to the uterus, by means of a very thin and fine membrane, which is reticulated, villoſe, and continuous with the chorion. Its concave part is turned towards the fœtus, and ſhews a multitude of very large veſſels: it is joined to the navel-ſtring, and ſurrounded with a ſmooth membrane from the chorion and amnios. It has no certain part of the uterus to adhere to; but is uſually fixed to its bottom. Its ſubſtance, according to Ruyſch and Heiſter, is truly vaſcular, or compoſed ſolely and entirely

tirely of the umbilical veins and arteries, interwoven in a very curious manner.

The uſe of the placenta is, together with the chorion, to abſorb the nutritious juices from the mother's uterus, as the inteſtines do the chyle; and finally to tranſmit it to the fœtus, by means of the umbilical veins. And it probably ſerves to refund again to the parent, the blood and urine of the fœtus, by the umbilical arteries.

PLACENTA is alſo a term uſed, by ſome botaniſts, for what is more uſually called the receptacle of the ſeeds. See the article RECEPTACLE.

PLACITA, PLEAS, in a law-ſenſe. See the article PLEA.

PLACITUM, in law, a ſentence of a court, or an opinion, decree, or ordinance.

PLAFOND, or PLAFOUND, in architecture, the ceiling of a room, whether it be flat or arched, lined with plaſter or joiner's work, and frequently enriched with painting.

The word plafond is alſo more particularly uſed for the bottom of the projecture of the larmier of the corniche, called alſo ſoffit. See SOFFIT.

PLAGIARY, in philology, the purloining another perſon's works, and putting them off for a man's own.

PLAGUE, a moſt acute fever, ariſing from a poiſonous miaſma, brought from Oriental countries, which unleſs it is immediately expelled out of the body, by the ſtrength of the vital motions, by buboes and carbuncles, proves fatal.

In this, as well as in moſt contagious diſeaſes, ſays Hoffman, the venomous miaſma is ſwallowed with the air, and inſinuates itſelf into the ſalival juice; whence it aſſaults the head, brain, nerves, and animal ſpirits; producing a torpor in the head, a heavineſs, a ſleepineſs, a violent pain, a ſtupor of the ſenſes, a forgetfulneſs, inquietude, watching, and loſs of ſtrength. From the fauces it proceeds to the ſtomach, creating a loathing of food, nauſeas, anxiety of the precordia, cardialgia attended with fainting, reaching to vomit, and vomiting itſelf. Hence it proceeds to the membranes of the ſpinal marrow, the coats of the arteries, producing horrors, a languid, ſmall, contracted, quick pulſe, and even fainting. All which are generally ſigns and ſymptoms of the plague, which are of a more violent and quick operation in proportion to the virulence of the peſtilential miaſma. This diſeaſe differs from other contagious, malignant, and eruptive fevers, becauſe it is the moſt acute, and ſometimes kills on the firſt, and ſometimes on the ſecond day. In our climate it is not epidemic or ſporadic, from a bad way of living, or an unhealthful air, but happens when it is moſt ſalutary, from contagion alone, and is imported from hot countries where this diſeaſe rages. It will not only abate by intenſe cold, but be perfectly extinguiſhed: wherefore in a cold ſeaſon and very cold countries, it either does not appear at all, or in a very mild degree; whereas if the climate is hot, it is not only moſt violent, but moſt common.

All plagues are not of the ſame nature, but vary according to different conſtitutions and circumſtances; but all who have written of the plague univerſally agree, that ſpongy and porous bodies, of an obeſe habit, of a ſanguine and phlegmatico-ſanguine conſtitution, women, young perſons and children, perſons of a timid diſpoſition, that are poor, live hard, or are given to luxury, and ſit up late at night, are more apt to be afflicted with this diſeaſe than the ſtrong and intrepid, lean, nervous, endued with large veſſels, men, old perſons obnoxious to the hæmorrhoidal flux, and who have iſſues and open ulcers. Nothing brings on this diſtemper ſooner than fear, a dread of death, and a conſternation of the mind. If the peſtilential poiſon is not expelled to the external parts, it is certainly fatal; nor is this to be done, according to Hoffman, as in other fevers, by large ſweats, by ſtools, by a flux of urine, by bleeding at the noſe, either natural or artificial: for theſe threaten deſtruction. The ſalutary and critical excretion which perfectly ſolves the peſtilential diſeaſe is by tumours in the ſurface of the body, not otherwiſe than the eryſipelas, between the third and fourth day, and the ſooner the better, becauſe then the ſymptoms are mitigated. That there is poiſon contained in theſe tumours appears from hence, that if the ſurgeon opens any of the tumours with his lancet, and then bleeds a ſound man with the ſame, he will be immediately ſeized with the plague. The peſtilential tumours are of two kinds; the firſt ariſes in the glandulous places, moſt commonly in the groin and arm pits; ſometimes in the parotid and mammary glands, as alſo the lower maxillary, and in thoſe near the aſpera arteria. The deſcription and treatment of the tumours, may be ſeen under the article *Peſtilential* BUBO.

The other ſort is the anthrax, or carbuncle, and is already treated of under the article CARBUNCLE.

As in the ſmall-pox the management conſiſts in clearing the primæ viæ in the beginning, in regulating the fever, and in promoting the natural diſcharges; ſo in the plague, the ſame indications will take place. When the fever is very acute, a cool regimen is neceſſary: but when the pulſe is languid, and the heat not exceſſive, moderate cordials muſt be uſed. The moſt gentle emetics may be given; the beſt is ipecacuhana, if the ſtomach or bowels are not inflamed, for in that caſe certain death may be expected. In France they bleed about twelve ounces on the firſt day, and then four or five ounces every two hours after. This, they ſay, had extraordinary ſucceſs with the aſſiſtance only of cooling ptiſans, and ſuch like drinks, which they gave plentifully at the ſame time. Sydenham adviſes, that ſweating be continued without intermiſſion. Dr. Mead recommends an infuſion of Virginia ſnake-root in boiling water, as the moſt proper ſudorific; or for want of that, ſome other warm aromatic, with the addition of about a fourth part of aqua theriacalis. Thoſe who are obliged to be near the ſick, muſt take care that the miaſmata do not approach the vital juices, nor yet the ſalival, to which purpoſe phyſicians recommend frequent ſpitting, and waſhing the mouth with vinegar or wine, or ſnuffing them up the noſe. The efficacy will be ſtill greater if they are imbued with rue, or citron-rind. It will be likewiſe proper to get a few ſpoonfuls of Rheniſh-wine, or Bezoardic vinegar diluted with water or wine, and ſo take them. The Turks deal much in the juice of lemons. Externally many recommend the uſe of iſſues, becauſe the matter of the miaſma is wont to adhere to the ſerous part of the blood, and to be brought by the ſtrength of nature to the place where the iſſue is made. When the plague is actually begun, and the body is coſtive, a gentle clyſter ſhould be uſed. Then a ſweat ſhould be promoted twenty-four hours at leaſt, that the poiſon may exhale and paſs through the ſkin; and epithems to the heart will not be without benefit: they may be made of theriac, expreſſed oil of nutmegs, camphor, ſaffron, caſtor, and balſam of Peru. Langius recommends bleeding after ſweating: but above all acids are highly praiſed, ſuch as juice of citrons, Seville-oranges, lemons, vinegar, &c. When the ſtrength of the diſeaſe is vanquiſhed, gentle laxatives will be proper to expel the ſordes during the courſe of the diſeaſe. Mindererus aſſerts, that unleſs alexiterials be given twenty-four hours, all medicines are vain.

PLAIN, *Planus*, in general, an appellation given to whatever is ſmooth and even, or ſimple, obvious, and eaſy to be underſtood; and, conſequently, ſtands oppoſed to rough, enriched, or laboured.

A plain figure, in geometry, is an uniform ſurface; from every point of whoſe perimeter, right lines may be drawn to every other point in the ſame.

A plain angle is one contained under two lines, or ſurfaces, in contradiſtinction to a ſolid angle. See ANGLE.

The doctrine of plain triangles, as thoſe included under three right lines, is termed plain trigonometry. See TRIGONOMETRY.

PLAIN *Chart*. See CHART.

PLAIN *Sailing*. See SAILING.

PLAIN *Scale*. See SCALE.

PLAIN *Table*, in geometry, &c. an inſtrument uſed in the ſurveying of lands, whereby the plan is taken on the ſpot, without any future protraction.

The table itſelf is a parallelogram of oak, or other wood (plate XCIX. *fig.* 8.) about fifteen inches long, and twelve broad, conſiſting of two ſeveral boards, round which are ledges of the ſame wood; the two oppoſite of which being taken off, and the ſpangle unſcrewed from the

the bottom, the aforeſaid two boards may be taken aſunder for eaſe and conveniency of carriage. For the binding of the two boards and ledges faſt, when the table is ſet together, there is a box-jointed frame, about three quarters of an inch broad, and of the ſame thickneſs as the boards, which may be folded together in ſix pieces. This frame is ſo contrived, that it may be taken off and put on the table at pleaſure, and may go eaſily on the table, either ſide being upwards. This frame alſo is to faſten a ſheet of paper upon the table, by forcing down the frame, and ſqueezing in all the edges of the paper; ſo that it lies firm and even upon the table, that thereby the plot of a field, or other incloſure, may conveniently be drawn upon it.

On both ſides this frame, near the inward edge, are ſcales of inches ſubdivided into ten equal parts, having their proper figures ſet to them. The uſes of theſe ſcales of inches are for ready drawing of parallel lines upon the paper; and alſo for ſhifting your paper, where one ſheet will not hold the whole work.

Upon one ſide of the ſaid box-frame, are projected the 360 degrees of a circle, from a braſs center-hole in the middle of the table. Each of theſe degrees are ſubdivided into thirty minutes; to every tenth degree are ſet two numbers, one expreſſing the proper numbers of degrees, and the other the complement of that number of degrees to 360. This is done to avoid the trouble of ſubtraction in taking of angles.

On the other ſide of this frame, are projected the 180 degrees of a ſemi-circle from a braſs center-hole, in the middle of the table's length, and about a fourth part of its breadth. Each of theſe degrees is ſubdivided into thirty minutes; to every tenth degree are ſet likewiſe, as on the other ſide, two numbers; one expreſſing the proper number of degrees, and the other the complement of that number of degrees to 180, for the ſame reaſon as before.

The manner of projecting the degrees on the aforeſaid frame is, by having a large circle divided into degrees, and every thirty minutes; for then placing either of the braſs center-holes on the table, in the center of that circle ſo divided, and laying a ruler from that center to the degrees on the limb of the circle; where the edge of the ruler cuts the frame, make marks for the correſpondent degrees on the frame.

The degrees, thus inſerted on the frame, are of excellent uſe in wet or ſtormy weather, when you cannot keep a ſheet of paper upon the table. Alſo, theſe degrees will make the plain-table a theodolite, or a ſemicircle, according as what ſide of the frame is uppermoſt.

There is a box, with a needle and card, covered with a glaſs, fixed to one of the long ſides of the table, by means of a ſcrew, that thereby it may be taken off. This box and needle is very uſeful for placing the inſtrument in the ſame poſition upon every remove.

There belongs to this inſtrument a braſs ſocket and ſpangle, ſcrewed with three ſcrews to the bottom of the table, into which muſt be put the head of the three-legged ſtaff, which may be ſcrewed faſt, by means of a ſcrew in the ſide of the ſocket.

There is alſo an index belonging to the table, which is a large braſs-ruler, at leaſt ſixteen inches long, and two inches broad, and ſo thick as to make it ſtrong and firm, having a ſloped edge, called the fiducial edge, and two ſights ſcrewed perpendicularly on it, of the ſame height. They muſt be ſet on the ruler perfectly at the ſame diſtance from the fiducial edge. Upon this index it is uſual to have many ſcales of equal parts, as alſo diagonals, and lines of chords.

When you would make your table fit for uſe, lay the two boards together, and alſo the ledges at the ends in their due places, according as they are marked. Then lay a ſheet of white paper all over the table, which muſt be ſtretched over the boards, by putting on the box-frame, which binds both the paper to the boards, and the boards to one another: then ſcrew the ſocket on the back ſide the table, and alſo the box and needle in its due place, the meridian line of the card lying parallel to the meridian or diameter of the table; which diameter is a right line drawn upon the table, from the beginning of the degrees through the center, and ſo to the end of the degrees. Then put the ſocket upon the head of the ſtaff, and there ſcrew it: alſo put the ſights upon the index, and lay the index on the table. So is your inſtrument prepared for uſe, as a plain table, theodolite, or ſemicircle.

1. *How to obſerve an angle in the field by the* PLAIN *Table.* —Suppoſe E, K, K, G, (*fig.* 9.) to be two hedges, or two ſides of a field, including the angle E K G, and it is required to draw upon the table an angle equal thereto: firſt, place your inſtrument as near the angular point K as conveniency will permit, turning it about, till the north end of the needle hang directly over the meridian line in the card, and then ſcrew the table faſt. Then upon your table, with your protracting-pin, which is a fine needle put into a piece of box or ivory, neatly turned, or compaſs-point, aſſign any point at pleaſure upon the table, and to that point apply the edge of the index, turning the index about upon that point, till through the ſights you ſee a mark ſet up at E, or parallel to the line E H; and then with your protracting pin, compaſs-point, or pencil, draw a line by the ſide of the index to the aſſigned-point upon the table: then, the table remaining immoveable, turn the index about upon the forementioned point, and direct the ſights to the mark ſet up at G, or parallel thereto, that is, ſo far diſtant from G, as your inſtrument is placed from K; and then by the ſide of the index draw another line to the aſſigned point. Thus will there be drawn upon the table two lines repreſenting the hedges E K and K G, and which include an angle equal to the angle E K G. And, though you know not the quantity of this angle, yet you may find it, if required: for, in working by this inſtrument, it is ſufficient only to give the proportions of angles, and not their quantities in degrees, as in working by the theodolite, ſemi-circle, or circumferentor. Alſo in working by the plain table, there needs no protraction at all, for you will have upon your table the true figure of any angle or angles that you obſerve in the field, in their true poſitions, without any further trouble.

2. *How to find a quantity of an angle in a field, by the* PLAIN *Table, conſidered as a theodolite or ſemi-circle.* —Let it firſt be required to find the quantity of the angle E K G (*fig.* 9.) by the plain table, as a theodolite. Place your inſtrument at K, with the theodolite ſide of the frame upwards, laying the index upon the diameter thereof; then turn the whole inſtrument about, the index ſtill reſting upon the diameter, till through the ſight you eſpy the mark at E: then ſcrewing the inſtrument faſt there, turn the index about upon the theodolite center-hole in the middle of the table, till through the ſights you eſpy the mark at G. Then note what degrees on the frame of the table are cut by the index, and thoſe will be the quantity of the angle E K G ſought.

You muſt proceed in the ſame manner for finding the quantity of an angle by the plain table as a ſemi circle; only put the ſemi-circle ſide of the frame upwards, and move the index upon the other center-hole.

3. *How, by the* PLAIN *Table, to take the plot of a field at one ſtation within the ſame, from whence all the angles of the ſame field may be ſeen.* — Having entered upon the field to ſurvey, your firſt work muſt be to ſet up ſome viſible mark at each angle thereof; which being done, make choice of ſome convenient place about the middle of the field, from whence all the marks may be ſeen, and there place your table, covered with a ſheet of paper, with the needle hanging directly over the meridian line of the card, which you muſt always have regard to, eſpecially when you are to ſurvey many fields together. Then make a mark about the middle of the paper, to repreſent that part of the field where the table ſtands; and, laying the index upon this point, direct your ſights to the ſeveral angles where you before placed marks, and draw lines by the ſide of the index upon the paper. Then meaſure the diſtance of every of theſe marks from your table, and by your ſcale ſet the ſame diſtances upon the lines drawn upon the table, making ſmall marks with your protracting-pin, or compaſs-point, at the end of each of them. Then lines, being drawn from the one to the other of theſe points, will

will give you the exact plot of the field; all the lines and angles upon the table being proportional to those of the field.

Example.—Suppose the plot of the field A B C D E F (*fig.* 10.) was to be taken. Having placed marks in the several angles thereof, make choice of some proper place about the middle of the field, as at L, from whence you may behold all the marks before placed in the several angles; and there place your table. Then turn your instrument about, till the needle hang over the meridian line of the card, denoted by the line N S.

Your table being thus placed with a sheet of paper thereon, make a mark about the middle of your table, which shall represent the place where your table stands. Then applying your index to this point, direct the sights to the first mark at A, and, the index resting there, draw a line by the side thereof to the point L. Then with your chain measure the distance from L, the place where your table stands, to A, the first mark, which suppose eight chains ten links. Then take eight chains ten links from any scale, and set that distance upon the line from L to A.

Then directing the sights to B, draw a line by the side of the index, as before, and measure the distance from your table at L, to the mark at B, which suppose eight chains seventy-five links. This distance taken from your scale, and applied to your table from L to B, will give the point B, representing the second mark. Then direct the sights to the third mark C, and draw a line by the side of the index, measuring the distance from L to C, which suppose ten chains sixty-five links. This distance being taken from your scale, and applied to your table from L to C, will give you the point C, representing the third mark.

In this manner you must deal with the rest of the marks at D, E, and F, and more, if the field had consisted of more sides and angles.

Lastly, when you have made observations of all the marks round the field, and found the points A B C D E and F upon your table, you must draw lines from one point to another, till you conclude where you first begun. As, draw a line from A to B, from B to C, from C to D, from D to E, from E to F, and from F to A, where you begun; then will A B C D E F be the exact figure of your field, and the line N S the meridian.

Note, Our chains are commonly four poles in length, and are divided into one hundred equal parts, called links, at every tenth of which are brass distinctions numbering them.

4. *To take the plot of a wood, park, or other large champaign plain by the* PLAIN *Table, in measuring round the same.*—Suppose A B C D E F G (*fig.* 11.) to be a large wood, whose plot you desire to take upon the plain table.

Having put a sheet of paper upon the table, place your instrument at the angle A, and direct your sights to the next angle at B, and by the side of which draw a line upon your table, as the line A B. Then measure by the hedge side from the angle A to the angle B, which suppose twelve chains five links. Then from your scale take twelve chains five links, and lay off upon your table from A to B. Then turn the index about, and direct the sights to G, and draw the line A G upon the table. But at present you need not measure the distance.

Remove your instrument from A, and set up a mark where it last stood, and place your instrument at the second angle B. Then laying the index upon the line A B, turn the whole instrument about, till through the sights you see the mark set up at A, and there screw the instrument. Then laying the index upon the point B, direct your sights to the angle C, and draw the line B C upon your table. Then measuring the distance B C four chains forty-five links, take that distance from your scale, and set it upon your table from B to C.

Remove your instrument from B, and set up a mark in the room of it, and place your instrument at C, laying the index upon the line C B; and turn the whole instrument about, till through the sights you espy the mark set up at B, and there fasten the instrument. Then laying the index on the point C, direct the sights to D, and draw upon the table the line C D. Then measure from C to D eight chains eighty-five links, and set that distance upon your table from C to D.

Remove the instrument to D, placing a mark at C, where it last stood, and lay the index upon the line D C, turning the whole instrument about, till through the sights you see the mark at C, and there fasten the instrument. Then lay the index on the point D, and direct the sights to E, and draw the line D E. Then with your chain measure the distance D E thirteen chains four links, which lay off on the table from D to E.

Remove your instrument to E, placing a mark at D, where it last stood, and, laying the index upon the line D E, turn the whole instrument about, till through the sights you see the mark at D, and there fasten the instrument. Then lay the index on the point E, and direct the sights to F, and draw the line E F. Then measure the distance E F seven chains seventy links, which take from your scale, and lay off from E to F.

Remove your instrument to F, placing a mark at E, where it last stood, and lay the index upon the line E F, turning the instrument about, till you see the mark set up at E, and there fasten the instrument. Then laying the index on the point F, direct the sights to G, and draw the line F G upon the table, which line F G will cut the line A G in the point G. Then measure the distance F G five chains sixty-seven links, and lay it off from F to G.

Remove your instrument to G, setting a mark where it last stood, and lay the index upon the line F G, turning the whole instrument about, till through the sights you see the mark at F, and there fasten the instrument. Then laying the index upon the point G, direct the sights to A, your first mark, and draw the line G A, which, if you have truly wrought, will pass directly through the point A, where you first began.

In this manner you may take the plot of any champaign plain, be it never so large. And here note, that very often hedges are of such thickness, that you cannot come near the sides or angles of the field, either to place your instrument, or measure the lines: therefore, in such cases, you must place your instrument, or measure your lines parallel to the side thereof; and then your work will be the same as if you measured the hedge itself. Note also, that in thus going about the field, you may much help yourself by the needle. For looking what degree of the card the needle cuts at one station, if you remove your instrument to the next station, and with your sights look to the mark where the instrument last stood, you will find the needle to cut the same degree again, which will give you no small satisfaction in the prosecution of your work. And though there be a hundred or more sides, the needle will still cut the same degrees at all of them, except you have committed some former error: therefore, at every station have an eye to the needle.

5. Of shifting the paper.—In taking the plot of a field by the plain table, and going about the same, as before directed, it may so fall out, if the field be very large, and when you are to take many inclosures together, that the sheet of paper upon the table will not hold all the work. But you must be forced to take off that sheet, and put another clean sheet in the room thereof: and, in plotting of a manor or lordship, many sheets may be thus changed, which we call shifting of paper. The manner of performing thereof is as follows.

Suppose in going about to take the plot A B C D E F G (*fig.* 12.) as before directed, that you having made choice of the angle at A for the place of the beginning, and proceed from thence to B, and from B to C, and from C to D, when you come to the angle at D, and are to draw D E, you want room to draw the same upon the table; do thus:

First, through the point D draw the line D O, which is almost so much of the line D E as the table will contain. Then near the edge of the table H M, draw a line parallel to H M, by means of inches and subdivisions on the opposite sides of the frame, as P Q, and another line at right angles to that through the point O, as O N. This being done, mark this sheet of paper with the figure (1) about the middle thereof, for the first sheet.

Then,

Then, taking this ſheet off your table, put another clean ſheet thereon, and draw upon it a line parallel to the contrary edge of the table, as the line R S (*fig.* 13.) Then taking your firſt ſheet of paper, lay it upon the table ſo, that the line P Q may exactly lie upon the line R S, to the beſt advantage, as at the point O. Then with the point of your compaſſes draw ſo much of the line O D upon the clean ſheet of paper as the table will hold. Having thus done, proceed with your work upon the new ſheet, beginning at the point O; and ſo going forward with your work, in all reſpects as has been before directed; as from O to E, from E to F, from F to G, and from G to A; ſhifting your paper as you have occaſion.

PLAIN *Number* is a number that may be produced by the multiplication of two numbers into one another: thus 20 is a plain number produced by the multiplication of 5 into 4.

PLAIN *Place*, *locus planus*, or *locus ad planum*, among the ancient geometricians, denoted a geometrical locus, when it was a right line or a circle, in oppoſition to a ſolid place, which was an ellipſis, parabola, or hyperbola. Theſe the moderns diſtinguiſhed into *loci ad rectam*, and *loci ad circulum*. See LOCUS.

PLAIN *Problem*, in mathematics, is ſuch a problem as cannot be ſolved geometrically, but by the interſection either of a right line and a circle, or of the circumferences of two circles; as, given the greateſt ſide, and the ſum of the other two ſides of a right angled triangle, to find the triangle, as alſo to deſcribe a trapezium that ſhall make a given area of four given lines. Such problems can only have two ſolutions, in regard a right line can only cut a circle, or one circle cut another in two points.

PLAIN, in heraldry, ſometimes denotes the point of the ſhield, when couped ſquare; a part remaining under the ſquare, of a different colour or metal from the ſhield. This has been ſometimes uſed as a mark of baſtardy, and called champaigne; for, when the legitimate deſcendants of baſtards have taken away the bar, fillet, or traverſe borne by their fathers, they are to cut the point of the ſhield with a different colour called plain.

PLAINT, in law, the exhibiting any action, real or perſonal, in writing. See ACTION.

PLAISE, the Engliſh name of a ſpecies of the pleuronectes, with ſmooth ſides, a ſpine near the anus, and the eyes and ſix tubercles placed on the right ſide of the head: it is ſomewhat larger than the flounder.

PLAISTER, or PLASTER. See the article PLASTER.

PLAN, in general, denotes the repreſentation of ſomething drawn on a plane: ſuch are maps, charts, ichnographies, &c.

The term plan, however, is particularly uſed for a draught of a building, ſuch as it appears, or is intended to appear, on the ground; ſhewing the extent, diviſion, and diſtribution of its area, or ground-plot, into apartments, rooms, paſſages, &c.

A geometrical plan is that, wherein the ſolid and vacant parts are repreſented in their natural proportions.

The raiſed plan of a building is the ſame with what is otherwiſe called an elevation or orthography.

A perſpective plan is that exhibited by degradations, or diminutions, according to the rules of perſpective. See PERSPECTIVE.

To render plans intelligible, it is uſual to diſtinguiſh the maſſives with a back waſh; the projectures on the ground are drawn in full lines, and thoſe ſuppoſed over them in dotted lines. The augmentations, or alterations, to be made, are diſtinguiſhed by a colour different from what is already built; and the tints of each plan made lighter, as the ſtories are raiſed.

In large buildings, it is uſual to have three ſeveral plans, for the three firſt ſtories.

PLANCHIER, or PLANCERE, in architecture, the under part of the corona, or drip, making the ſuperior part of the corniche, between two cymatiums.

PLANE, *Planum*, in geometry, denotes a plain ſurface, or one that lies evenly between its bounding lines: and as a right line is the ſhorteſt extenſion from one point to another, ſo a plane ſurface is the ſhorteſt extenſion from one line to another.

In aſtronomy, conics, &c. the term plane is frequently uſed for an imaginary ſurface, ſuppoſed to cut and paſs through ſolid bodies; and on this foundation, is the whole doctrine of conic ſections built.

In mechanics, planes are either horizontal, that is, parallel to the horizon, or inclined thereto.

The determining how far any given plane deviates from an horizontal one, makes the whole buſineſs of levelling.

In optics, the planes of reflection and refraction are thoſe drawn through the incident and reflected or refracted rays.

The plane of the horopter is that drawn through the horopter, perpendicularly to the plane of the two optical axes. See HOROPTER.

In perſpective, we meet with the perſpective plane, which is ſuppoſed to be pellucid, and perpendicular to the horizon; the horizon plane, ſuppoſed to paſs through the ſpectator's eye, parallel to the horizon; the geometrical plane, likewiſe parallel to the horizon, whereon the object to be repreſented is ſuppoſed to be placed, &c.

The plane of projection, in the ſtereographic projection of the ſphere, is that on which the projection is made; correſponding to the perſpective plane.

PLANE, in joinery, an edge-tool to ſhave wood ſmooth and even. It conſiſts of a wooden ſtock, very ſmooth at bottom, in the middle of which is an aperture, through which paſſes a ſteel edge very ſharp, that takes off the inequalities of the wood on which it is ſlid along.

It has various names according to its forms, ſizes, and uſes.

PLANET, *Planeta*, in aſtronomy, a celeſtial body revolving round the ſun as a center, and changing its poſition with reſpect to the fixed ſtars.

The word is formed from the Greek, πλανητης, which is derived from πλανη, wandering; becauſe they are not fixed like the other ſtars.

The planets are uſually diſtinguiſhed into primary and ſecondary.

Primary PLANETS are thoſe which move round the ſun as a center, and theſe, by way of eminence, are uſually called planets.

Secondary PLANETS, or ſatellites, are ſuch as move round ſome primary planet, as their reſpective center, in the ſame manner as the primary planets do round the ſun.

The primary planets are ſix in number, viz. Saturn, Jupiter, Mars, the Earth, Venus, and Mercury. Of theſe the firſt three are called ſuperior planets, becauſe their orbits circumſcribe that of the earth; and the two laſt inferior planets, becauſe their orbits are circumſcribed by the orbit of the earth. The order, poſition, magnitude, &c. of the planets are repreſented in plate CI. *fig.* 3.

From the ſeveral phaſes and appearances of the planets, they are found to be all perfectly like the moon, that is, opake bodies, and borrow all their light from the ſun.

This will plainly appear from the following particulars:

1. Venus, obſerved with a teleſcope, is rarely found full, but with variable phaſes like thoſe of the moon, her illuminated part ſtill turned towards the eaſt, when ſhe is the morning ſtar, and weſt, when the evening ſtar. And the like phaſes have been obſerved of Mars and Mercury.

2. Gaſſendus firſt, and after him others, have obſerved Mercury on the face of the ſun, acroſs which he appeared to paſs like a black round ſpot.—Horrox, in 1639, alſo obſerved Venus in the ſun, where ſhe made the ſame appearance.

3. De la Hire, in 1700, with a teleſcope of ſixteen feet, diſcovered mountains in Venus, larger than thoſe of the moon.

4. Caſſini obſerved two ſpots in Venus; four in Mars, likewiſe obſerved by Campani; and ſeveral, at ſeveral times, in Jupiter: and from his obſervations of theſe ſpots found that they had a rotation round their axes: he even determined the velocity of that rotation, or the period wherein it was effected, v. gr. that of Jupiter 9 hours 56′; that of Mars, 24 hours 40′; and that of Venus, 24 hours.—And ſince the ſun, moon, Jupiter, Mars, Venus, and the earth, are found to revolve on their axes, i. e. to have a diurnal rotation: no doubt Mercury and Saturn

have the ſame; though the great nearneſs of the former to the ſun, and the great diſtance of the latter, prevent any ſpots from being obſerved on them, whence that rotation might be demonſtrated.

5. In Jupiter are obſerved two ſwaths, or belts, brighter than the reſt of his diſk, and moveable; ſometimes found in one part, ſometimes in another; ſometimes broader, ſometimes narrower.

6. In 1609, were firſt obſerved three little ſtars, or moons, moving about Jupiter, by Sim. Marius; and in 1610 the ſame were obſerved by Galileo: theſe are now frequently obſerved to diſappear in a clear ſky, when Jupiter happens to be diametrically interpoſed between them and the ſun.—Whence it appears they are void of light, at ſuch time when the ſun's rays, intercepted by Jupiter, cannot be propagated to them in right lines; and hence alſo, that, like the moon, they are opake bodies, illuminated by the ſun; and hence again, ſince Jupiter does not illuminate his ſatellites when placed behind, he himſelf in that part turned from the ſun, may be argued to be void of light.

7. When Jupiter's moons are diametrically interpoſed between Jupiter and the ſun, there is ſeen a round ſpot on Jupiter's diſk, which is ſometimes larger than the ſatellite itſelf—Whence it appears, that the ſatellites are opake bodies, illuminated by the ſun; that they project a ſhadow upon the planet, and that the round ſpots ſeen in Jupiter are the ſhadows of the ſatellites. Whence alſo, the interſection of that ſhadow being found to be a circle, the ſhadow muſt be conical; and therefore the figure of the ſatellites, at leaſt as to ſenſe, is ſpherical.

8. The earth being between Jupiter and the ſun, if, at the ſame time, any of the ſatellites happen to be between Jupiter and the ſun, it is loſt in Jupiter's light, though ſometimes appearing like a black ſpot.—This phænomenon has been frequently obſerved by Caſſini and Maraldi, who have likewiſe noted very conſiderable alterations in the apparent magnitudes of the ſatellites; for which no reaſon could be given from the diſtance of Jupiter, the ſun, or the earth: e. gr. That the fourth, which is uſually ſeen the ſmalleſt, is ſometimes the largeſt, and the third, which is uſually the largeſt, ſometimes the ſmalleſt—Hence, as the ſatellites are illuminated by the ſun, even then when emerged in Jupiter's light, yet appear obſcure, there muſt be ſome alteration in their atmoſpheres, to prevent the ſun's rays being equally reflected from every part of their ſurface; which muſt likewiſe be the cauſe why their ſhadow is ſometimes larger than themſelves.

Now, to ſum up the evidence.—1. Since in Venus, Mercury, and Mars, only that part of the diſk illuminated by the ſun is found to ſhine; and, again, Venus and Mercury, when between the earth and the ſun, appear like dark ſpots or maculæ on the ſun's diſk; it is evident, that Mars, Jupiter, and Mercury, are opake bodies, illuminated with the borrowed light of the ſun. And the ſame appears of Jupiter, from its being void of light in that part to which the ſhadow of the ſatellites reaches, as well as in that part turned from the ſun; and that his ſatellites are opake, and reflect the ſun's light, is abundantly ſhewn. Wherefore, ſince Saturn, with his ring and ſatellites, only yield a faint light, fainter conſiderably than that of the fixed ſtars, though theſe be vaſtly more remote; and than that of the reſt of the planets: it is paſt doubt, he too, with his attendants, are opake bodies.

2. Since the ſun's light is not tranſmitted through Mercury and Venus, when placed againſt him, it is plain they are denſe opake bodies; which is likewiſe evident of Jupiter, from his hiding the ſatellites in his ſhadow; and therefore, by analogy, the ſame may be concluded of Saturn.

3. From the variable ſpots in Venus, Mars, and Jupiter, it is evident thoſe planets have a changeable atmoſphere; which changeable atmoſphere may, by a like argument, be inferred of the ſatellites of Jupiter, and therefore by ſimilitude the ſame may be concluded of the other planets.

4. In like manner, from the mountains obſerved in Venus, the ſame may be ſuppoſed in the other planets.

5. Since then Saturn, Jupiter, both their ſatellites, Mars, Venus, and Mercury, are opake bodies, ſhining with the ſun's borrowed light, are furniſhed with mountains, and encompaſſed with a changeable atmoſphere; they have, of conſequence, waters, ſeas, &c. as well as dry land, and are bodies like the moon, and therefore like the earth. Q. E. D.

And hence nothing hinders but that the planets may alſo be concluded to be inhabited. — Huygens, in his Coſmotheoros, argues very plauſibly for the exiſtence of planetary inhabitants, from the ſimilitude of the planets with our earth; thoſe, like this, being opake, denſe, uneven, round, heavy, illuminated and warmed by the ſun; having night and day, ſummer and winter, &c.

Wolfius deduces ſomething relating hereto from arguments of another kind.—Thus, e. gr. it is ſcarce to be doubted, that the inhabitants of Jupiter are much larger than thoſe of the earth; and, in effect, of the giant kind. For it is ſhewn in optics, that the pupil of the eye contracts in a ſtrong light, and dilates in a weak one; wherefore, ſince in Jupiter the ſun's meridian light is much feebler than on the earth, by reaſon of Jupiter's greater diſtance from the ſun; the pupil will need to be much more dilatable in the inhabitants of Jupiter, than in thoſe of the earth. But the pupil is obſerved to have a conſtant proportion to the ball of the eye, and the eye to the reſt of the body; ſo that, in animals, the larger the pupil, the larger the eye, and the larger the body.

To aſcertain the ſize of theſe jovial inhabitants, it may be obſerved, that the diſtance of Jupiter from the ſun is to the earth's diſtance from the ſame, as 26 to 5; the intenſity of the ſun's light in Jupiter is to its intenſity on the earth, in a duplicate ratio of 5 to 26; but it is found by experience, that the pupil dilates in a ratio greater than that wherein the intenſity of light decreaſes; otherwiſe, a body at a great diſtance might be ſeen as clearly as nearer: the diameter, therefore, of the pupil in its greateſt dilatation, in Jupiter, is to its diameter in the like ſtate in the earth, in a ratio greater than that of 5 to 26.—If then we put it, as 10 to 26, or as 5 to 13: ſince the ordinary ſtature of the inhabitants of the earth is computed at 5 Engliſh feet, 4 inches and $\frac{3}{16}$ (which Wolfius tells us is his own height;) the ordinary ſtature of Jupiter's inhabitants will be found 14 feet $\frac{2}{3}$, which is very nearly the ſize of the giant Og, mentioned by Moſes, whoſe iron bed was 9 cubits long, and its breadth 4.

In the Copernican ſyſtem, the proportion between the ſemi-diameters of the planetary orbits, or between the diſtances of the ſeveral planets from the ſun, is found by trigonometry; ſo that if the diſtance of any one of them, as for inſtance, if the diſtance of the earth from the ſun be given, the diſtances of all the reſt of the planets from the ſun may be found: in any of the ſuperior planets, the ratio its diſtance from the ſun bears to the diſtance of the earth from the ſun is known, by meaſuring the angle of the planet's retrogradation: thus, let S (plate CII. *fig.* 2.) be the ſun, A B C the orbit of the earth, E F G the orbit of Mars, H L M be part of a great circle in the ſphere of the heaven wherein Mars appears to go retrograde; let the place of Mars be at F; by the earth paſſing in her orbit from B to C, Mars will appear to move retrograde from M to H: the angle then of the retrogradation of Mars, namely, M F H, is known by obſervation; to this the vertical angle B F C is equal; draw S F and S B, and you have the triangle S B F, wherein the angle S B F is a right one; but the angle S F B is equal to half the angle of retrogradation, and conſequently known; ſo that, in this triangle, two angles are known, and, therefore, the remaining angle F S B may be found; and, all the angles being known, the ratio of any one ſide to any other, as the ratio of S B, the diſtance of the earth from the ſun, to S F, the diſtance of Mars from the ſun, may be found.

The angle of the retrogradation of Mars is here expreſſed as if Mars ſtood ſtill at F, whilſt the earth went from B to C; whereas Mars, in the mean time, moves forward in his orbit, from F to K, ſo that his real retrogradation will be only M L leſs than M H: but ſince the quantity of Mars's motion in his orbit may be found, during the time of his retrogradation, it may be known how

how much the angle of his retrogradation is thereby diminiſhed, and conſequently what his retrogradation would have been, if he had ſtood ſtill all the while at F.

In either of the inferior planets, the ratio of the ſemi-diameter of its orbit to the ſemi-diameter of the orbit of the earth is eaſily found by the angle of the planet's greateſt elongation: thus, let S (*fig.* 1.) be the ſun, A B C the orbit of Mercury, E F G the orbit of the earth, L M N an arch of a great circle in the ſphere of the fixed ſtars, and the place of Mercury, when ſeen at L, in his greateſt elongation from the ſun; draw S E and SA, and you have a triangle, whereof the angle S A E is a right one; S E A is the angle of Mercury's elongation, known by obſervation, and, therefore, the remaining angle A S E may be found: and, conſequently, the ratio of E S, the diſtance of the earth from the ſun, to A S, the diſtance of Mercury from the ſun, may be known.

The two paragraphs immediately preceding, ſhew how to find the comparative diſtances of the planets from the ſun, but only in a general and leſs accurate way; becauſe neither the excentricities of the planetary orbits, nor the inclinations of their planes, are there taken into the account: more exact methods may be ſeen in Gregory's Aſtronomy, book 3, prop. 19, 21, and 22; and Caſſini's Elemens d'Aſtronomie, liv. 4. chap. 6.

The diſtances of the planets from the ſun are found to be in a certain ratio to the periodical times of their revolutions round the ſun; the ſquares of their periodical times are as the cubes of their diſtances: this analogy, diſcovered by Kepler, furniſhes us with a method of finding the ratio between the diſtances of the planets from the ſun, to greater exactneſs than can be done by any other method: becauſe the periodical times of the planets are known to great exactneſs.

That the different dimenſions, revolutions, denſities, quantities of matter, light, heat, &c. of the ſix primary planets, may be ſeen at one general view, we have drawn up the following ſynopſis, from Mr. Whiſton's calculations.

A ſynopſis of divers affections of the PLANETS.

TITLES.	SATURN.	JUPITER.	MARS.	EARTH.	VENUS.	MERCURY.
Diam. in Eng. miles	67870	81155	4440	7964	7906	2460
Circum. of their bod.	213112	254908	13960	25020	24823	7724
Sup. in ſquare miles	14468430000	20688000000	62032000	199250205	196238000	1900804
Solidity or magn. in cubic miles	1636377000000000	2810423000000000	45966600000	264466789070	25844590000	7793273000
Mean diſt. from the ſun in miles	777000000	424000000	123000000	81000000	59000000	32000000
Diam. of their orbs in miles	1554000000	848000000	246000000	162000000	118000000	64000000
C. of their orb. in m.	4881891000	2662280000	773686000	508939200	370636000	201024000
Periodical times	10759d. 6h. 36′	4332d. 12h. 20′	686d. 23h. 27′	365d. 6h. 9′	224d. 16h. 49′	87d. 23h. 16′
Times of their diurnal motions	— — —	0. 9. 56	1. 00. 40	0. 23. 56	0. 23. 00	* * *
Daily mean motions in the ecliptic	00°. 02′. 00″	00°. 04′. 59″	00°. 31′. 27″	00°. 59′. 08″	01°. 36′. 08″	04°. 05′. 32″
Inclin. of their orb. to the ecliptic	02. 30. 00	01. 20. 00	01. 52. 00	00. 00. 00	03. 24. 00	06. 54. 00
Exc. of their orbits	54700	25050	141000	1490	517	7970
P. of wt. on their ſurf.	529	943	* * *	435	* * *	* * *
Prop. of their bulks	62135	106450	170	1000	985	30
Denſ. of their maſſes	67	94½	* * *	400	* * *	* * *
Q. of matter in each	33	92	* * *	59/100	* * *	* * *
Prop. of light & heat	1 1/10	3 1/12	43	100	200	700
Moons or ſatellites	5	4	* * *	1	* * *	* *
Prop. of diam. to that of the ſun 1000	137	181	6	12	12	4
Prop. mean diſtances	95380	520110	152369	100000	72333	38710
Gr. apparent diam.	0′. 19″. 40‴	0′. 24″. 12‴	0′. 20″. 50‴	32′. 47″. ſun	1°. 5′. 58″	0′. 11″. 48‴
Leaſt apparent diam.	0′. 14″. 11‴	0′. 14″. 36‴	0′. 2″. 46‴	31′. 30″. ſun	0′. 9″. 34‴	0′. 4″. 4‴
Place of the aphelion	♐ 27°. 49′. 54″	♎ 9°. 9′. 54″	♍ 0°. 31′. 54″	♑ 80°. 1′. 10″	♒ 4°. 19′. 54″	♐ 13°. 7′. 54″
Place of the node	♋ 21°. 49′. 54″	♋ 7°. 19′. 54″	♉ 18°. 29′. 54″	* * *	♊ 14°. 25′. 54″	♉ 15°. 1′. 54″
The greateſt elongation of the inferior and parallax of the ſuperior planets	6°. 0′. 0″	11°. 5′. 0″	41°. 0′. 0″	* * *	46°. 41′. 0″	22°. 46′. 0″

We have hitherto conſidered the phænomena of the heavenly bodies without regard to the accurate form of their orbits, which is not circular, but elliptical; yet that it is very little ſo, even in the moſt excentric orbit, as that of Mercury, will appear by comparing their excentricities with their mean diſtances from the ſun. Thus, ſuppoſe the mean diſtance of the earth from the ſun be divided into 1000 equal parts, then in thoſe parts we have,

In Mercury,	CS : DS ::	80 :	387	:: 1 :	4,84
Venus,	CS : DS ::	5 :	723	:: 1 :	144,6
Earth,	CS : DS ::	17 :	1000	:: 1 :	19
Mars,	CS : DS ::	141 :	1524	:: 1 :	10,8
Jupiter,	CS : DS ::	250 :	5201	:: 1 :	20,8
Saturn,	CS : DS ::	547 :	9538	:: 1 :	17,4

It is found by experience, that the orbits of the planets are quieſcent, or that the line of the apſides A P (plate CII. *fig.* 3) always keeps one and the ſame poſition with reſpect to the fixed ſtars: and the aphelium, or point A, poſſeſſes different points in the ecliptic in the ſeveral orbits, as in the foregoing ſynopſis.

That the earth's orbit is elliptical, is well known from common experience; for were the orbit circular, the ſun's apparent diameter would always be the ſame; but we find it is not, for if it be meaſured with a micrometer in winter-time, it will be found conſiderably larger than in the ſummer, and it will be greateſt of all when the ſun is in the 8° of ♑ (which ſhews that is the place of the aphelium) it being then 32′ 47″; whereas, when the ſun is in the 8° of ♋, his diameter is but 31′ 40″.

Hence it is evident that the ſun is really nearer to us in the midſt of winter than in the midſt of ſummer; but this ſeems a paradox to many, who think the ſun muſt needs be hotteſt when it is neareſt to us, and that the ſun is apparently more diſtant from us in December than in June. As to the ſun's being hotter, it is true, it is ſo to all thoſe places which receive his rays directly or perpendicularly, but we find his heat abated on account of the obliquity of the rays, and his ſhort continuance above the horizon at that time. And, as to his diſtance, it is only with reſpect to the zenith of the place, not the center of the earth; ſince it is plain, the ſun may approach the center of the earth, at the ſame time that it recedes from the zenith of any place.

Agreeable to the ſun's nearer diſtance in the winter, we obſerve his apparent motion is then quicker than in ſummer; for in the 8° of ♑ it is about 61′ per day, but in the 8° of ♋ his motion is but 57′ per day. Accordingly, we find the ſummer half-year 8 days longer than the winter half-year, as appears by the following computation, according to the new ſtyle.

In March	10½ days.	In September	07 days.
April	30	October	31
May	31	November	30
June	30	December	31
July	31	January	31
Auguſt	31	February	28
September	23	March	20½
	186½		178½
	178½		
The difference	8 days.		

For the ſun's attracting force being one part of the cauſe of the planet's motion, and this force always increaſing and decreaſing in the inverſe ratio of the ſquares of the diſtances, it is evident the velocity of the planet will always be greater the nearer it is to the ſun. and *vice verſa*. Hence the motion of a planet is every where unequable, being conſtantly accelerated, as it paſſes from A (*fig.* 3.) by D to P, and in the other half from P to A it is retarded.

Yet is this unequal motion of a planet regulated by a certain immutable law, from which it never varies, which is, That a line, drawn from the center of the ſun to the center of the planet, does ſo move with the planet about the ſun, that it deſcribes elliptic areas always proportional to the times; that is, if when the planet moves ſloweſt, it deſcribes the arch A *d* in a given time, and when it moves quickeſt, it deſcribes the arch *b* P in the ſame time, then will the trilineal area A S *d* be equal to the other trilineal area *b* S P.

To demonſtrate this, let the time in which the planet moves through the periphery of its orbit be divided into equal parts, and ſuppoſe that in the firſt part it deſcribed any right line A B (*fig.* 4.) by the projectile force in any direction and the centripetal force conjointly; then in the ſecond part of time it would proceed in the ſame right line to *c*, if nothing prevented; ſo that B *c* = A B, as is manifeſt from the firſt law of motion.

Draw the right lines S B, S *c*, and the triangles A B S and B *c* S will be equal, as having equal baſes A B, B *c*, and the ſame altitude of the vertex S. But when the body comes to B, let the centripetal force act with a new impulſe either equal to the former or unequal, and let it cauſe the body to decline from the right line B *c*, and deſcribe the right line B C; draw C *c* parallel to B S, meeting B C in C; and at the end of the ſecond part of time the body will be at C, and in the ſame plane with the triangle A S B. Join S C, and becauſe of the parallels S B, C *c*, the triangle S B C will be equal to the triangle S B *c*, and therefore equal to the triangle S A B. By the ſame way of reaſoning, if the centripetal force act ſucceſſively in the points C, D, E, cauſing the body in each equal part of time to deſcribe the right lines C D, D E, E F, &c. the triangles S C D, S D E, S E F, &c. will be equal, and all in the ſame plane.

In equal times, therefore, equal area's are deſcribed; and, by compoſition of ratio's, any ſums of area's S A D S, S A F S, are to each other as the times in which they are deſcribed. Let now the number of triangles be increaſed, and their breadth be diminiſhed in infinitum; then will their perimeter A D F be ultimately a curve: and, therefore, the centripetal force, by which the body is drawn perpetually from the tangent to this curve, acts inceſſantly; and the area's deſcribed are alſo in this caſe proportional to the times of their deſcription. Hence the velocity of the revolving body or planet is every where inverſely, as the perpendicular let fall from the center S to the tangent of the orbit in the place of the planet. For the velocities in the points, A, B, C, &c. are the baſes of the triangles A B, B C, C D, &c. as being the ſpaces deſcribed in the ſame time; and the baſes of equal triangles are reciprocally as their perpendicular altitudes; and, therefore, ſince in the evaneſcent triangles A S B, and A S C, &c. the right lines A *c*, B *d*, C *e*, &c. become tangents to the curve in the points A, B, C, &c. it is manifeſt, the velocity in thoſe points will be inverſely, as a perpendicular from S let fall upon thoſe tangent lines produced.

Hence alſo it follows, that the times in which equal arches are deſcribed in any planetary orbit, are directly as thoſe perpendiculars, becauſe they are inverſely as the velocities.

PLANETARIUM, an aſtronomical machine, ſo called from its repreſenting the motions, orbits, &c. of the planets, agreeably to the Copernican ſyſtem.

The planetarium is more generally known by the name orrery, and therefore we have given its deſcription and uſe under that article. See ORRERY.

PLANETARY, ſomething relating to the planets.

Thus we meet with planetary days, hours, years, ſyſtems, &c.

PLANIMETRY, that part of geometry which conſiders lines and plain figures, without conſidering their height or depth.

PLANISPHERE ſignifies a projection of the ſphere and its various circles on a plane; in which ſenſe maps, wherein are exhibited the meridians, and other circles of the ſphere, are planiſpheres.

PLANISPHERE is more particularly uſed for an aſtronomical inſtrument uſed in obſerving the motions of the heavenly bodies.

It conſiſts of a projection of the celeſtial ſphere upon a plane, repreſenting the ſtars, conſtellations, &c. in their proper order; ſome being projected on the meridian, and others on the equator.

Among all theſe planiſpheres, that of M. Caſſini ſeems to deſerve the preference; it is compoſed of two circular, but unequal plates, A and B (plate CII. *fig.* 5.) whereof the leaſt, B, is ſo fitted within the other, as to turn round

upon the center, whilſt the larger circle, A, remains immoveable. On the leſſer plate are delineated the conſtellations of the northern hemiſphere, with its ſeveral circles. The limb of the inferior plate, A, is divided into three hundred and ſixty degrees, and into twenty-four hours, which are reckoned from twelve to twelve, and each hour into ſixty minutes. Between the two oppoſite hours, twelve and twelve, is extended a ſilver-thread, which paſſing over the center, or northern pole, repreſents the meridian. If then the ſouth point be turned towards the obſerver, the ſemi-circle towards the left hand will be the eaſt, and that on the right the weſt; and the hours on the former will be thoſe of the fore-noon, and the hours on the latter thoſe of the afternoon.

Uſe of the PLANISPHERE. 1. To repreſent the face of the heavens for any day and hour: find, on the leſſer moveable plate, the month and day propoſed, and turn the plate till the given day of the month ſtand againſt the hour and minute required; and the plate will then repreſent the face of the heavens, by ſhewing what ſtars are then riſing in the meridian, or what ſetting. 2. To know at what hour and minute any ſtar riſes or ſets, &c. Turn the moveable plate, till the given ſtar reaches the horizon, eaſt or weſt, and againſt the given day, on the moveable plate, is the hour and minute on the exterior or immoveable one: and in the ſame manner may moſt of the problems uſually reſolved by the celeſtial globe, be determined.

PLANT, *planta*, is defined to be an organical body, deſtitute of ſenſe and ſpontaneous motion, adhering to another body in ſuch a manner as to draw from it its nouriſhment, and having power of propagating itſelf by ſeeds.

As to the parts of which a plant conſiſts, they are the root, ſtalk, leaf, flower, and fruit.

Plant and vegetable are pretty near terms ſynonymous, every plant being a vegetable. Dr. Boerhaave defines a vegetable to be a body generated of the earth, or ſomething ariſing of the earth, to which it adheres or is connected by parts called roots, thro' which it receives the matter of its nouriſhment and increaſe; and conſiſts of juices and veſſels ſenſibly diſtinct from each other: or, a vegetable is an organical body, compoſed of veſſels and juices every where diſtinguiſhable from each other; to which body grow roots or parts, whereto it adheres, and from which it derives the matter of its life and growth.

This definition furniſhes a juſt and adequate idea of a vegetable; for by its conſiſting of diſtinct veſſels and juices, it is diſtinguiſhed from a foſſil; and by its adhering to another body, from which it derives its nouriſhment, and being deſtitute of ſenſation, it is ſufficiently diſtinguiſhed from an animal.

The veſſels, or containing parts of plants, conſiſt chiefly of earth, bound or connected together by oil, as a gluten: which being exhauſted by fire, air, age, or the like, the plant moulders, or returns again into its earth or duſt: but it muſt be owned, that water, air, ſalt, and ſulphur or oil, are likewiſe conſtituent parts of plants, ſince they can be all obtained by a well managed analyſis.

The root, or part whereby plants are connected to their matrix, and by which they receive their nutritious juice, conſiſts of an infinite number of abſorbent veſſels, which being diſperſed thro' the interſtices of the earth, attract or imbibe the juices of the ſame; conſequently, every thing in the earth that is diſſoluble in water, is liable to be imbibed, as air, ſalt, oil, and fumes of minerals, metals, &c. and of theſe plants do really conſiſt. See ROOT.

The motion of theſe nutritious juices is not unlike that of the blood in animals, being effected by the action of the air. The diſcovery of this we owe to the admirable Malpighi, who firſt obſerved, that plants conſiſt of two ſeries or orders of veſſels: 1. Such as receive and diſtribute the alimentary juices, anſwering to the arteries, lacteals, veins, &c. of animals. 2. The tracheæ, or air-veſſels, which are long hollow pipes, wherein air is commonly received and expelled; that is, inſpired and expired. Hence it follows, that the heat of the ſun muſt have a ſtrong effect on the air included in theſe tracheæ; whence ariſes a perpetual ſpring of action, to promote the circulation of the juices in plants.

For the botanical diſtribution of plants into claſſes, genera, &c. ſee the articles BOTANY, GENUS, &c.

Foſſile PLANTS, thoſe found buried in the earth, and lodged in almoſt all the kinds of ſtrata, or ſubſtances, to be met with there.

PLANTA, in anatomy, the ſole of the foot. See FOOT.

PLANTAIN, *Plantago*, in botany, a plant the flower whereof conſiſts of one petal, uſually wide expanded at the mouth, and with the limb divided into four oval ſegments: the fruit is a bilocular capſule, of an ovated figure, containing a great many oblong ſeeds.

The root, leaves, and ſeeds of plantain are uſed in medicine, and reckoned cooling and aſtringent; being much recommended in fluxes of all kinds, particularly hæmorrhages, whether from the noſe, mouth, or uterus. It is likewiſe accounted a great healer of freſh wounds.

Ribwort, and bucks-horn plantain, are two ſpecies of, and agree with, plantain in virtues.

PLANTATION, in the Weſt-Indies, denotes a ſpot of ground which a planter or perſon, arrived in a new colony, pitches on to cultivate for his own uſe, or is aſſigned for that purpoſe. However, the term plantation is often uſed in a ſynonymous ſenſe with colony.

PLANTING, in agriculture and gardening, is ſetting a tree or plant taken from its proper place, in a new hole or pit: throwing freſh earth over its root, and filling up the hole to the level of the ſurface of the ground.

The firſt thing in planting is to prepare the ground before the trees or plants are taken out of the earth, that they may remain out of the ground, as ſhort a time as poſſible, and the next is to take up the trees or plants in order to their being tranſplanted. In taking up the trees, carefully dig away the earth round the roots, ſo as to come at their ſeveral parts to cut them off; for if they are torn out of the ground without care, the roots will be broken and bruiſed, to the great injury of the trees. When you have taken them up, the next thing is to prepare them for planting by pruning the roots and heads. And firſt, as to the roots; all the ſmall fibres are to be cut off, as near to the place from whence they are produced, as may be, except they are to be replanted immediately after they are taken up. Then prune off all the bruiſed or broken roots, all ſuch as are irregular, and croſs each other, and all downright roots, eſpecially in fruit trees: ſhorten the larger roots in proportion to the age, the ſtrength, and nature of the tree, obſerving that the walnut, mulberry, and ſome other tender-rooted kinds, ſhould not be pruned ſo cloſe as the more hardy ſorts of fruit and foreſt trees: in young fruit trees, ſuch as pears, apples, plums, peaches, &c. that are one year old from the time of their budding or grafting, the roots may be left only about eight or nine inches long; but in older trees they muſt be left of a much greater length; but this is only to be underſtood of the larger roots; for the ſmall ones muſt be chiefly quite cut out, or pruned very ſhort. The next thing is the pruning of their heads, which muſt be differently performed in different times; and the deſign of the trees muſt alſo be conſidered: thus, if they are deſigned for walls, or eſpaliers, it is beſt to plant them with the greateſt part of their heads, which ſhould remain on till they begin to ſhoot in the ſpring, when they muſt be cut down to five or ſix eyes, at the ſame time taking care not to diſturb the roots. But if the trees are deſigned for ſtandards, you ſhould prune off all the ſmall branches cloſe to the place where they are produced, as alſo the irregular ones, which croſs each other; and, after having diſplaced theſe branches, you ſhould alſo cut off all ſuch parts of branches as have by any accident been broken or wounded; but by no means cut off the main leading ſhoots, which are neceſſary to attract the ſap from the root, and thereby promote the growth of the tree.

Having thus prepared the trees for planting, you muſt now proceed to place them in the earth; but firſt, if the trees have been long out of the ground, ſo that the fibres of the roots are dried, place them eight or ten hours in water, before they are planted, with their heads erect, and the roots only immerſed therein, which will ſwell the dried veſſels of the roots, and prepare them to imbibe nouriſhment from the earth. In planting them, great regard ſhould be had to the nature of the ſoil; for if that be

be cold and moiſt, the trees ſhould be planted very ſhallow; and if it be a hard rock or gravel, it will be better to raiſe a hill of earth where each tree is to be planted, than to dig into the rock or gravel, and fill it up with earth, as is too often practiſed, by which means the trees are planted, as it were, in a tub, and have but little room to extend their roots. The next thing to be obſerved is to place the trees in the hole in ſuch a manner that the roots may be about the ſame depth in the ground as before they were taken up: then break the earth fine with a ſpade, and ſcatter it into the hole, ſo that it may fall in between every root, that there may be no hollowneſs in the earth; then, having filled up the hole, gently tread down the earth with your feet, but do not make it too hard, which is a great fault, eſpecially if the ground be ſtrong or wet. Having thus planted the trees, they ſhould be faſtened to ſtakes driven into the ground, to prevent their being diſplaced by the wind, and ſome mulch laid about the ſurface of the ground about their roots: as to ſuch as are planted againſt walls, their roots ſhould be placed about five or ſix inches from the wall, to which their heads ſhould be nailed to prevent their being blown up by the wind. The ſeaſons for planting are various, according to the different ſorts of trees, or the ſoil in which they are planted: for the trees whoſe leaves fall off in winter, the beſt time is the beginning of October, provided the ſoil be dry; but if it be a very wet ſoil, it is better to defer it till the latter end of February, or the beginning of March; and for many kinds of evergreens, the beginning of April is by far the beſt ſeaſon; though they may be ſafely removed at Midſummer, provided they are not to be carried very far; but you ſhould always make choice of a cloudy wet ſeaſon. *Miller's Gard. Dict.*

For other obſervations on planting, ſee the articles NURSERY, KITCHEN-GARDEN, ORCHARD, GROVE, &c.

Reverſe PLANTING, a method of planting in which the natural poſition of the plant or ſhoot is inverted; the branches being ſet into the earth, and the root reared into the air. Dr. Agricola mentions this monſtrous method of planting, which he found to ſucceed very well in moſt or all ſorts of fruit-trees, timber-trees, &c. Bradley affirms that he has ſeen a lime-tree in Holland growing with its firſt roots in the air, which had ſhot out branches in great plenty, at the ſame time that its firſt branches produced roots and fed the tree. Mr. Fairchild, of Hoxton, has practiſed the ſame with us, and gives the following directions for performing it: Make choice of a young tree of one ſhoot, of alder, elm, willow, or any other tree that eaſily takes root by laying; bend the ſhoot gently down into the earth, and ſo let it remain till it has taken root. Then dig about the firſt root, and raiſe it gently out of the ground, till the ſtem be nearly upright, and ſtake it up. Then prune the roots, now erected in the air, from the bruiſes and wounds they received in being dug up, and anoint the pruned parts with a compoſition of two ounces of turpentine, four ounces of tallow, and four ounces of bees wax melted together and applied pretty warm. Afterwards prune off all the buds or ſhoots that are upon the ſtem, and dreſs the wounds with the ſame compoſition, to prevent any collateral ſhootings, that might ſpoil the beauty of the ſtem.

PLANTING, in architecture, the laying the firſt courſe of ſtones, in the foundation of buildings. See FOUNDATION.

PLASHING *of Quickſet-Hedges*, an operation very neceſſary to promote the growth and continuance of old hedges.

It is performed in this manner: the old ſtubs muſt be cut off, &c. within two or three inches of the ground, and the beſt and longeſt of the middle-ſized ſhoots muſt be left to lay down. Some of the ſtrongeſt of theſe muſt alſo be left to anſwer the purpoſe of ſtakes. Theſe are to be cut off to the height at which the hedge is intended to be left; and they are to ſtand at ten foot diſtance one from another: when there are not proper ſhoots for theſe at the due diſtances, their places muſt be ſupplied with common ſtakes of dead wood. The hedge is to be firſt thinned, by cutting away all but thoſe ſhoots which are intended to be uſed either as ſtakes, or the other work of the plaſhing: the ditch is to be cleaned out with the ſpade: and it muſt be now dug as at firſt, with ſloping ſides each way; and when there is any cavity on the bank on which the hedge grows, or the earth has been waſhed away from the roots of the ſhrubs, it is to be made good by facing it, as they expreſs it, with the mould dug from the upper part of the ditch; all the reſt of the earth dug out of the ditch is to be laid upon the top of the bank, and the owner ſhould look carefully into it that this be done; for the workmen, to ſpare themſelves trouble, are apt to throw as much as they can upon the face of the bank; which being by this means overloaded, is ſoon waſhed off into the ditch again, and a very great part of the work undone; whereas what is laid on the top of the bank always remains there, and makes a good fence of an indifferent hedge.

In the plaſhing the quick, two extremes are to be avoided; theſe are, the laying it too low, and the laying it too thick: this makes the ſap run all into the ſhoots, and leaves the plaſhes without ſufficient nouriſhment; which, with the thickneſs of the hedge, finally kills them. The other extreme of laying them too high is equally to be avoided; for this carries up all the nouriſhment into the plaſhes, and ſo makes the ſhoots ſmall and weak at the bottom, and, conſequently, the hedge thin. This is a common error in the north of England. The beſt hedges made any where in England, are thoſe in Hertfordſhire; for they are plaſhed in a middle way between the two extremes, and the cattle are by that prevented both from cropping the young ſhoots, and from going through; and a new and vigorous hedge ſoon forms itſelf. When the ſhoot is bent down that is intended to be plaſhed, it muſt be cut half way through with the bill: the cut muſt be given ſloping, ſomewhat downwards, and then it is to be wound about the ſtakes, and after this its ſuperfluous branches are to be cut off, as they ſtand out at the ſides of the hedge. If for the firſt year or two the field where a new hedge is made can be ploughed, it will thrive the better for it; but if the ſtubs are very old, it is beſt to cut them quite down, and to ſecure them with good dead hedges on both ſides, till the ſhoots are grown up from them ſtrong enough to plaſh; and wherever void ſpaces are ſeen, new ſets are to be planted to fill them up. A new hedge raiſed from ſets in the common way, generally requires plaſhing about eight or nine years after.

PLASTER, *Emplaſtrum*, in pharmacy, is defined to be an external application, of a harder conſiſtence than our ointments: theſe are to be ſpread according to the different circumſtances of the wound, place, or patient, either upon linnen or leather.

PLASTER, among builders, &c. The plaſter of Paris is a preparation of ſeveral ſpecies of gypſums, dug near Mont Maitre, a village in the neighbourhood of Paris; whence the name. See GYPSUM.

The beſt ſort is hard, white, ſhining, and marbly; known by the names of plaſter-ſtone, or parget of Mont Maitre. It will neither give fire with ſteel, nor ferment with aqua-fortis, but very freely and readily calcines in the fire, into a very fine plaſter; the uſe of which in building, and caſting ſtatues, is well known. See the article STUCCO.

As the modern taſte runs greatly into plaſtering, it were to be wiſhed that this art could be brought to its ancient perfection. The plaſters of the Romans were exceeding durable; witneſs ſeveral yards of it ſtill to be found on the top of the Pont de Garde, near Niſmes. At Venice they uſe a very durable plaſter; but as the ſecret of preparing it, is not known among us, it would be worth while to try whether ſuch a ſubſtance might not be made by boiling the powder of gypſum dry over the fire, for it will boil in the manner of water; and when this boiling or recalcining was over, the mixing with it reſin, or pitch, or both together, with common ſulphur, and the powder of ſea-ſhells. If theſe were all mixed together, and the water added to it hot, and the matter all kept hot upon the fire till the inſtant of its being uſed, ſo that it might be laid on hot, it is poſſible this ſecret might be hit upon.

Wax and oil of turpentine may be alſo tried as additions; theſe being the common ingredients in ſuch cements as we have accounts of are the firmeſt. Strong

ale-wort is by ſome directed to be uſed, inſtead of water, to make mortar of lime-ſtone be of a more than ordinary ſtrength. It is poſſible that the uſe of this tenacious liquor in the powdered ingredients of this propoſed plaſter, might greatly add to their ſolidity and firmneſs.

PLASTIC, πλαστικ⊙, denotes a thing endued with a formative power, or a faculty of forming or faſhioning a maſs of matter, after the likeneſs of a living being; ſuch a virtue as ſome of the ancient Epicureans, and perhaps the Peripatetics too, imagined to reſide in the earth, or, at leaſt, to have anciently reſided therein, by means whereof, and without any extraordinary intervention of a creator, it put forth plants, &c. Some of them ſeem to be of opinion, that animals, and even man himſelf, was the effect of this plaſtic power.

PLASTICE, the PLASTIC ART, a branch of ſculpture, being the art of forming figures of men, birds, beaſts, fiſhes, &c. in plaſter, clay, ſtuc, or the like.

PLAT, among ſeamen, a ſort of flat cordage faſtened about the cables to prevent them from fretting in the hawſe.

PLAT-VEINS, in the manege, the veins wherein we bleed horſes, one in the lower part of each ſhoulder, and the other in the flat part of the thighs.

PLAT-BAND *of a Door or Window*, in architecture, denotes the lintel where it is made ſquare, or not much arched. It is uſually croſſed with iron bars, when they have a great bearing; but it is much better to eaſe them by arches of diſcharge built over them.

PLAT-BANDS *of Flutings* are the liſts or fillets between the flutings of columns.

PLATE, in commerce, ſignifies gold or ſilver wrought into veſſels, for domeſtic uſes.

PLATE, in heraldry, is a round flat piece of ſilver, without any impreſſion; but as it were formed, ready to receive it.

PLATES, in gunnery. The priſe-plates are two plates of iron on the cheeks of a gun-carriage, from the cape-ſquare to the center, through which the priſe-bolts go, and on which the handſpike reſts when it poiſes up the breech of the piece. Breaſt-plates are the two plates on the face of the carriage, one on each cheek. Train-plates are the two plates on the cheeks at the train of the carriage. Dulidge-plates are the ſix plates on the wheel of a gun-carriage, where the felloes are joined together, and ſerve to ſtrengthen the dulidges.

PLATFORM, in the military art, an elevation of earth, on which cannon is placed, to fire on the enemy; ſuch are the mounts in the middle of curtins. On the rampart there is always a platform, where the cannon are mounted. It is made by the heaping up of earth on the rampart, or by an arrangement of madriers, riſing inſenſibly, for the cannon to roll on, either in a caſemate, or on attack in the out-works.

All practitioners are agreed, that no ſhot can be depended on, unleſs the piece can be placed on a ſolid platform; for if the platform ſhakes with the firſt impulſe of the powder, the piece muſt likewiſe ſhake, which will alter its direction, and render the ſhot uncertain.

PLATFORM, in architecture, is a row of beams, which ſupport the timber-work of a roof, and lie on the top of the wall, where the entablature ought to be raiſed. This term is alſo uſed for a kind of terrace, or broad, ſmooth, open walk at the top of a building, from whence a fair proſpect may be taken of the adjacent country. Hence an edifice is ſaid to be covered with a platform, when it is flat at top, and has no ridge. Moſt of the Oriental buildings are thus covered, as were all thoſe of the ancients.

PLATONIC, ſomething that relates to Plato, his ſchool-philoſophy, opinions, or the like; thus, Platonic love denotes a pure ſpiritual affection. for which Plato was a great advocate, ſubſiſting between the different ſexes, abſtracted from all carnal appetites, and regarding no other object but the mind and its beauties: or it is even a ſincere diſintereſted friendſhip ſubſiſting between perſons of the ſame ſex, abſtracted from any ſelfiſh views, and regarding no other object than the perſon, if any ſuch love or friendſhip has aught of a foundation in nature.

PLATONIC YEAR, or the GREAT YEAR, is a period of time determined by the revolution of the equinoxes, or the ſpace wherein the ſtars and conſtellations return to their former places, in reſpect of the equinoxes. The Platonic year, according to Tycho Brahe, is 25816, according to Ricciolus 25920, and according to Caſſini 24800 years. See the article PRECESSION *of the Equinoxes*.

This period once accompliſhed, it was an opinion among the ancients, that the world was to begin anew, and the ſame ſeries of things to turn over again.

PLATONISM, the doctrine and ſentiments of Plato and his followers, with regard to philoſophy, &c.

PLATTOON, or PLOTTOON, in the military art, a ſmall ſquare body of forty or fifty men, drawn out of a battalion of foot, and placed between the ſquadrons of horſe, to ſuſtain them; or in ambuſcades, ſtreights, and defiles, where there is not room for whole battalions or regiments. Plattoons are always uſed when they form the hollow ſquare, to ſtrengthen the angles. The grenadiers are generally poſted in plattoons.

PLEA, in law, is what either party alledges for himſelf in court, in a cauſe there depending; and, in a more reſtrained ſenſe, it is the defendant's anſwer to the plaintiff's declaration.

Pleas are uſually divided into thoſe of the crown, and common pleas. Pleas of the crown are all ſuits in the king's name, or in the name of the attorney-general on his behalf, for offences committed againſt his crown and dignity, and againſt his peace; as treaſon, murder, felony, &c. Common pleas are ſuch ſuits as are carried on between common perſons, in civil caſes. Theſe pleas may be divided into as many branches as there are actions. To an action there is either a general or a ſpecial plea: and here, a general plea is a general anſwer to the declaration; as in a debt or contract, the general plea is, that he owes nothing; in a debt upon bond, that it is not his deed, or he paid it on the day; in an action on a promiſe, that he made no promiſe; and in a treſpaſs, not guilty. Special pleas are either in bar to the action brought, or in abatement of the writ on which the action is framed. All pleas are to be ſuccinct, without any unneceſſary repetitions, and muſt be direct and pertinent to the caſe.

PLEADING, in law, a ſpeech uttered at the bar, in defence of a cauſe: but, in a ſtricter ſenſe, pleadings are all the allegations of the parties to a ſuit, made after the declaration, till the iſſue is joined. In this ſenſe they expreſs what is contained in the bar, replication, and rejoinder; and not what is in the declaration itſelf. Hence defaults in the matter of declaration are not confined within the miſpleading.

From the Conqueſt all pleading was performed in French, till the reign of Edward III. when it was appointed that the pleas ſhould be pleaded in Engliſh; but that they ſhould be entered or recorded in Latin. At Athens, and even in France and England, formal and prepared pleadings were prohibited, and it was unlawful to amuſe the court with long artful harangues; only it was the ſettled cuſtom here, in important matters, to begin the pleadings with a text out of the Holy Scriptures. It is but of late years that eloquence was admitted to the bar.

PLEASURE and Pain, ſays Mr. Locke, are ſimple ideas, which we receive both from ſenſation and reflection; there being thoughts of the mind, as well as ſenſation, accompanied with pleaſure or pain. See the article PAIN.

There are a great many modes of pleaſure and pain, which reſult from the various conſiderations of good and evil, whether natural or moral, and the paſſions thereby excited. See the articles GOOD, EVIL, and PASSIONS.

Pleaſure and pain ſeem to be the means made uſe of, by nature, to direct us in the purſuit of happineſs; ſince pleaſure is annexed to whatever contributes thereto, and pain is the companion of what tends to our ruin. Hence it is, that the pleaſures of a child, a youth, a grown perſon, and an old man, all vary, according to the different things required by nature in each ſtate, whether ſimply

for

for the preſervation of the individual, or for that and propagation jointly.

PLEBEIAN, *Plebeius*, any perſon of the rank of the common people. It is chiefly uſed in ſpeaking of the ancient Romans, who were divided into ſenators, knights, and plebeians or commons.

PLEBISCITUM, in Roman antiquity, a law enacted by the common people, at the requeſt of the tribune, or other plebeian magiſtrate, without the intervention of the ſenate; but more particularly denotes the law which the people made, when they retired to the Aventine mount.

PLEDGE, *Plegius*, in common law, a ſurety, either real or perſonal, which the plaintiff is to find, for proſecuting the ſuit.

PLEDGERY, or PLEGGERY, ſuretiſhip, or an anſwering for another perſon.

PLEDGET, BOLSTER, or COMPRESS, *Plumaceolus*, in ſurgery, a kind of flat tent, laid over a wound to imbibe the ſuperfluous humours, and keep it clean. See WOUND.

PLEIADES, *Virgiliæ*, in aſtronomy, an aſſemblage of ſeven ſtars in the neck of the conſtellation Taurus. See CONSTELLATION and TAURUS.

The word is formed from the Greek πλεω, to ſail, as being terrible to mariners, by reaſon of the rains and ſtorms that frequently riſe with them.

PLENARTY, in law, is when a church benefice is full of an incumbent.

PLENARY, ſomething complete or full.

PLENILUNIUM, in aſtronomy, that phaſis of the moon commonly called the full moon. See the article MOON.

PLENIPOTENTIARY, a perſon veſted with full power to do any thing. See AMBASSADOR.

PLENITUDE, *Plenitudo*, the quality of a thing that is full, or fills another.

In medicine it chiefly denotes a redundancy of blood and humours. See PLETHORA.

PLENUM, in phyſics, denotes, according to the Carteſians, that ſtate of things, wherein every part of ſpace is ſuppoſed to be full of matter; in oppoſition to a vacuum. See VACUUM.

PLEONASM, *Pleonaſmus*, *Redundantia*, a figure in rhetoric, whereby we uſe words ſeemingly ſuperfluous, in order to expreſs a thought with the greater energy; ſuch as, "I ſaw it with my own eyes, &c."

PLEROTICS, *Plerotica*, in medicine, a kind of remedies that are healing, or that fill up the fleſh: otherwiſe called incarnatives and ſarcotics. See the article SARCOTICS.

PLETHORA, in medicine, a greater redundance of laudable blood and humours than is capable of undergoing thoſe changes which muſt neceſſarily happen for the purpoſes of life, without inducing diſeaſes.

A plethora is cured by veneſection, exerciſe, watchings, a ſharp and acrid diet, after due evacuations, and by a gradual omiſſion of theſe evacuations.

PLETHORIC, *Plethoricus*, a perſon abounding with blood, or labouring under a plethora.

PLEURA, in anatomy, a ſmooth, robuſt, and tenſe membrane, adhering to the ribs and to the intercoſtal muſcles, and ſurrounding the whole cavity of the thorax. Its ſtructure reſembles two ſacks, one of which ſurrounds one ſide of the thorax, and the other the other ſide; and each of them contains one of the two lobes of the lungs: from the conjunction of theſe two ſacculi of the pleura, in the middle of the thorax, is formed the mediaſtinum.

The uſe of the pleura is to lubricate and ſtrengthen the whole cavity of the thorax.

PLEURISY, πλευρίτις, in medicine, a violent pain in the ſide, attended with an acute fever, a cough, and a difficulty of breathing.

This diſorder affects all the parts of the internal integuments of the thorax, the whole of the pleura, and the whole of the mediaſtinum; and therefore, when it is ſeated in the membrane internally lining the ribs, it is called a true or internal pleuriſy; but when it chiefly occupies the external parts, and only the intercoſtal muſcles, and thoſe above them, are affected, it is called a ſpurious or baſtard-pleuriſy.

The pleuriſy is moſt predominant between the ſpring and ſummer. It begins with chilneſs and ſhivering, which are ſoon ſucceeded by heat, thirſt, inquietude, and the other common ſymptoms of a fever. After a few hours the patient is ſeized with a violent pricking pain in one of his ſides, about the ribs, which ſometimes extends itſelf towards the ſhoulder-blades, ſometimes towards the back-bone, and ſometimes towards the fore-parts of the breaſt, and this is attended with frequent coughing. The matter which the patient ſpits is at firſt little and thin, and mixed with particles of blood; but as the diſeaſe advances, it is more plentiful and more concocted, but not without a mixture of blood. The pulſe is remarkably ſtrong, and ſeems to vibrate like a tenſe ſtring of a muſical inſtrument; and the blood drawn from a vein, as ſoon as it is cold, looks like melted ſuet. As to the ſpitting, it is frequently abſent; and hence pleuriſies are diſtinguiſhed into moiſt and dry.

As in all inflammatory fevers, ſo in this, too hot a regimen is to be ſhunned, both with reſpect to the bed-cloaths and the heat of the room; nor muſt the patient be expoſed to the cold air, nor drink things actually cold. Hoffman obſerves, that all ſtrong ſudorifics and cathartics are hurtful; and that if the patient has three or four ſtools, the courſe of nature muſt not be ſtopped. The diet ſhould be cooling, relaxing, ſlender, and diluting. Moiſtening things taken warm, are preferable to all others; and hence barley or oatmeal-gruel, ſweetened with honey, and alſo ſweet whey, are proper. If the phyſician is called before the third day, Boerhaave directs a large quantity of blood to be let, from a wide orifice in a large veſſel, and to fetch deep ſighs, or cough, to promote its celerity; and the part affected ſhould be rubbed gently at the ſame time, and the bleeding continued till the pain remits, or the patient is ready to faint. This ſhould be repeated as often as the ſymptoms return, which it was intended to remove, and till the abſence of the white inflammatory pellicle from the ſurface of the blood when cold, ſhews it is time to leave it off. This Huxham confirms by his own experience, and adds, that after the fourth day, bleeding is not ſafe; he likewiſe recommends fomenting the part, which often eaſes the pain, and terminates the diſeaſe: but if it is obſtinate, he recommends ſlight ſcarifications, then cupping, and afterwards a bliſter on the ſame place; which has been ſucceſsful, when the uſual methods failed. The patient's body ſhould be kept open, for which purpoſe emollient clyſters are proper; and he ſhould, at the ſame time, take large quantities of ſtrong, diluting, aperient, and antiſeptic liquors: for this purpoſe, take the leaves of ſcordium, jack-by-the-hedge, and white horehound, each two ounces: boil them in two pints of water, with which mix of the oxymel of ſquills, eight ounces; of nitre, three drams; and of treacle-vinegar, one ounce: of this mixture let the patient, every quarter of an hour, take two ounces, as warm as poſſible.

Dr. Mead obſerves, on the treatment of this diſorder, that after drawing as much blood as is neceſſary, draughts with freſh-drawn linſeed-oil, are of great ſervice for eaſing the cough; nitre, for allaying the heat; and for diſſolving the ſizy blood that obſtructs the ſmall canals, wild goat's blood and volatile ſalts; and, laſtly, a bliſter laid on the part affected, in order to draw forth the peccant humour.

A purulent abſceſs or empyema is ſometimes formed in this diſeaſe; for the treatment of which, ſee EMPYEMA.

As to the baſtard-pleuriſy, Hoffman ſays, that it is properly a kind of rheumatiſm, and does not require bleeding unleſs the patient is plethoric, but a diaphoreſis and a more free perſpiration. Lanciſi, however, adviſes plentiful bleeding in the arm, ſcarifying the part affected, and cupping: and during the cure, it is neceſſary to keep the body open, and the bowels free from ſpaſms; for which purpoſes, emollient clyſters are proper, with oil of ſweet almonds.

PLEUROPNEUMONY, in medicine, a diſeaſe partaking of the nature both of a pleuriſy and peripneu-

5 JA 59

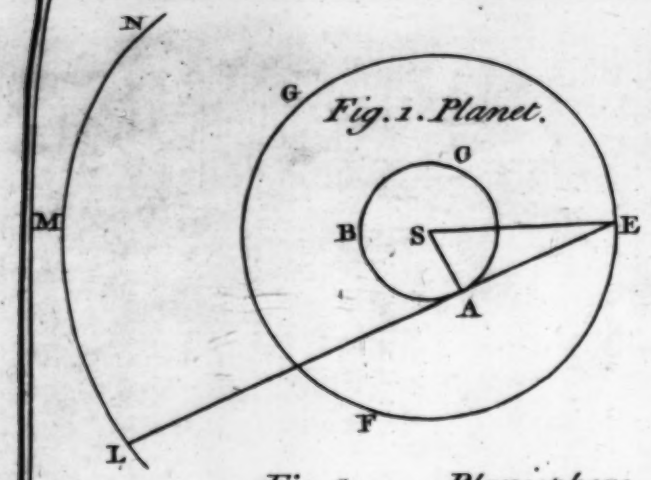


Fig. 1. Planet.

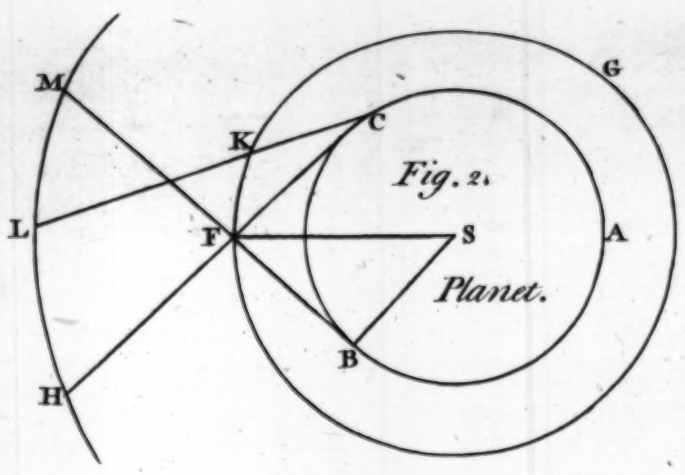


Fig. 2. Planet.

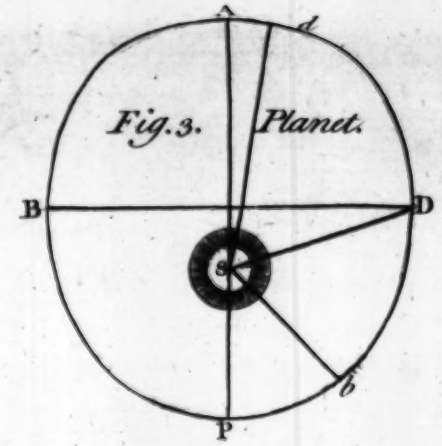


Fig. 3. Planet.

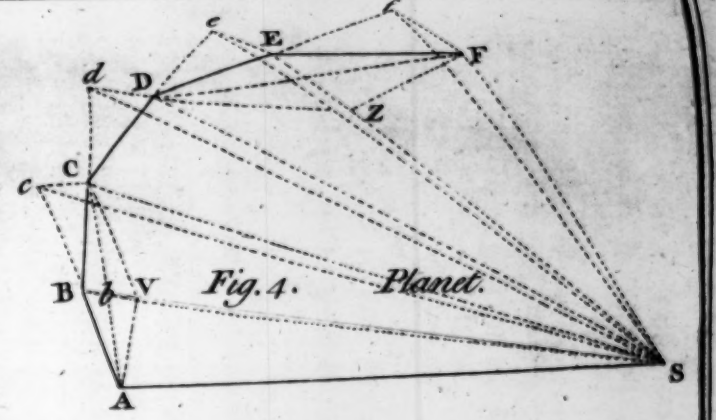


Fig. 4. Planet.

Fig. 5. Planisphere.

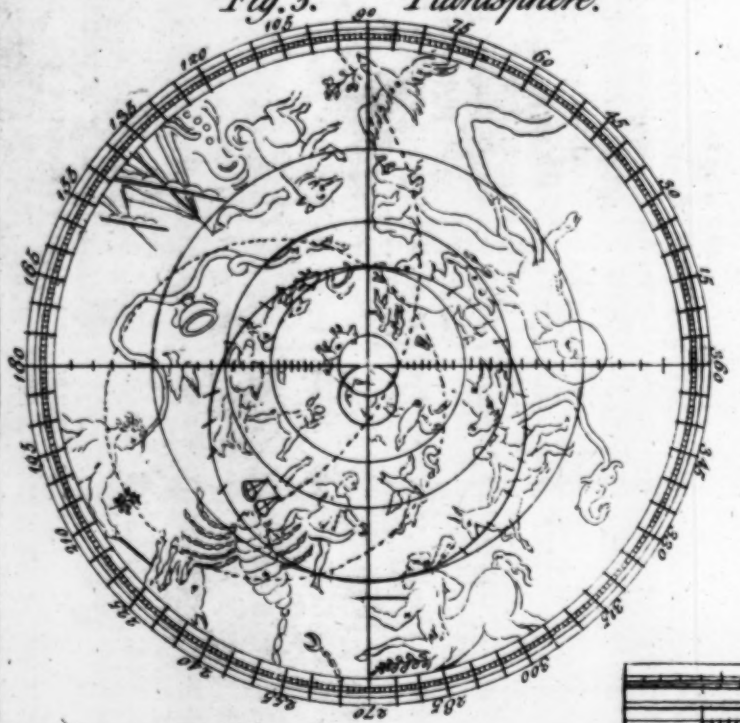


Fig. 10. Protractor.

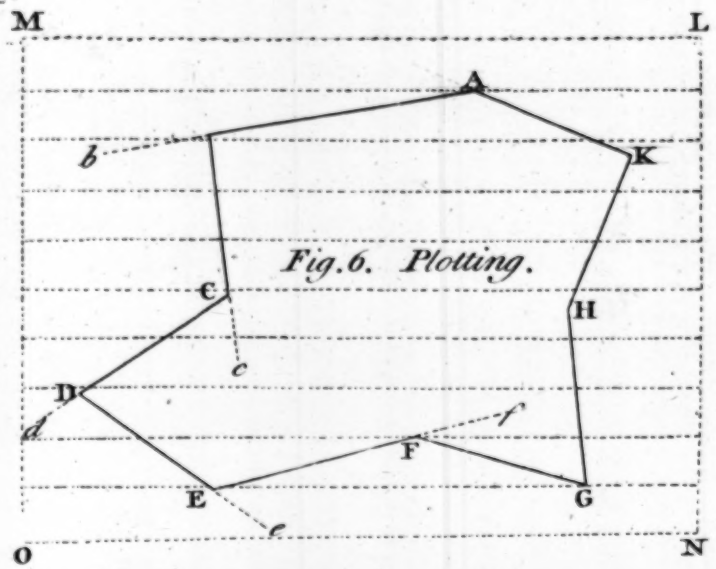


Fig. 6. Plotting.

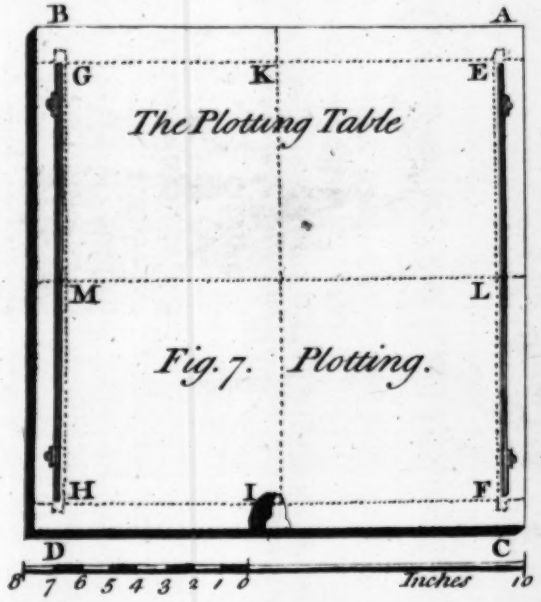


Fig. 7. Plotting.

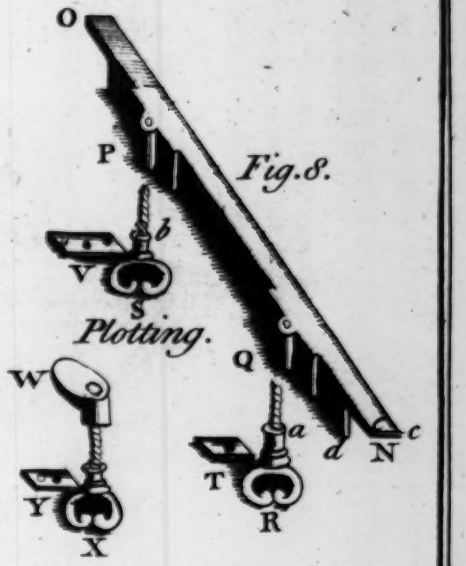
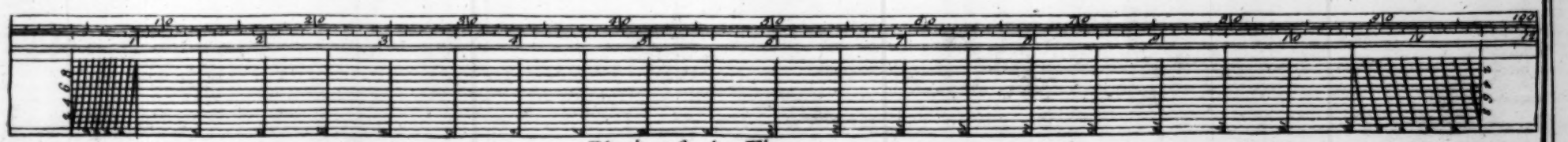
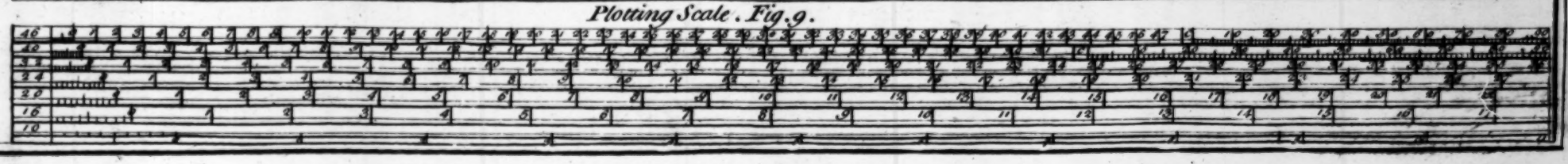


Fig. 8. Plotting.


Plotting Scale. Fig. 9.

mony. See the articles PLEURISY and PERIPNEUMONY.

PLEXUS, among anatomiſts, a bundle of ſmall veſſels interwoven in the form of net-work: thus a congeries of veſſels within the brain is called plexus choroides, reticularis, or retiformis. See the article *Plexus* CHOROIDES.

A plexus of nerves is an union of two or more nerves, forming a ſort of ganglion or knot.

PLICA POLONICA, in medicine, a diſeaſe of the hair, almoſt peculiar to Poland and Lithuania, and hence denominated Polonica. It conſiſts of a preternatural bulk of the hair, which being firmly conglutinated and wrapped up in inextricable knots, and extended to a monſtrous length, affords a very unſeemly ſpectacle. When theſe are cut off, the blood is diſcharged from them, the head racked with pain, the ſight impaired, and the patient's life frequently endangered.

PLICATED, ſomething folded together, one part over another; as the leaves of certain plants, &c.

PLINTH, ORLE, or ORLO, in architecture, a flat ſquare member, in the form of a brick.

It is uſed as the foundation of columns, being that flat ſquare table, under the moulding of the baſe and pedeſtal, at the bottom of the whole order. It ſeems to have been originally intended to keep the bottom of the original wooden pillars from rotting.

Vitruvius alſo calls the Tuſcan abacus, plinth.

PLINTH *of a Statue*, &c. is a baſe, either flat, round, or ſquare, that ſerves to ſupport it.

PLINTH *of a Wall*, denotes two or three rows of bricks advancing out from a wall; or, in general, any flat high moulding, that ſerves in a front wall to mark the floors, to ſuſtain the eaves of a wall, or the larmier of a chimney.

PLOT, in dramatic poetry, is ſometimes uſed for the fable of a tragedy or comedy, but more particularly the knot or intrigue, which makes the embarras of any piece. The unravelling puts an end to the plot.

PLOT, in ſurveying, the plan or draught of any field, farm, or manor, ſurveyed with an inſtrument, and laid down in the proper figure and dimenſions.

PLOTTING, among ſurveyors, is the art of laying down on paper, &c. the ſeveral angles and lines of a tract of ground ſurveyed by a theodolite, &c. and a chain.

In ſurveying with the plain-table, the plotting is ſaved; the ſeveral angles and diſtances being laid down on the ſpot, as faſt as they are taken. See the article PLAIN-TABLE.

But, in working with the theodolite, ſemi-circle, or circumferentor, the angles are taken in degrees; and the diſtances in chains and links; ſo that there remains an after-operation to reduce theſe members into lines, and ſo to form a draught, plan, or map; this operation is called plotting.

Plotting then is performed by means of two inſtruments, the protractor and plotting ſcale. By the firſt, ſeveral angles obſerved in the field with a theodolite, or the like, and entered down in degrees in the field-book, are protracted on paper in their juſt quantity.

By the latter, the ſeveral diſtances meaſured with the chain, and entered down in like manner in the field-book, are laid down in their juſt proportion.

Under the articles Protractor and Plotting-ſcale, are found ſeverally the uſe of their reſpective inſtruments in the laying down of angles and diſtances: we ſhall here give their uſe conjointly in the plotting of a field, ſurveyed either with the circumferentor or theodolite.

Method of PLOTTING *from the Circumferentor.* Suppoſe an encloſure, e. gr. ABCDEFGHK (plate CII. *fig.* 6.) to have been ſurveyed; and the ſeveral angles, as taken by a circumferentor, in going round the field, and the diſtances, as meaſured by a chain, to be found entered in the field-book, as in the following table:

	Deg.	Min.	Cha.	Link.
A	191	00	10	75
B	297	00	6	83
C	216	30	7	82
D	325	00	6	96
E	12	24	9	71
F	324	30	7	54
G	98	30	7	54
H	71	00	7	78
K	161	30	8	22

On a paper of the proper dimenſions, as LMNO draw a number of parallel and equidiſtant lines. Their uſe is to direct the poſition of the protractor; the diameter whereof muſt always be laid either upon one of them or parallel thereto; the ſemi-circular limb downwards for angles greater than 180°, and upwards, for thoſe leſs than 180°.

The paper being thus prepared, aſſume a point on ſome meridian, as A, whereon lay the center of the protractor and the diameter along the line. Conſult the field-book for the firſt angle, i. e. for the degrees cut by the needle at A, which the table gives you 191°.

Now ſince 191° is more than a ſemi-circle, or 180, the ſemi-circle of the protractor is to be laid downwards; where keeping it to the point with the protracting pin, make a mark againſt 191; through which mark, from A, draw an indefinite line A *b*. The firſt angle thus protracted, again conſult the book, for the length of the firſt line AB; thus you find 10 chains 75 links. From a convenient ſcale, therefore, on the plotting ſcale, take the extent of 10 chains 75 links between the compaſſes; and ſetting one point in A, mark where the other falls in the line A *b*, which ſuppoſe in B: draw therefore the full line AB, for the firſt ſide of the incloſure.

Proceed then to the ſecond angle, and laying the center of the protractor on the point B, with the diameter as before directed, make a mark, as *c*, againſt 297°, the degrees cut at B; and draw the indefinite line B *c*. On this line from the plotting-ſcale, as before, ſet off the length of your ſecond line, viz. 6 chains 83 links; which extending from B to the point C, draw the line BC for the ſecond ſide. Proceeding now to the third angle or ſtation, lay the center of the protractor, as before, on the point C; make a mark, as *d*, againſt the number of degrees cut at C, viz. 216 degrees, 30 minutes; draw the indefinite line *d* C, and thereon ſet off the third diſtance, viz. 7 chains 82 links; which terminating, e. gr. at D, draw the full line CD for the third ſide. Proceed now to the fourth angle D; and, laying the center of the protractor over the point D, againſt 325°, the degree cut by the needle, make a mark *e*; draw the dry line D *e*, and thereon ſet off the diſtance 6 chains 96 links, which terminating in E, draw DE for the fourth line, and proceed to the fifth angle, viz. E.

Here the degrees cut by the needle being 12° 24′, which is leſs than a ſemi-circle, the center of the protractor muſt be laid on the point E, and the diameter on the meridian, with the ſemi-diameter limb turned upwards. In this ſituation make a mark, as before, againſt the number of degrees, viz. 12° 24′, cut by the needle at E; draw the dry line E *f*, on which ſet off the fifth diſtance, viz. 9 chains 71 links, which extending from E to F, draw the full line EF, for the fifth ſide of the incloſure. After the ſame manner proceed orderly to the angles F, G, H, and K; then placing the protractor, making marks againſt the reſpective degrees, drawing indefinite dry lines, and ſetting off the reſpective diſtances as above, you will have the plot of the whole incloſure ABC, &c.

Such is the general method of plotting from this inſtrument; but it muſt be obſerved, that in this proceſs the ſtationary lines, that is, the lines wherein the circumferentor is placed to take the angles, and wherein the chain is run to meaſure the diſtances, are properly the lines, here plotted. When, therefore, in ſurveying, the ſtationary lines are at any diſtance from the fence or boundaries of the field, &c. off-ſets are taken, that is, the diſtance of the fence from the ſtationary line is meaſured at each ſtation; and even at intermediate places, if there prove any conſiderable bends in the fence.

In plotting, therefore, the ſtationary lines being laid down as above, the off-ſets muſt be laid down from them, that is, perpendiculars of the proper lengths muſt be let fall at the proper places from the ſtationary lines; the extremes of which perpendiculars, being connected by lines, give the plot deſired. If inſtead of going round the field the angles and diſtances have been all taken from

one ſtation, the proceſs of plotting is obvious, from the example above; all here required being to protract, after the manner already deſcribed, the ſeveral angles and diſtances taken from the ſame ſtationary point in the field, from the ſame point or center of the paper. The extremities of the lines thus determined, being then connected by lines, will give the plot required.

The following is a new plotting inſtrument invented by Mr. Henry Beighton.—It is a plain ſmooth board, about eighteen inches ſquare and three fourths of an inch thick, as A B C D (plate CII. *fig.* 7.) made of mahogany, walnut, pear-tree or Norway oak, well clamped at the ends, or a braſs frame round it to prevent its warping, and, as much as poſſible, ſhrinking and ſwelling.

Within ſix tenths of an inch of its oppoſite ſides, and parallel to them and one another, are two grooves E F, G H, cut on the face half an inch deep, to let in two braſs holders in the ſhape of N O (*fig.* 8.) which are each of one piece of caſt braſs, like two braſs rulers joined together at right angles. The perpendicular part is one tenth and three-hundred parts of an inch thick, as at *d*, half an inch deep, and a little ſhorter at each end than the upper part, which is ſeventeen inches long, three tenths broad, and about eight parts of a hundredth of an inch thick; about two inches and a half from each end of the holder, are thick parts or boſſes in the upright piece, as at P and Q, through which are holes drilled to receive the ſcrews P S, Q R, which ſcrews go through a braſs plate at T and V, fixed by rivets on the under ſide of the table, and little round nuts, as at *a* and *b*, put on them, to confine them in their ſhoulders in turning in the plates, that they never riſe nor fall; theſe holes muſt go eaſy in the grooves, to ſink even with the upper ſurface of the table. Then when the ſcrews enter the holes of the holders by turning R and S at the ſame time forward, the holders will fall and pinch down any papers, &c. that are under them; and turning backward will riſe and releaſe them. In the middle of one end of the table is a groove to receive the braſs W, which has the ſame ſort of ſcrew and fixing as the other to riſe or fall at. But the groove is quadranial, that the holder W may on occaſion be turned ſo as to lie all on the outſide the line E K, and to croſs it in caſe of high winds, for ſecuring the papers down, on three ſides; and a fourth might be added, but there is ſeldom any occaſion for it.

To the center of the table underneath is fixed a braſs ſocket, ſo truly made that the table may, when ſet, turn round truly, horizontally: and a machine caſed with glaſs in which a plummet hangs to ſet the table level; or the parallel plates, or glaſs tubes of ſpirit of wine, may be uſed to make it horizontal, as any one ſees occaſion to fancy them.

To any one of the four edges underneath is ſcrewed a box and needle, ſet to the variation.

There belongs to this inſtrument a ſtrong three-legged ſtaff, and an index with plain or teleſcope ſights, near two feet long.

The papers or charts for this table are to be either a thin fine paſte-board, fine paper paſted on cartridge-paper, or two papers paſted together, cut as exactly ſquare as poſſible, each ſide being nearly ſixteen inches and a half long, juſt as they may ſlide in eaſy between the upright part, and between the flat part of the holders.

Any of theſe charts may be put in the table four different ways, be fixed, taken out, or changed at pleaſure; any two of them may be joined together truly on the table, if you make each of them meet exact at the line L M, whilſt near one half of each will hang over the ſides of the table; or, by creſting, or doubling each, the whole of them will be within the table. And if occaſion ſhould happen, as ſeldom it does, by creſting each paper both ways through the middle, four of them may be put on at one time, meeting in the center of the table.

Each chart is always croſſed by right angles through the middle, for the purpoſe above, and to make any of them anſwer to the guide lines on the table I K, L M, drawn quite through the center, and the whole table.—So the grand objection of ſhifting papers is obviated.

PLOTTING-SCALE, a mathematical inſtrument, uſually of wood, ſometimes of braſs, or other matter; and either a foot, or half a foot long. See SCALE.

On one ſide of the inſtrument (plate CII. *fig.* 9) are ſeven ſeveral ſcales, or lines, divided into equal parts. The firſt diviſion of the firſt ſcale is ſubdivided into ten equal parts, to which is prefixed the number 10, ſignifying that ten of thoſe ſubdiviſions make an inch; or that the diviſions of that ſcale are decimals of inches.

The firſt diviſion of the ſecond ſcale is likewiſe ſubdivided into 10, to which is prefixed the number 16, denoting that 16 of thoſe ſubdiviſions make an inch.—The firſt diviſion of the third ſcale is ſubdivided in like manner into 10, to which is prefixed the number 20.—To that of the fourth ſcale is prefixed the number 24; to that of the fifth 32; that of the ſixth 40; that of the ſeventh 48; denoting the number of ſubdiviſions equal to an inch, in each, reſpectively.

The two laſt ſcales are broken off before the end, to give room for two lines of chords marked by the letters *ct.* See CHORD.

On the back-ſide of the inſtrument is a diagonal ſcale, the firſt of whoſe diviſions, which is an inch long, if the ſcale be a foot, and half an inch, if half a foot, is ſubdivided, diagonally, into 100 equal parts.—At the other end of the ſcale is another diagonal ſubdiviſion, of half the length of the former, into the ſame number of parts, viz. 100.

Next the ſcales, is a line divided into hundredth parts of a foot, numbered 10, 20, 30, &c. and a line of inches ſubdivided into tenth parts, marked, 1, 2, 3, &c.

As to the uſe of the plotting ſcale, if we were required to lay down any diſtance upon paper, ſuppoſe 6 chains 50 links: draw an indefinite line; then ſetting one foot of the compaſſes at figure 6 on the ſcale, e. gr. the ſcale of 20 in an inch, extend the other to 5 of the ſubdiviſions, for the 50 links: this diſtance, being transferred to the line, will exhibit the 6 chains 50 links required.

If it be deſired to have 6 chains 50 links take up more or leſs ſpace, take them off from a greater or leſſer ſcale, that is, from a ſcale that has more or fewer diviſions in an inch.

To find the chains and links contained in a right line, e. gr. that is juſt drawn, according to any ſcale, e. gr. that of 20 in an inch. Take the length of the line in the compaſſes, and applying it to the given ſcale, you will find it extend from the number 6 of the great diviſions, to 5 of the ſmall ones: hence the given line contains 6 chains 50 links.

PLOVER, *Pluvialis*, in ornithology, the Engliſh name of ſeveral diſtinct birds; as the green plover, or variegated black and yellowiſh charadrius, about the ſize of the common lapwing; and the grey plover, or blackiſh-brown tringa, with a black beak and green legs, a very beautiful bird.

Baſtard PLOVER, the name by which the vanellus, or lapwing, is called in ſeveral parts of the kingdom. See VANELLUS.

PLOUGH, in agriculture, a machine for turning up the ſoil, contrived to ſave the time, labour, and expence, that without this inſtrument muſt have been employed in digging land, to prepare it for the ſowing of all kinds of grain.

The ſtructure of a plough is various for various kinds of grounds; but the common two-wheeled plough, in plate CIII. *fig.* 1. uſed in almoſt all the counties in the ſouth of England, is generally eſteemed the beſt for all ſorts of land, except ſuch miry clays as ſtick to the wheels, and clog them up ſo as to prevent their turning round. It is commonly divided into two parts, the plough-head, and the plough-tail. The plough-head contains the two wheels A, B, and their axis, or iron-ſpindle, which paſſes through the box C, and turns round both in it and in the wheels; the two crow-ſtaves D, D, faſtened perpendicularly into the box, having in each two rows of holes, in order to raiſe or ſink the beam, by pinning up or down the pillow E, to encreaſe or diminiſh the depth of the furrow; the gallows F, through which the crow-ſtaves paſs at top, by mortiſes into which they are pinned; G the wilds, with its links and crooks of iron, by which the plough is drawn; H the tow-chain, which faſtens the plough-tail to the plough-head, by the collar

Fig. 1. Ploughs.

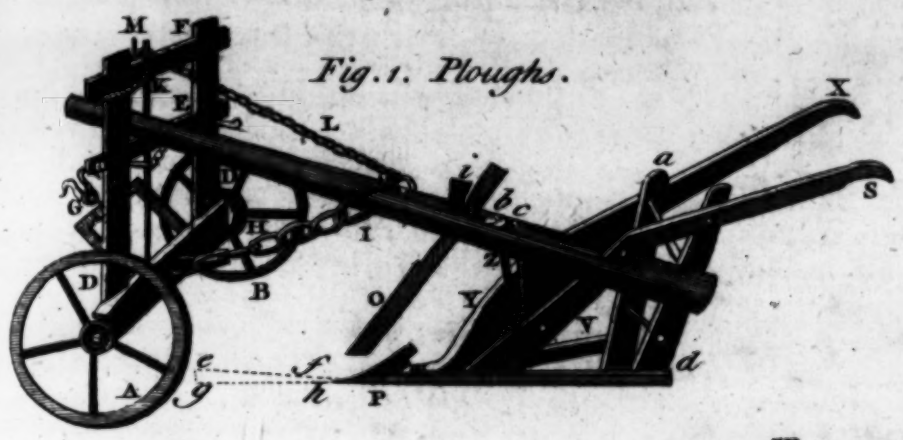


Fig. 3.

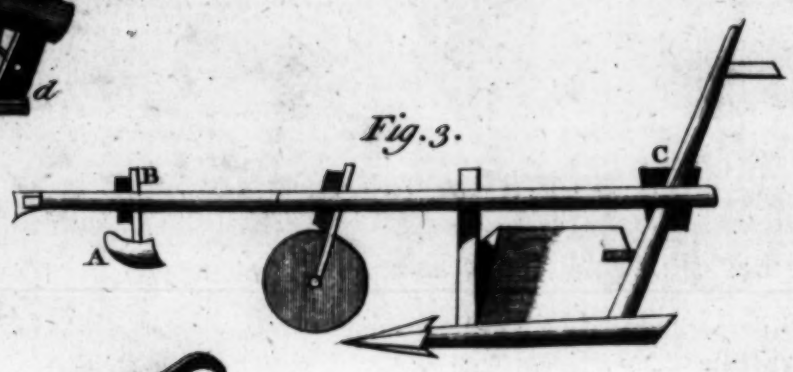


Fig. 2.

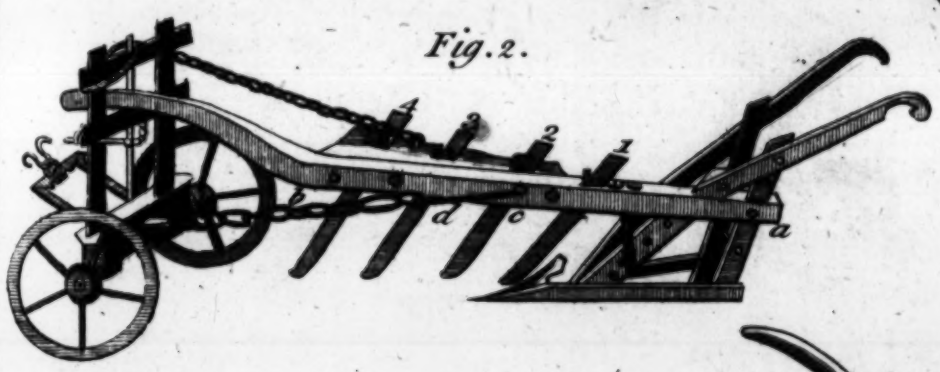


Fig. 4.

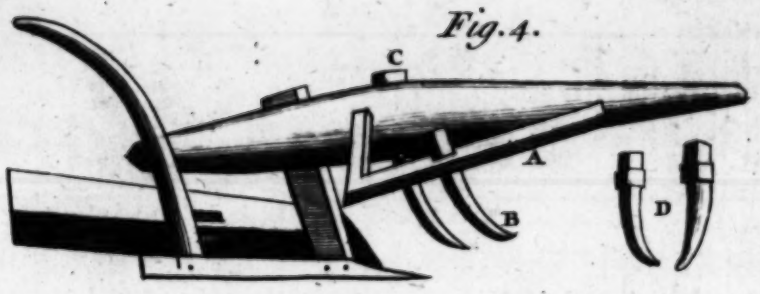


Fig. 5.

Fig. 7. Polygon.

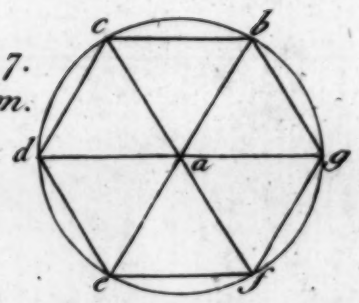
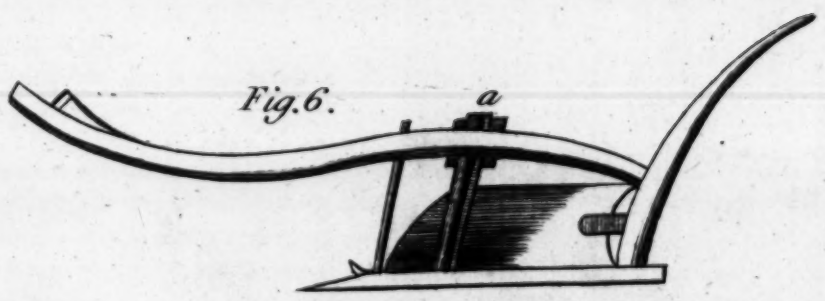


Fig. 6.



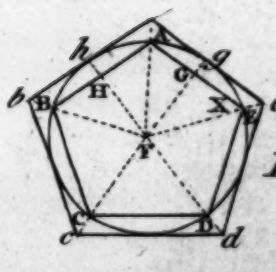
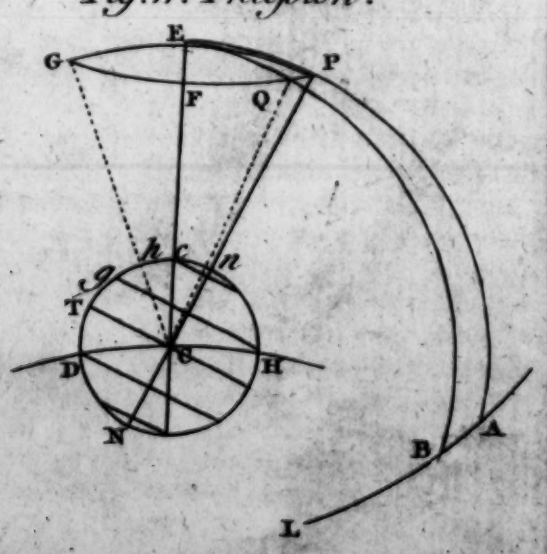


Fig. 8.

Fig. 10.

Fig. 9. A Cluster Polype.

Fig. 11. Precession.



5 JA 59

collar I at one end, and by the other end paſſing through a hole in the middle of the box, where it is pinned in by the ſtake K; L the bridle-chain, one end of which is faſtened to the beam with a pin, and the other end to the top of the ſtake, which ſtake is held up to the left crow-ſtaff, by the end of the with or rope M paſſing round it above, and under the end of the gallows below, or by the end of the bridle-chain itſelf, when that is long enough. The plough-tail conſiſts of the beam, N; the coulter, O; the ſhare, P; and the ſheat, Q; the hinder ſheat, R, paſſing through the beam near its end; S the ſhort handle, faſtened to the top of the hinder ſheat by a pin, and to the top of the fore-ſheat by another pin; T the drock, which belongs to the right-ſide of the plough-tail, and to which the ground-wriſt V is faſtened; as is the earth-board, whoſe fore-part W, is ſeen before the ſheat; as alſo the long handle X, whoſe fore-part Y appears before the ſheat, and is faſtened to the drock by the pin at *a*, the other end of which pin goes into the beam. Z is the double retch, which holds up the ſheat, and paſſes through the beam to be faſtened by its ſcrews and nuts at *b* and *c*.

The ſtructure of the four-coultered plough (*fig.* 2.) is in ſeveral reſpects different from this, though in general founded on it. Its beam is ten feet four inches long, whereas that of the common plough is but eight feet: it differs alſo in ſhape; for as the other is ſtraight from one end to the other, this is ſtraight only from *a* to *b*, and thence turns up, in the manner ſhewn in the plate; ſo that a perpendicular line let down from the corner at *a*, to the even ſurface on which the plough ſtands, would be eleven inches and an half, which is its height in that place; and if another line was let down from the turning of the beam at *b*, to the ſame ſurface, it would be one foot eight inches and a half, which is the height the beam ſtands from the ground at that part; and a third line let down to the ſurface from the bottom of the beam, at that part which bears upon the pillow, will ſhew the beam to be, in that part, two feet ten inches high above the ſurface. At the diſtance of three feet two inches from the end of the beam, at the plough-tail, the firſt coulter, or that next the ſhare, is let through: and at thirteen inches from this, a ſecond coulter is let through: a third at the ſame diſtance from that; and finally, a fourth at the ſame diſtance from the third. The crookedneſs of the beam is to avoid the too great length of the fore-moſt coulters, which would be ſo long if the beam was ſtraight all the way, that they would be apt to bend and be diſplaced, unleſs they were vaſtly thick and clumſy.

The ſheat in this plough is to be ſeven inches broad, and the fixing the ſheat in this, as well as in the common plough, is the niceſt part, and requires the utmoſt art of the maker; for ſuppoſing the axis of the beam, and the left ſide of the ſhare to be both horizontal, they muſt never be ſet parallel to each other; but the ſtraight ſide of the ſhare muſt make an angle on the left-ſide of the beam, which muſt be very acute, that the tail of the ſhare may preſs leſs againſt the ſide of the trench than the point does: this angle is ſhewn by the pricked lines at the bottom of *fig.* 1. where the line *e f* is ſuppoſed to be the axis of the beam let down to the ground, and the line *g h*, parallel to the left-ſide of the ſhare. The great thing to be taken care of, is the placing the four coulters, which muſt be ſo ſet that the four imaginary planes deſcribed by the four edges, as the plough moves forwards, may be all parallel to each other, or very nearly ſo; for if any one of them ſhould be very much inclined to, or ſhould recede much from either of the other, then they would not enter the ground together. In order to the placing them thus, the ſecond coulter-hole muſt be two inches and a half more on the right-hand than the firſt; the third muſt be as much more to the right of the ſecond; and the fourth the ſame diſtance to the right of the third: and this two inches and a half muſt be carefully meaſured from the center of one hole to the center of the other. Each of theſe holes is a mortiſe of an inch and a quarter wide, and is three inches and a half long at the top, and three inches at the bottom. The two oppoſite ſides of the hole are parallel to the top and bottom, but the back is oblique, and determines the obliquity of the ſtanding of the coulter, which is wedged tight up by pieces of wood. The coulters are two feet eight inches long, of which ſixteen inches are allowed for the handles, which is to be thus long, that the coulter may be drawn down as the point wears away. As to the wheels, the left-hand wheel is twenty inches diameter, and that on the right hand, two feet three inches; and the diſtance the wheels are ſet from each other is two feet five inches and a half.

Beſides theſe there are, the Lincolnſhire plough, proper for fenny-lands ſubject to weeds and ſedges, and remarkable for the largeneſs of its ſhare, which is frequently a foot broad and very ſharp, (*fig.* 3.) At A is a foot, which is ſet higher or lower, by a wedge drove in at B; and which keeps the fore part of the plough from going deeper than they would have it. At C there are wedges by which the hinder part is ſet. Inſtead of a coulter there is a wheel with a ſharp edge, which cuts the roots of the graſs or ſedge as it turns round, while the broad ſhare cuts them up at the bottom.

The Caxton or trenching plough, invented to cut drains about Caxton in Cambridgeſhire, in ſtiff, miry, clay ground. This plough (*fig.* 4.) is larger and ſtronger than an ordinary: to the beam is fixed a piece of wood at A, in which is a coulter ſet at B, and another ſet in the beam at C, which two coulters ſtand bending inwards as at D, to cut each ſide of the trench. The ſhare is very flat and broad, in order to form the bottom of the trench; and the mould board is three times the length of other ploughs, in order to caſt the turf a great way from the trench. This plough cuts a trench a foot wide at the bottom, a foot and a half broad at the top, and a foot deep, and it is drawn with twenty horſes.

But the moſt common plough, ſays Mortimer, is the dray-plough repreſented in *fig.* 6. which is beſt for miry clays, when the land is ſoft; but is extremely bad in ſummer, when the land is hard, becauſe its point will be continually flying out of the ground: it is ſet higher or lower, by wedges at *a*. *Fig.* 5. is a Spaniſh plough, with which and one horſe, they will plough two or three acres of their light lands in a day. We have given a figure of it, merely on account of its ſingularity.

PLOUGH, among book-binders, is a machine for cutting the edges of the leaves of books ſmooth.

PLOUGHMAN, the perſon who guides the plough in the operation of tilling.

PLOUGHING, or PLOWING, in agriculture, the art of turning up the earth with a plough.

Ploughing is principally either that of lays or of fallows. Ploughing of lays, is the firſt cutting up of graſs-ground for corn, and is a work commonly performed in January. The beſt time for doing it is when the land is wet, becauſe the turf is then ſoft and tough, and will turn up without breaking. In the well turning of this conſiſts the chief part of this ſort of ploughing, which if rightly performed, will lay the turf ſo flat and true, that it can hardly be ſeen where the plough went. This, indeed, depends greatly upon the make of the plough; but if the earth-board does not turn the turf well, ſome nail upon it a ſmall piece of wood to take the upper part of the earth as it riſes upon the earth-board, which cauſes it to fall with the graſs-ſide downwards. Ploughing of fallows, called alſo fallowing, is preparing land by ploughing long before it is ploughed for ſeed. See the article FALLOWING.

PLUM-TREE, in botany, a genus of plants, the flower of which conſiſts of five roundiſh, concave, and large petals: the fruit is a roundiſh drupe, marked with a longitudinal furrow, and containing a compreſſed and acute-pointed nut, with the ſutures ſtanding out each way in an edge.

PLUMAGE, the feathers which ſerve birds for a covering.

PLUMBAGO, MOCK-LEAD, in mineralogy, a foſſile ſubſtance reſembling lead-ore, much uſed in drawing, and for making pencils.

PLUMBERY, the art of caſting, preparing, and working of lead, and of uſing it in buildings, &c.

The word is formed of the Latin, *plumbum*, lead.

The lead uſed in plumbery, is furniſhed from the lead works in large ingots called pigs of lead, ordinarily weighing about a hundred pounds a piece.

As lead melts very eaſily, it is no hard matter to caſt figures hereof by running it into moulds. But the chief article in plumbery is the ſheets and pipes of lead.

PLUMBUM, lead, in natural hiſtory. See the article LEAD.

PLUMMET, PLUMB-RULE, or PLUMB-LINE, an inſtrument uſed by carpenters, maſons, &c. in order to judge whether walls, &c. be upright planes, horizontal, or the like. It is thus called from a piece of lead, *plumbum*, faſtened to the end of a cord, which uſually conſtitutes this inſtrument. Sometimes the ſtring deſcends along a wooden ruler, &c. raiſed perpendicularly on another; in which caſe it becomes a level. See LEVEL.

PLUMMING, among miners, is the method of uſing a mine-dial, in order to know the exact place of the work where to ſink down an air-ſhaft, or to bring an adit to the work, or to know which way the load inclines when any flexure happens in it.

It is performed in this manner: A ſkilful perſon, with an aſſiſtant, and with pen, ink, and paper, and a long line and a ſun-dial, after his gueſs of the place above ground, deſcends into the adit or work, and there faſtens one end of the line to ſome fixed thing in it, then the incited needle is let to reſt, and the exact point where it reſts is marked with a pen: he then goes on farther in the line ſtill faſtened, and at the next flexure of the adit he makes a mark on the line by a knot or otherwiſe; and then letting down the dial again, he there likewiſe notes down that point at which the needle ſtands in this ſecond poſition. In this manner he proceeds, from turning to turning, marking down the points, and marking the line till he comes to the intended place; this done, he aſcends, and begins to work on the ſurface of the earth what he did in the adit, bringing the firſt knot in the line to ſuch a place where the mark of the place of the needle will again anſwer its pointing, and continues this till he comes to the deſired place above ground, which is certain to be perpendicularly over the part of the mine into which the air-ſhaft is to be ſunk.

PLUMOSE, ſomething formed in the manner of feathers, with a ſtem and fibres iſſuing from it on each ſide: ſuch are the antennæ of certain moths, butterflies, &c.

PLUNGER, in mechanics, the ſame with the forcer of a pump. See FORCER.

PLURAL, *Pluralis*, in grammar, an epithet applied to that number of nouns and verbs which is uſed when we ſpeak of more than one thing; or that which expreſſes a plurality or number of things. See the article NUMBER.

PLURALITY, *Pluralitas*, a diſcrete quantity, conſiſting of two or a greater number of the ſame kind: thus we ſay a plurality of gods, &c.

Hence plurality of benefices, or livings, is where the ſame clerk is poſſeſſed of two or more ſpiritual preferments, with cure of ſouls.

PLUS, in algebra, a character marked thus +, uſed for the ſign of addition. See CHARACTER.

PLUSH, in commerce, &c. a kind of ſtuff having a ſort of velvet knap, or ſhag, on one ſide, compoſed regularly of a woof of a ſingle woolen thread and a double warp, the one wool, of two threads twiſted, the other goats or camels hair; though there are ſome pluſhes entirely of worſted, and others compoſed wholly of hair.

Pluſh is manufactured, like velvet, on a loom with three treadles; two of theſe ſeparate and depreſs the woolen warp, and the third raiſes the hair-warp, upon which the workman throwing the ſhuttle, paſſes the woof between the woollen and hair-warp; and afterwards laying a braſs-broach, or needle, under that of the hair, he cuts it thereon with a knife deſtined for that uſe; conducting the knife on the broach, which is made a little hollow all its length, and thus gives the ſurface of the pluſh an appearance of velvet. See VELVET.

There are other kinds of pluſh, all of ſilk; ſome of which have a pretty long knap on one ſide, and ſome on both.

PNEUMATICS, called alſo PNEUMATOLOGY and PNEUMATOSOPHY, among the ſchoolmen, the doctrine and contemplation of ſpirits and ſpiritual ſubſtances, as God, angels, and the human ſoul, in which ſenſe pneumatics are the ſame with what we otherwiſe call metaphyſics. See METAPHYSICS.

PNEUMATICS is more commonly uſed among us, for that part of natural philoſophy which treats of the nature and properties of the air; the doctrine and laws of which will be found under the articles AIR, ATMOSPHERE, &c.

PNEUMATIC ENGINE. See the article AIR-PUMP.

PNEUMATOCELE, HERNIA FLATULENTA, or WINDY-RUPTURE, in ſurgery and medicine, a ſpecies of hernia, which ſeveral authors aſſure us occurs in practice. The ſigns by which they tell us it may be diſcovered are, 1. That upon handling the ſcrotum it feels like a bladder diſtended with wind; and that, therefore, 2. it ſeems to be much lighter than if it contained any humour, appearing alſo pellucid at the approach of a candle; and, 3. if it be ſtruck by a fillip of the finger, it ſounds like a bladder which is diſtended with wind, and ſtruck in the ſame manner. However, Heiſter is of opinion that theſe authors have miſtaken the hydrocele or enterocele for the pneumatocele, and ſeems to be more confirmed in this opinion, not only becauſe the ſymptoms and cure of this diſorder, with which they acquaint us, agree exactly with thoſe of the hydrocele, but becauſe that in all his practice he never obſerved any thing like this diſorder; this makes him at leaſt ſuſpect that the caſe does not ſo often occur as ſome would inſinuate: but whenever it is met with he directs to proceed in the cure as follows. Let the tumour be treated externally with warm and diſcutient medicines, as in the hydrocele, together with fomentations and plaſters; and internally may be taken carminative and gentle purges: but if theſe take no effect, and the tumour ſtill increaſes, or continues the ſame, the ſcrotum ſhould then be perforated with the trochar, and its contents thereby diſcharged, which will demonſtrate whether it be wind or water.

PNEUMATOMACHI, Πνευμοτομαχοι, ancient heretics, ſo called becauſe they oppoſed the divinity of the Holy Spirit, placing him in the number of creatures.

PNEUMONICS, in pharmacy, medicines proper in diſeaſes of the lungs, in which reſpiration is affected. Of this number are ſulphur, lungwort, hyſſop, ground-ivy, and colt's-foot: they are uſed in phthiſes, aſthmas, peripneumonies, pleuriſies, &c.

POA, meadow-graſs, in botany, a genus of plants, the corolla whereof is compoſed of two valves, of an ovato-acuminated figure, hollow, compreſſed, and ſomewhat longer than the cup, and without awns. It ſupplies the place of a pericarpium; and adheres every way to the ſeed, which is ſingle, of an oblong figure, compreſſed, and pointed at each end.

This is the moſt common of all graſſes with us, and makes principally the green covering of moſt of our fields and meadows.

POCKET, in the woolen trade, a word uſed to denote a larger ſort of bag, in which wool is packed up to be ſent from one part of the kingdom to another. The pocket contains uſually twenty-five hundred weight of wool.

POD, among botaniſts, a term uſed to expreſs a pericarpium conſiſting of two valves, which open from the baſe to the point, and are ſeparated by a membranaceous partition, from which the ſeeds hang by a kind of funiculus umbilicalis.

PODAGRA, in medicine, the gout in the feet. See GOUT.

PODOMETER, or PEDOMETER, the ſame with perambulator. See PERAMBULATOR.

PODARIA, in zoology, a diviſion, order, or ſeries of wingleſs inſects, with ſhort bodies, and not very numerous legs; comprehending the puceron, pediculus, acarus, ſpider, ſquill, &c.

PODEX, in anatomy, &c. the ſame with anus or fundament. See ANUS.

POEM, Ποιημα, a compoſition in verſe of a due length and meaſure. See the article VERSE, and MEASURE.

Poems are generally denominated from the ſubject matter, as the apobaterion, epibaterion, epinicion, epithalamium, genethliac, elegiac, ſatiric, epitaph, panegyric, lyric, paſtoral, &c. and others, from the manner of narration, as epic, dramatic, &c. to which may be added, odes,

odes, eclogues, and idylliums. To this head may alſo be referred ſeveral other compoſitions of a leſs ſerious kind, as the acroſtic, enigma, anagram, cento, echo, &c.

The Abbé Du Bos obſerves, in regard to poems, that ſome are intereſting in general, others in particular; that the beauties of execution alone do not conſtitute a good poem; that the defects of poems are leſs diſcernible than thoſe of a picture; that our diſlike falls only on the bad part of a poem; that every kind of poem has ſomething particular in its ſtyle; that by the beauty of the ſtyle we muſt judge of poems; that it muſt be a long time before the merit of a good poem is diſtinguiſhed; and finally, that the character of the poetic ſtyle has always decided the good or bad ſucceſs of poems, even of thoſe which by their length ſeem to have the greateſt dependance on the œconomy of the plan, on the diſtribution of the action, and on the decency of the manners.

POESY, the ſame with poetry. See POETRY.

POET, ποιητης, the author of a poem. See POEM.

POETICAL, ſomething that relates to poetry or poets, in which ſenſe we ſay poetical genius, poetical licence, &c.

POETICAL *Juſtice*, is chiefly uſed in reſpect of the drama, to denote a diſtribution of rewards and puniſhments to the ſeveral perſons at the cataſtrophe or cloſe of a piece, anſwerable to the ſeveral characters they appeared in.

POETICAL *riſing and ſetting of the Stars*. The three kinds of riſing and ſetting, viz. the coſmical, acronical, and heliacal, were made by the ancient poets referring the riſing, &c. of the ſtars to that of the ſun. See COSMICAL, &c.

POETICS, the doctrine of poetry, or the laws and rules of conducting pieces, or compoſitions of poetry: ſuch is Ariſtotle's Poetics, a work much valued.

POETRY, the art of compoſing poems, or pieces in verſe; or, as defined by Voſſius, the art of repreſenting actions in metre.

Voſſius thinks that love was the firſt occaſion of poetry, which is not improbable, conſidering that this affection is coeval with mankind, is univerſal, and naturally productive of poetry; yet it undoubtedly owes its increaſes and progreſs to religion: Dacier indeed calls it the offspring of religion; and it is certain, in the earlieſt ages of the world, that it was uſual to ſing hymns to the honour of the gods upon ſolemn feſtivals. Du Bos thinks that poetry has been employed in all ages, even by the moſt unpoliſhed nations, to preſerve the memory of paſt events. Its principal aim is to flatter our ſenſes and imagination; for, according to Plato, it awakens the ſpiritual empire of the ſoul. Every kind of poetry charms us in proportion to its object, ſays Du Bos; and to be very affecting, it ought to be very exact. It is not the ſame with poetry as with other arts, for an ignorant perſon may judge of poetry by the impreſſion it makes on him; whence all men have a right to give their opinion, and this judgment ought to be founded on experience rather than on argumentation. Poetry is an art where every thing ſhould pleaſe. It is not enough to exhibit nature, which in certain places and circumſtances is rude and unpleaſant; but the poet muſt chuſe in her what is beautiful from what is not: whence a poet ought to chuſe, for the ſubject of his imitation, ſomething that is naturally affecting. There is a particular rhetoric for poetry, which conſiſts in diſcerning very preciſely what ought to be ſaid figuratively, and what to be ſpoken ſimply; and in knowing where ornament is required, and where not: yet the ſtyle ſhould be copious, and every ſpecies of writing in this art ſhould have a diction proper to itſelf.

The qualifications then neceſſary for poetry, or thoſe which form a good poet, are ſeldom found united in one perſon: he muſt have an extraordinary genius, great natural gifts, a wit juſt, piercing, ſolid, and univerſal; an underſtanding clear and diſtinct; an imagination neat and pleaſant; an elevation of ſoul that depends not on art, or ſtudy, and which is purely a gift of heaven, and muſt be ſuſtained by a lively ſenſe and vivacity, a great judgment to conſider wiſely of things, and a vivacity to expreſs them with that grace and abundance which gives them beauty. In fine, to accompliſh a poet, is required a temperature of wit and fancy, of ſtrength and ſweetneſs, of penetration and delicacy; but, above all, he muſt have a ſovereign eloquence, and a profound capacity. Theſe are the qualities that muſt concur together to form the genius of a poet, and ſuſtain his character. The rules of poetry and verſifying are taught by art, and acquired by ſtudy; but this force and elevation of thought, which Horace calls ſomething divine, and which alone makes the poetry of any value, muſt be derived from nature; or, according to Ariſtotle, from ſome happy tranſports, to which that author gives the name of madneſs. Hence the critics conclude, the end of poetry is to pleaſe; its cauſe, either the excellence of the poet's genius, or a poetical fury and tranſport of the ſoul, manageable by the judgment; its matter, long and ſhort ſyllables, and feet compoſed hereof, with words furniſhed by grammar; and its form, the arrangement of all theſe things in juſt and agreeable verſe, expreſſing the thoughts and ſentiments of the author after the manner already mentioned. But after all, how narrow are all theſe bounds, if we conſider poetry in the light wherein the works of Homer and Virgil have ſet it! This, which is therefore diſtinguiſhed by the name of the greater poetry, in contradiſtinction to the low and ſimple, or verſification, conſiſts principally in fiction, or the invention of fables, in the expreſſing of things by allegories and metaphors, and in the inventing of actions, under which the truths which the poet has to teach, may be agreeably diſguiſed.

POINT, a term uſed in various arts.

POINT, *Punctum*, in geometry, as defined by Euclid, is a quantity which has no parts, or which is indiviſible. Points are the ends or extremities of lines. If a point be ſuppoſed to be moved any way, it will, by its motion, deſcribe a line.

POINT, in phyſics, the leaſt ſenſible object of ſight, marked with a pen, point of a compaſs, or the like. Of ſuch points all phyſical magnitude conſiſts. This phyſical point is the ſame with what Mr. Locke calls the point ſenſible, and which he defines to be the leaſt particle of matter, or ſpace, we can diſcern. He adds, that to the ſharpeſt eye, this is ſeldom leſs than thirty ſeconds of a circle, whereof the eye is the center.

POINT, in grammar, a character uſed to mark the diviſions of diſcourſe. A point proper, is what we otherwiſe call a full ſtop or period. See PERIOD.

The points, or vowel-points, in the Hebrew grammar, are certain characters which, in the writings of that language, ſerve to mark the vowels. The antiquity of theſe points make the ſubject of a celebrated controverſy; ſome maintaining their origin to be the ſame with that of the Hebrew language; and others aſſerting them to have been firſt introduced by Eſdras, after the Babyloniſh captivity, when he compiled the canon, tranſcribed the books into the preſent Chaldee character, and reſtored the purity of the Hebrew text. Some will have them invented by the doctors of the ſchool of Tiberias, uſually called the Maſſoretes, five or ſix hundred years after Chriſt.

POINT, in muſic, a mark or note anciently uſed to diſtinguiſh the tones or ſounds: hence we ſtill call it ſimple counter-point, when a note of the lower part anſwers exactly to that of an upper; and figurative counter-point, when any note is ſyncopated, and one of the parts makes ſeveral notes or inflexions of the voice, while the other holds on one.

We ſtill uſe a point, to raiſe the value of a note, and prolong its time by one half; e. g. a point added to a ſemibreve, inſtead of two minims, makes it equal to three; and ſo of the other notes.

POINT, in aſtronomy, a term applied to certain points or places, marked in the heavens, and diſtinguiſhed by proper epithets.

The four grand points or diviſions of the horizon, viz. the eaſt, weſt, north, and ſouth, are called the cardinal points.

The zenith and nadir are the vertical points; the points wherein the orbits of the planets cut the plane of the ecliptic, are called the nodes: the points wherein the equator and ecliptic interſect, are called the equinoctial points; particularly, that whence the ſun aſcends towards the north pole, is called the vernal point; and that by which he deſcends to the ſouth pole, the autumnal point.

POINT *of the Horizon*, or *Compaſs*, in navigation and geography. See the articles HORIZON and COMPASS.

POINT is alſo uſed for a cape or headland, jetting out into the ſea: thus ſeamen ſay, two points of land are in one another, when they are ſo in a right line againſt each other, as that the innermoſt is hindered from being ſeen by the outermoſt.

POINTS, in heraldry, are the ſeveral different parts of an eſcutcheon, denoting the local poſitions of any figure.

POINT is alſo uſed in heraldry for the loweſt part of the eſcutcheon, which uſually terminates in a point.

POINT is alſo an iron or ſteel-inſtrument uſed with ſome variety in ſeveral arts. Engravers, etchers, cutters in wood, &c. uſe points to trace their deſigns on the copper, wood, ſtone, &c.

POINT, in the manufactories, is a general term uſed for all kinds of laces wrought with the needle; ſuch are the point de Venice, point de France, point de Genoa, &c. which are diſtinguiſhed by the particular oeconomy and arrangement of their points.

POINT, in poetry, denotes a lively briſk turn, or conceit, uſually found or expected at the cloſe of an epigram.

POINT-BLANK, in gunnery, denotes the ſhot of a gun levelled horizontally. See GUNNERY.

POINTS, little flat platted cords, by which the ſails are reefed. See REEF, and EARING.

POINTING, in grammar, the art of dividing a diſcourſe, by points, into periods and members of periods, in order to ſhew the proper pauſes to be made in reading, and to facilitate the pronunciation and underſtanding thereof.

POINTING, in war, the levelling a cannon, or mortar, ſo as to play againſt any certain point.

POINTING, among ſailors, the act of tapering the end of a rope, ſo as to make it ſtiff, that it may eaſily enter ſome hole or other; it is afterwards covered by a kind of matt, or coat, which they weave round it.

POISON, in medicine, a malignant quality in ſome animal, vegetable, or mineral body, which renders it hurtful and even mortal to thoſe who take it.

There are three eſſential marks of poiſons, which diſtinguiſh them from other things that are noxious to human bodies. The firſt is, that they conſiſt of moſt ſubtile parts, and are conſequently pernicious in a ſmall quantity. The ſecond, that they in a ſhort time prevent the regular motions of the ſolids and fluids throughout the body, and induce the moſt grievous ſymptoms, and even death itſelf. And the third, that they exerciſe their cruelty on the moſt ſubtile fluids, and the moſt nervous parts. Poiſons are of various kinds, and operate in various manners; ſome by diſſolving the blood, others by coagulating it, and others by corroding and deſtroying the ſolid parts. All the three kingdoms have poiſons peculiar to themſelves; but the animal kingdom affords the moſt ſubtile, which are communicated by the bite of mad or venomous beaſts, when they are angered. The mineral kingdom produces arſenicals and mercurials. And the vegetable, herbs and plants of a moſt acrid, noxious, and deleterious quality, ſuch as the moſt violent cathartics and narcotics. Every ſort of poiſon ſeems to have an effect peculiar to itſelf; thus arſenic occaſions the moſt cruel torments, convulſions, mortification of the coats of the inteſtines: the ſeeds of datura induce madneſs or abſolute ſtupidity: opium brings on ſleepineſs, and a torpor on the mind: the berries of deadly nightſhade produce madneſs, rage, or folly: litharge, unwarily taken, cauſes a convulſive colic, with an obſtinate coſtiveneſs: the bite of a mad dog occaſions the dread of water: the venom induced by the ſting of a tarantula, produces wonderful effects; for the patient is delighted with muſical inſtruments, and when he hears their ſounds, immediately falls to capering: the ſting of a ſcorpion produces a ſudden chilneſs and exceeding cold ſweats. The mineral kingdom furniſhes very few real poiſons; the only natural one is cobalt; the factitious are arſenic, corroſive ſublimate, and glaſs of antimony. The moſt dangerous vegetable poiſons are the true hemloc, wolf's bane, the deadly nightſhade, henbane, and datura, to which may be added the roots of hemloc-drop-wort.

Milk mixed with oil, is an excellent remedy againſt all corroſive poiſons. Hoffman ſays, that he once prevented the death of ten young perſons, who had taken among them almoſt two ounces of arſenic in water-gruel, which in a ſhort time produced the higheſt anxieties, and corroding tortures, by oil of ſweet almonds and milk. They took at leaſt ten quarts a-piece, which they vomited up again before the reaching to vomit ceaſed. The ſame author alſo affirms, that milk, in a large quantity, is an univerſal remedy againſt all poiſons that kill by inflammation, as hemloc does; and, if taken in time, will prevent their dreadful conſequences. Allen thinks a vomit with warm water and oil, taken in large draughts, and often repeated, will be of great ſervice; as alſo warm with freſh butter; milk and oil, or milk and butter: but for fat broths, which he alſo recommends, or any thing elſe which requires ſome time for the preparation, they only allow the poiſon to take deeper root, and therefore ought not to be waited for. If the above things will not provoke the patient to vomit, oxymel of ſquills, ſalt of vitriol, or a decoction of tobacco may be uſed, as having a more immediate effect. It is hardly ſafe to give even the moſt gentle cathartic. The ſtomach being thus emptied of all, or as much as poſſible of the hemloc, recourſe muſt be had to generous wine and alexipharmics, ſuch as venice-treacle, the bezoardic powder, &c. When there is a ſuſpicion that the coats of the ſtomach or inteſtines are corroded, or ulcerated, it will not be proper for the patient to uſe ſpices or vinegar, nor to indulge in drinking too much wine; but to take a decoction of barley with raiſins, and a decoction of china-root, ſaſſafras, &c. The ſame method is moſt likely to anſwer when any deleterious herb or root has been eaten by miſtake, though the particular ſpecies ſhould not be known: and Hoffman affirms, that when the patient has been ſtupified by narcotics, the beſt remedies are vomits mixed with oil.

To POISON *a Piece*, with gunners, is the ſame as to clog and nail it up.

POISON-WEED, *Toxicodendron*, in botany. See TOXICODENDRON.

POLACRE, among ſeamen, a ſhip which, contrary to the common method, has caſt off her maſts, formed of one piece of timber for the whole length, and without the addition of top-maſts. Some polacres are fitted with two maſts, but in general they have three; and are alſo diſtinguiſhed by a prow, formed in a manner quite different to thoſe of other ſhips. See PROW.

POLAND, a large kingdom of Europe, ſituated between 16° and 34° eaſt longitude. and between 46° and 57° north latitude; bounded by Ruſſia on the north and eaſt; by Beſſarabia, Moldavia, Tranſilvania, and Hungary on the ſouth; and by Pomerania, Brandenburg, and Sileſia on the weſt; being almoſt ſquare, and ſeven hundred miles over either way.

The conſtitution of Poland is a mixed monarchy, in which the nobility and gentry ſeem to have the greateſt ſhare, whence it is frequently called a republic. The king is elective by the whole body of the gentry, who oblige him to ſwear to what conditions they pleaſe.

POLAR, in general, ſomething relating to the poles of the world, or poles of the artificial globes: thus we meet with polar circles, polar dial, polar projection, &c.

POLARITY, the quality of a thing conſidered as having poles; but chiefly uſed in ſpeaking of the magnet.

POLE, πολος, in aſtronomy, one of the extremities of the axis on which the ſphere revolves.

Theſe two points, each 90° diſtant from the equinoctial or equator, are by way of eminence called the poles of the world; and the extremities of the axes of the artificial globes correſponding to theſe points in the heavens are termed the poles thereof.

POLES, in ſpherics, a point equally diſtant from every part of the circumference of a great circle of the ſphere, as the center is in a plane figure; or it is a point 90° diſtant from the plane of a circle, and in a line, called the axis, paſſing perpendicularly through the center. The zenith and nadir are the poles of the horizon; and the poles of the equator are the ſame with thoſe of the ſphere.

POLES *of the Ecliptic*, are two points on the ſurface of the

the ſphere, 23° 30′ diſtant from the poles of the world, and 90° diſtant from every part of the ecliptic.

POLES, in magnetics, are two points of a loadſtone, correſponding to the poles of the world; the one pointting to the north, the other to the ſouth. See the article MAGNET.

POLE, or VERTEX *of a Glaſs*, in optics, is the thickeſt part of the convex, or the thinneſt of a concave-glaſs. If the glaſs be truly ground, the pole will be exactly in the middle of its ſurface.

POLE, PERCH, or ROD, in ſurveying, is a meaſure containing ſixteen feet and a half.

POLE, or POLAR-STAR, is a ſtar of the ſecond magnitude, the laſt in the tail of urſa minor.

The nearneſs of this ſtar to the pole, whence it happens that it never ſets, renders it of vaſt ſervice in navigation, &c. for determining the meridian line, the elevation of the pole, and, conſequently, the latitude of the place, &c.

POLEMICAL, in matters of literature, an appellation given to books of controverſy, eſpecially thoſe in divinity.

POLEMOSCOPE, in optics, a kind of reflecting perſpective glaſs, invented by Hevelius, who commends it as uſeful in ſieges, &c. for diſcovering what the enemy is doing, while the ſpectator lies hid behind an obſtacle.

POLIANTHES, in botany, a genus of plants, with a monopetalous, funnel-faſhioned flower; and a roundiſh capſule for its fruit, with a great many ſemi-orbiculated ſeeds.

POLISHER, or BURNISHER, among mechanics, an inſtrument for poliſhing and burniſhing things proper to take a poliſh. The gilders uſe an iron-poliſher to prepare their metals before gilding, and the blood-ſtone to give them the bright poliſh after gilding.

The poliſher uſed by the makers of ſpurs, and bits, &c. is partly iron, partly ſteel, and partly wood; it conſiſts of an iron-bar with a wooden handle at one end, and a hook at the other, to faſten it to another piece of wood held in the vice, while the operator is at work. In the middle of the bow, withinſide, is what is properly called the poliſher, being a triangular piece of ſteel with a tail, whereby it is riveted to the bow.

The poliſhers, among cutlers, are a kind of wooden wheels made of walnut-tree, about an inch thick, and of a diameter at pleaſure, which are turned round by the great wheel; upon theſe they ſmooth and poliſh their work with emery and putty.

The poliſhers for glaſs conſiſt of two pieces of wood; the one flat, covered with old hat; the other long and half-round, faſtened on the former, whoſe edge it exceeds on both ſides by ſome inches, which ſerve the workmen to take hold of, and to work backwards and forwards by.

The poliſhers uſed by ſpectacle-makers, are pieces of wood a foot long, ſeven or eight inches broad, and an inch and a half thick, covered with old beaver-hat, whereon they poliſh the ſhell and horn-frames their ſpectacle-glaſſes are to be ſet in.

POLISHING, in general, the operation of giving a gloſs or luſtre to certain ſubſtances, as metals, glaſs, marble, &c.

The operation of poliſhing optic-glaſſes, after being properly ground, is one of the moſt difficult points of the whole proceſs. See GLASS and GRINDING.

Before the poliſhing is begun, it is proper to ſtretch an even well-wrought piece of linnen over the tool, duſting thereupon ſome very fine tripoli. Then taking the glaſs in your hand, run round forty or fifty times upon the tool, to take off the roughneſs of the glaſs about the border of it. This cloth is then to be removed, and the glaſs to be poliſhed upon the naked tool, with a compound powder made of four parts tripoli mixed with one of fine blue vitriol; ſix or eight grains of which mixture is ſufficient for a glaſs five inches broad. This powder muſt be wetted with eight or ten drops of clear vinegar, in the middle of the tool; being firſt mixed and ſoftened thoroughly with a very fine ſmall mullet. Then with a nice bruſh, having ſpread this mixture thinly and equably upon the tool, take ſome very fine tripoli, and ſtrow it thinly and equably upon the tool ſo prepared; after which take the glaſs to be poliſhed, wiped very clean, and apply it on the tool, and move it gently twice or thrice in a ſtraight line backwards and forwards; then take it off, and obſerve whether the marks of the tripoli, ſticking to the glaſs, be equably ſpread over the whole ſurface thereof; if not, it is a ſign that either the tool or glaſs is too warm; in which caſe you muſt wait a while and try again, till you find the glaſs takes the tripoli every where alike. Then you may begin to poliſh boldly, there being no danger of ſpoiling the figure of the glaſs, which in the other caſe would infallibly happen. This is Mr. Huygens's method; but it ought to be obſerved, that almoſt every operator has a peculiar one of his own, and of which ſome of them make a mighty ſecret.

Sir Iſaac Newton no where expreſsly deſcribes his method of poliſhing optic-glaſſes; but his method of poliſhing reflecting metals he thus deſcribes in his Optics. He had two round copper plates, each ſix inches in diameter, the one convex, the other concave, ground very true to one another. On the convex one he ground the object-metal, or concave which was to be poliſhed, till he had taken the figure of the convex, and was ready for a poliſh. He then pitched over the convex very thinly, by dropping melted pitch upon it, and warming it to keep the pitch ſoft, whilſt he ground it with the concave copper wetted to make it ſpread evenly all over the convex, till it was no thicker than a groat-piece; and after the convex was cold, he ground it again, to give it as true a figure as poſſible. He then ground it with very fine putty, till it made no noiſe; and then upon the pitch he ground the object-metal with a briſk motion for two or three minutes; when laying freſh putty upon the pitch, he ground it again till it had done making a noiſe, and afterwards ground the object-metal upon the pitch as before: and this operation he repeated, till the metal was perfectly poliſhed.

POLITICAL, in general, ſomething relating to policy or government.

POLITICAL *Arithmetic* is the application of arithmetical calculations to political ſubjects, as the public revenues, number of people, extent and value of lands, taxes, trade, manufactures, &c. of any commonwealth.

The calculations of this kind, which Sir William Petty attempted, Dr. Davenant gives ſome good reaſons why many of his numbers are not to be entirely depended on; and therefore he advances others of his own founded on the obſervations of Mr. Greg. King.

The land of England, he ſays, is 39 millions of acres; the number of people about 5,545,000, increaſing about 9,000 every year, allowance being made for plagues, &c. wars, ſhipping, plantations. The people in London he reckons at 530,000; thoſe in the other cities and market-towns 870,000; and thoſe in the villages and hamlets at 4,100,000; the yearly rent of the land he accounts to be 10,000,000 l. that of the houſes and buildings 2,000,000 l. per annum; the produce of all kinds of grain he reckons to be worth 9,075,000 l. in a moderately plentiful year; the rent of the corn-lands annually 2,000,000 l. and their net produce above 9,000,000 l. the rent of the paſtures, meadows, woods, foreſts, commons, heaths, &c. 7,000,000 l. The annual produce in butter, cheeſe, and milk, about 2,500,000 l. The value of the wool, yearly ſhorn, about 2,000,000 l. Of horſes yearly bred, about 250,000 l. Of the fleſh yearly conſumed about 3,350,000 l. Tallow and hides about 600,000 l. Hay yearly conſumed by horſes 1,300,000 l. By other cattle, 1,000,000 l. The timber yearly felled for building, 500,000 l. Wood yearly burnt, &c. 500,000 l. The land of England is now about ſeven acres one quarter to each inhabitant. The value of the wheat, rye, and barley, neceſſary for the ſuſtenance of England, at leaſt 6,000,000 l. per annum. The value of the woollen manufacture made here is about 8,000,000 l. per annum, and our exports of all kinds of woollen manufactures above 2,000,000 l. per annum. The annual income of England, on which the people live, and out of which taxes of all kinds are paid, is now about 43,000,000 l. that of France 81,000,000 l. and Holland 18,250,000 l.

Major Grant, in his obſervations on the bills of mortality, computes that there are 39,000 ſquare miles of land

land in England; that in England and Wales there are 4,600,000 ſouls; that the people of London are about 640,000, and one fourteenth part of the people of England. That in England and Wales are about 10,000 pariſhes, and 25 millions of acres, being about 4 acres to every head. That but 64 out of a hundred of the children born are living at 6 years old; but 40 at 16; but 25 at 26; but 16 at 36; but 10 at 46; but 6 at 56; but 3 at 66; but 1 at 76. And that London doubles itſelf in about 64 years.

Let p repreſent the number of perſons in being at any given time, and put $\frac{p}{s}$ for the increaſe at the end of the firſt year; then $p+\frac{p}{s}$ will expound the number of perſons living at the end of the firſt year, and conſequently $\frac{p}{s}+\frac{p}{ss}$ will be the increaſe in the ſecond year; therefore the number of perſons in being at the expiration of the ſecond year will be denoted by $p+\frac{p}{s}+\frac{p}{s}+\frac{p}{ss}$, or $p+\frac{2p}{s}+\frac{p}{ss}$; at the end of the third year there will be $p+\frac{3p}{s}+\frac{3p}{ss}+\frac{p}{s^3}$, perſons living; at the end of the fourth year $p+\frac{4p}{s}+\frac{6p}{ss}+\frac{4p}{s^3}+\frac{p}{s^4}$; and at the end of the fifth year, $p+\frac{5p}{s}+\frac{10p}{s^2}+\frac{10p}{s^3}+\frac{5p}{s^4}+\frac{p}{s^5}$; from whence the law of continuation becomes manifeſt, the coefficients of p being the unciæ of a binomial raiſed to that power, whoſe exponent is the propoſed number of years; and therefore the number of people in being at the expiration of 11 years will be expreſſed by $p+n\times\frac{p}{s}+n\times\frac{n-1}{2}\times\frac{p}{s^2}+n\times\frac{n-1}{2}\times\frac{n-2}{3}\times\frac{p}{s^3}+n\times\frac{n-1}{2}\times\frac{n-2}{3}\times\frac{n-3}{4}\times\frac{p}{s^4}$, &c.

Sir William Petty, in his diſcourſe about duplicate proportion, ſays, that it is found by experience that there are more perſons living between 16 and 26 than of any other age; and thence he infers that the ſquare roots of every number of men's ages under 16, ſhew the proportion of the probability of ſuch perſons reaching the age of 70.

Thus, it is 4 times more likely that one of 16 years of age lives to be 70, than a child of one year old; it is thrice as probable that one of 9 years lives to be 70, as ſuch a new-born child, &c. That the odds is 5 to 4, that one of 25 dies before one of 16; and ſo on as the ſquare roots of the ages.

Dr. Halley has made a very exact eſtimate of the degrees of the mortality of mankind, from a curious table of the births and burials at the city of Breſlau, the capital of Sileſia, with an attempt to aſcertain the price of annuities upon lives. See the *Philoſophical Tranſactions*.

From the whole he makes the two following very good obſervations: 1. How unjuſtly we uſe to complain of the ſhortneſs of our lives; for that it appears that one half of thoſe that are born, do not live above 17 years; and, 2. That the growth and increaſe of mankind is not ſo much ſtinted by any thing in the nature of the ſpecies, as it is from the curious difficulty moſt people make of venturing on the ſtate of marriage; and, therefore, that celibacy ought to be every way diſcouraged by all wiſe governments; and thoſe who have numerous families of children encouraged by good laws, ſuch as the *jus trium liberorum*, &c. among the Romans.

POLITICS, the firſt part of œconomy, conſiſting in the well governing and regulating the affairs of a ſtate, for the maintenance of the public ſafety, order, tranquility, and morals.

POLITY, or POLICY, πολιτεια, denotes the peculiar form and conſtitution of the government of any ſtate or nation; or the laws, orders, and regulations, relating thereto.

POLL, a word uſed in ancient writings for the head: hence to poll, is either to vote or to enter down the names of thoſe perſons who give in their votes at an election.

POLL-MONEY, a capitation or tax impoſed by the authority of parliament on the head or perſon either of all indifferently, or according to ſome known mark of diſtinction.

POLLARD, among hunters, a ſtag which has caſt his horns.

POLLARD, or POLLENGER, in agriculture, ſignifies a tree that has been frequently polled, or lopped.

POLLEX, in anatomy, denotes either the thumb or great toe, according as either manus or pedis is added to it.

POLLING, among gardeners, the operation of ſpreading the worm caſts all over the walks, by means of long aſh-poles; which is ſaid to be very beneficial to the graſs of the walks.

POLLUX, in aſtronomy, a fixed ſtar of the ſecond magnitudein the conſtellation of Gemini, or the Twins. Its longitude is 19°. 56′. 29″ of ♋, and its latitude 6°. 39′. 27″ N.

POLVERINE, in commerce, the aſhes of the herb hali, preſerved for the uſe of making glaſs.

POLYADELPHIA, in botany, a claſs of plants, the eighteenth in order, whoſe ſtamina are connected together at their baſes into ſeveral ſerieſes.

The plants of this claſs are ſubdvided into orders according to the number of their ſtamina: thus the polyadelphia pentandria contain five ſtamina; and the polyadelphia icoſandria and polyandria contain twenty or more ſtamina.

POLYANDRIA, in botany, a claſs of plants, the thirteenth in order, with hermaphrodite-flowers, and a large number of ſtamina, or male parts in each; theſe always exceed the number of twelve, and grow on the receptacle of the future ſeeds. The genera of this claſs being numerous, are arranged under different orders; the firſt of which is called polyandria monogynia, as containing only one ſtyle; the ſecond, polyandria digynia, as having two ſtyles; and ſo of the polyandria trigynia, tetragynia, pentagynia, &c. from their containing three, four, five, &c. ſtyles.

POLYANTHUS, in botany, a beautiful garden flower of the primroſe kind; the varieties of which are innumerable, being produced from ſeeds, which ſhould be ſown in February, either in borders, boxes, or pots, and ſhould have an eaſt aſpect, ſo as to be ſhaded from the heat of the day; in May they will be fit to be planted out for good, which ſhould be in a ſhady border of ſtrong rich earth, at about ſix inches aſunder, and the ſucceeding ſpring they will ſhew their bloſſoms, when their goodneſs may be judged of.

POLYCHREST, in pharmacy, a medicine that ſerves for many uſes, or that cures many diſeaſes.

Sal POLYCHREST, a compound ſalt made of equal parts of ſalt-petre and ſulphur, laid on a red-hot crucible.

POLYGAMIA, in botany, a claſs of plants, the twenty-third in order, the characters of which are, that they have flowers of different ſtructure; ſome having male-flowers, others female ones, and others hermaphrodite.

Of this claſs there are two orders, or ſubdiviſions; whereof the firſt comprehends ſuch polygamious plants as contain the different kinds of flowers on different parts of the ſame plant; and hence called polygamia monoecia: ſuch are the muſa, veratum, celtis, parietaria, &c. The ſecond order conſiſts of ſuch polygamious plants, as have their different flowers, not on the ſame individual plant, but on different plants of the ſame ſpecies: ſuch are the chamærops, fraxinus, rhodiola, &c.

POLYGAMY, a plurality of wives or huſbands, in the poſſeſſion of one man or woman, at the ſame time.

POLYGLOTT, πολυγλοττος, among divines and critics, chiefly denotes a bible printed in ſeveral languages. In theſe editions of the Holy Scriptures, the text in each language is ranged in oppoſite columns. The firſt polyglott bible was that of cardinal Ximenes printed in 1517, which contains the Hebrew text, the Chaldee

paraphraſe on the Pentateuch, the Greek verſion of the LXX. and the ancient Latin verſion. After this, there were many others, as the bible of Juſtiniani, biſhop of Nebio, in Hebrew, Chaldee, Greek, Latin, and Arabic; the pſalter by John Potken, in Hebrew, Greek, Ethiopic, and Latin; Plantin's polyglott bible, in Hebrew, Chaldee, Greek, and Latin, with the Syriac verſion of the New Teſtament; M. le Jay's bible in Hebrew, Samaritan, Chaldee, Greek, Syriac, Latin, and Arabic; Walton's polyglott, which is a new edition of Le Jay's polyglott, more correct, extenſive, and perfect, with ſeveral new Oriental verſions, and a large collection of various readings, &c.

POLYGON, in geometry, a figure whoſe perimeter conſiſts of more than four ſides and angles.

The word is compounded of the Greek, πολυς, many, and γωνια, angle.

If the ſides and angles be equal, the figure is called a regular polygon. Polygons of five ſides are called pentagons; of ſix, hexagons; of ſeven, heptagons; of eight, octagons, &c.

General Properties of POLYGONS.—Every polygon may be divided into as many triangles as it hath ſides.—

If you take a point, as *a* (plate CII. *fig.* 7.) any where within the polygon, and from thence draw lines to every angle *ab*, *ac*, *ad*, &c. they ſhall make as many triangles as the figure hath ſides. Thus, if the polygon hath ſix ſides (as in the figure above) the double of that is twelve, from whence take four, and there remains eight: I ſay, that all the angles *b*, *c*, *d*, *e*, *f*, *g*, of that polygon, taken together, are equal to eight right angles.—For the polygon, having ſix ſides, is divided into ſix triangles; and the three angles of each by 1. è 32 Eucl. are equal to two right ones; ſo that all the angles together make twelve right ones: but each of theſe triangles hath one angle in the point *a*, and by it they complete the ſpace round the ſame point; and all the angles about a point are known to be equal to four right ones, wherefore thoſe four taken from twelve leave eight, the ſum of the right angles of the hexagon.

So it is plain the figure hath twice as many right angles, as it hath ſides, except four. Q. E. D.

Every polygon circumſcribed about a circle is equal to a rectangled-triangle, one of whoſe legs ſhall be the radius of the circle, and the other the perimeter (or ſum of all the ſides) of the polygon.

Hence every regular polygon is equal to a rectangled triangle, one of whoſe legs is the perimeter of the polygon, and the other a perpendicular drawn from the center to one of the ſides of the polygon.

And every polygon circumſcribed about a circle is bigger than it; and every polygon inſcribed is leſs than the circle, as is manifeſt, becauſe the thing containing is always leſs than the thing contained.

The perimeter of every polygon circumſcribed about a circle is greater than the circumference of that circle, and the perimeter of every polygon inſcribed is leſs. Hence, a circle is equal to a right-angled triangle whoſe baſe is the circumference of the circle, and its height the radius of it.

For this triangle will be leſs than any polygon circumſcribed, and greater than any inſcribed; becauſe the circumference of the circle, which is the baſe of the triangle, is greater than the compaſs of any inſcribed, therefore it will be equal to the circle. For, if this triangle be greater than any thing that is bigger than the circle, and leſſer than any thing that is leſſer than the circle, it follows that it muſt be equal to the circle. This is called the quadrature or ſquaring of the circle; that is, to find a right-lined figure equal to a circle, upon a ſuppoſition that the baſis given is equal to the circumference of the circle: but actually to find a right line equal to the circumference of a circle is not yet diſcovered geometrically.

To find the Area of a regular POLYGON.—Multiply a ſide of the polygon, as AB (*fig.* 8.) by half the number of the ſides, e. gr. the ſide of a heptagon by $2\frac{1}{2}$. Again, multiply the product by a perpendicular let fall from the center of the circumſcribing circle to the ſide AB; the product is the area required. See AREA.

Thus ſuppoſe A B 54, and half the number of the ſides $2\frac{1}{2}$, the product or ſemi-diameter is 135. Suppoſing the perpendicular F*g* 29, the product of theſe two, 3915, is the area of the pentagon required.

To find the Area of an irregular POLYGON, or *Trapezium.*—Reſolve it into triangles, and find the ſeveral area's of the ſeveral triangles; the ſum of this is the polygon required.

To find the Sum of all the Angles in any POLYGON.

Multiply the number of ſides by 2, and from the product ſubtract 4, the remainder multiplied by 90° gives the ſum required.

Thus in a pentagon 90° being multiplied by 6, or $2 \times 5 - 4$, gives 540, the ſum of the angles of a pentagon.

Hence, if the ſum found be divided by the number of ſides, the quotient will be the angle of a regular polygon.

POLYGON, in fortification, denotes the figure of a town, or other fortreſs.

POLYGONAL *Numbers*, in algebra, are ſuch as ariſe from a continual addition of a rank of numbers in arithmetical progreſſion, beginning from unity; ſo called by reaſon the units of which it conſiſts may be diſpoſed in ſuch a manner as to repreſent the figure of ſeveral equal ſides and angles.

Polygonal numbers are divided, with reſpect to the number of their terms, into, triangular, which are thoſe whoſe number of terms is 1; quadrangular or ſquare, where it is 2; pentagonal, where 3; hexagonal, where 4; heptagonal, where 5; octagonal, where 6, &c.

The geneſis of the ſeveral kinds of polygonal numbers from the ſeveral arithmetical progreſſions, may be conceived from the following examples:

Arithmetical progreſſion —	1.	2.	3.	4.	5.	6.	7.
Triangular numbers —	1.	3.	6.	10.	15.	21.	28.
Arithmetical progreſſion —	1.	3.	5.	7.	9.	11.	13.
Square numbers — —	1.	4.	9.	16.	25.	36.	49.
Arithmetical progreſſion —	1.	4.	7.	10.	13.	16.	19.
Pentagonal numbers —	1.	5.	12.	22.	35.	51.	70.
Arithmetical progreſſion —	1.	5.	9.	13.	17.	21.	25.
Hexagonal numbers — —	1.	6.	15.	28.	45.	66.	91.

Polygonal numbers may be thus generally repreſented. Let *d* be the common difference of the terms in any arithmetical progreſſion, beginning with an unit, and call the number of terms *n*; then will 1, $2 + d$, $\overline{2 + 2d} \times \frac{1}{2}$, $\overline{2+3d} \times \frac{1}{2}$, $\overline{2+4d} \times \frac{1}{2}$, &c. to *n* terms be the polygonal number correſponding to the propoſed arithmetical progreſſion.

Side of a POLYGONAL *Number* is the number of terms of the arithmetical progreſſion that compoſe it; and the number of angles is that which ſhews how many angles that figure has, whence the polygonal number takes its name.

The number of angles, therefore, in triangular numbers, is 3, in tetragonal 4, in pentagonal 5, &c. conſequently the number of angles exceeds the common difference of terms by two.

POLYGONATUM, Solomon's ſeal, in botany, is ranked by Linnæus among the convallaria.

The root of this plant is a famous vulnerary; for being applied in form of a poultice, it not only heals freſh wounds, but takes away the marks of bruiſes, &c.

POLYGONUM, knot-graſs, in botany, a genus of plants, the flower of which conſiſts of a ſingle imperforate petal, divided into five oval ſegments at the limb: there is no pericarpium, the ſeeds being contained in the cup.

An infuſion of this plant is a valuable aſtringent medicine in hæmorrhages of all kinds.

POLYGYNIA, among botaniſts, denotes an order or ſubdiviſion of a claſs of plants; comprehending ſuch plants of that claſs, as have a great number of piſtils, or female organs of generation. See PISTIL and GENERATION.

POLYHEDRON, in geometry, a body compriſed under many rectilinear ſides or planes.

If the ſides of a polyhedron be regular polygons, all ſimilar and equal, it becomes a regular body, and may be inſcribed in a ſphere. See SPHERE.

POLYHISTOR, a perſon of great and various erudition; whence

POLYMATHY, πολυμαθια, denotes the knowledge of many arts and ſciences.

POLYMYTHY, πολυμυθια, in poetry, a fault in an epic poem, when, inſtead of a ſingle mythos, or fable, there is a multiplicity of them.

POLYNOMIAL, or MULTINOMIAL, in algebra. See MULTINOMIAL.

POLYOPTRUM, in optics, a glaſs through which objects appear multiplied, but diminiſhed.

POLYPE, or POLYPUS, in zoology, a ſmall freſh-water inſect, of a cylindric figure, but variable, with very long tentacula.

There is ſcarce an animal in the world more difficult to deſcribe than this ſurpriſing inſect; it varies its whole figure at pleaſure, and is frequently found beſet with young in ſuch a manner as to appear ramoſe and divaricated; theſe young ones adhering to it in ſuch a manner as to appear parts of its body.

When ſimple, and in a moderate ſtate as to contraction or dilatation, it is oblong, ſlender, pellucid, and of a pale-reddiſh colour: its body is ſomewhat ſmaller towards the tail, by which it affixes itſelf to ſome ſolid body; and larger towards the other extremity, where it has a large opening, which is the mouth, around which are the tentacula, which are eight in number, and one uſually extended to about half the length of its body. By means of its tentacula, or arms, as they are commonly called, expanded into a circle of more than half a foot diameter, the creature feels every thing that can ſerve it for food; and ſeizing the prey with one of them, calls in the aſſiſtance of the others, if neceſſary, to conduct it to its mouth.

The production of its young is different from the common courſe of nature in other animals; for the young one iſſues from the ſide of its parent in the form of a ſmall pimple, which lengthening every hour, becomes, in about two days, a perfect animal, and drops from off its parent to ſhift for itſelf; but before it does this, it has often another growing from its ſide; and ſometimes a third from it, even before the firſt is ſeparated from its parent; and what is very extraordinary is, that there has never yet been diſcovered among them any diſtinction of ſex, or appearance of copulation; every individual of the whole ſpecies being prolific, and that as much if kept ſeparate, as if ſuffered to live among others. But what is even ſtill more ſurpriſing, is the reproduction of its ſeveral parts when cut off, for when cut into a number of ſeparate pieces, it becomes in a day or two ſo many diſtinct and ſeparate animals; each piece having the property of producing a head and tail, and the other organs neceſſary for life, and all the animal functions. There are ſeveral other ſpecies of this animal, moſt of which are found in our ditches. Plate CII. *fig.* 9. repreſents a cluſter-polype, extending itſelf; and *fig.* 10. the ſame polype after being ſoaked in water, and the tentacula, or branches, laid ſtraight.

POLYPODY, *Polypodium*, in botany, a plant with long leaves iſſuing from the root, divided on both ſides, down to the rib, into a number of oblong ſegments broadeſt at the baſe: it has no ſtalk, or manifeſt flower; the ſeeds are a fine duſt, lying on the backs of the leaves, in roundiſh ſpecks, which are diſpoſed in rows parallel to the rib: the roots are long and ſlender, of a reddiſh brown colour on the outſide, greeniſh within, full of ſmall tubercles, which are reſembled to the feet of an inſect, whence the name of the plant. It grows in the clefts of old walls, rocks, and decayed trees: that produced on the oak has been generally accounted the beſt, though not ſenſibly different from the others. It is found green at all ſeaſons of the year.

The leaves of polypody have a weak ungrateful ſmell, and a nauſeous ſweet taſte, leaving a kind of roughneſs and ſlight acrimony in the mouth. This root is ſuppoſed to be aperient, reſolvent, and expectorant: it was formerly ranked among the purgatives, but operates ſo weakly, a decoction of an ounce or two ſcarcely moving the belly, that it has long been expunged from that claſs: the preſent practice pay very little regard to it in any intention.

POLYPUS, or POLYPUS *of the Heart*, in medicine, a maſs compoſed of various pellicles and fibres generated in the heart and large veſſels.

Polypuſes are generally found in acute as well as chronic diſeaſes. Their principal ſeat is in the heart, pulmonary artery, and the aorta. They chiefly attack the ſanguine conſtitutions, and ſuch as have ſmall veſſels and ſoft fibres; thoſe who are of a ſedentary life, who drink little, or are free in the uſe of acid wines and ſpirituous liquors, or who eat great ſuppers.

The beginning of a polypus may be known by a compreſſion of the breaſt, a fixed pain about the heart; and when it increaſes, there is a frequent palpitation of the heart, from very ſlight cauſes; the pulſe is ſtrangely unequal, and often intermits; on a violent motion of the body, or the patient's taking a medicine which diſturbs the blood, or on the mind's being violently affected, there ariſes a ſhortneſs of breath, and an incredible anxiety of the heart. Laſtly, there are frequent faintings, without any evident cauſe, or only from a certain poſition of the body; and if the blood is let fall into hot water, it will congeal like jelly, and cleave into white filaments.

A polypus frequently produces the moſt dreadful diſeaſes, and even ſudden death. In the cure, an exact regimen and diet muſt be made uſe of, with frequent exerciſe, and motions of the body. Etmuller ſays, that when it proceeds from the ſcurvy, or hyſteric affection, it is curable; and that the cure is to be attempted with chalybeate and coraline medicines, with cinnabar, volatiles, preparations of amber, and all antiſpaſmodics.

POLYPUSES *of the Lungs* are viſcous excretions of the ſmall glands, formed in the deeper branches of the aſpera arteria, and frequently miſtaken for pieces of the blood-veſſels or lungs.

POLYPUS *of the Noſe*, a fleſhy excreſcence, in the inſide of the noſtrils, which is of various ſizes, and of different conſiſtencies; ſometimes theſe excreſcences are ſoft, ſometimes they are capable of elongation, and at other times they turn hard and rigid. In their beginning they are generally ſmall, and advance gradually; ſome are concealed within the noſe, and others hang out of that organ down to the lips, while others deſcend backwards through the apertures by which we draw the air through the noſtrils, and not only occaſion great difficulty in ſpeaking and ſwallowing, but ſometimes almoſt ſtrangle the patient. They are generally attended with pain; but ſome, which are hard and livid, are extremely painful. They have generally but one root; but ſometimes they have many.

Heiſter mentions a method of extirpating a polypus, by conveying a ligature round its baſis, and tying it faſt: but when the roots are inacceſſible, he adviſes taking hold of it with a crooked forceps, and twiſting it till the roots are broken. If the flux of blood is not conſiderable, the ſurgeon may ſuffer it to continue till it ceaſes of itſelf; but if it is profuſe and dangerous, it is to be ſtopped with doſſils dipt in ſtyptic liquors and powders, thruſt up the noſtrils. Mr. Le Dran cured a polypus of the noſe, which he could not extract wholly, in the following manner: he introduced one end of a large ſeton put on the point of the fore-finger of the left-hand into the patient's mouth, till he brought it behind the velum pendulum; then ſliding a pair of thin crooked forceps into the affected noſtril, catched hold of the ſeton, after covering what was to be introduced into the noſe with a ſuppurant medicine. While he drew the cord, he endeavoured to preſerve the velum pendulum from being hurt, by introducing his fore-finger into the mouth, and ſupporting the cord upon it. He continued the ſuppurant till he was ſenſible by the patient's breathing freely thro' the noſtril, that the remains of the polypus was deſtroyed, and then he injected deſiccatives to cauterize the ulcer.

POLYPYRENEOUS, an appellation given to fruits containing ſeveral kernels, or ſeeds.

POLYSCOPE, in optics, the ſame with polyhedron. See POLYHEDRON.

POLYSPASTON, in mechanics, a machine conſiſting of an aſſemblage of ſeveral pullies; for the nature and force of which, ſee PULLEY.

POLYSPERMOUS, among botaniſts, ſuch plants as have

have more ſeeds than four ſucceeding each flower, without any certain order.

POLYSYLLABLE, in grammar, a word conſiſting of more ſyllables than three; for when a word conſiſts of one, two, or three ſyllables, it is called a monoſyllable, diſſyllable, and triſyllable.

POLYSYNDETON, in grammar and rhetoric, a figure whereby a redundance of conjunctions, eſpecially copulative ones, is uſed.

POLYTHEISM, in matters of religion, the doctrine or belief of a plurality of gods.

POMATUM, an ointment made thus: Take of freſh hog's lard, and beat it into cream with roſe water, and ſcent it with oil of lemons, thyme, or the like. Pomatums are alſo occaſionally perfumed with the odours of jeſſamines, oranges, jonquils, tuberoſes, &c. They are principally uſed for pimples, and foulneſſes of the ſkin.

POMEGRANATE, *Malus Punica*, in botany, a prickly tree or ſhrub; with long narrow leaves; deep red pentapetalous flowers ſet in bell ſhaped cups of the ſame colour; producing fruit about the ſize of an orange, which conſiſts of a thick tough rhind, externally browniſh and internally yellow, with a juicy pulp and numerous ſeeds in cells like a honey-comb. It is a native of the ſouthern parts of Europe, and rarely brings its fruit to full perfection in this climate.

The flowers of this tree are mild aſtringents, ſimilar to thoſe of the wild pomegranate or balauſtine, which laſt are preferred only on account of their being larger. See BALAUSTINE.

The pulp of the fruit, when in perfection, is of a grateful dulco-acid taſte, and of the ſame general qualities with the other *fructus horæi*. The rhind of the fruit is moderately aſtringent, and in this intention is now and then directed, under the names of *cortex granati*, *malicorium*, *pſidium*, and *ſidium*, both in the London and Edinburgh college.

POMEIS, in heraldry, are green roundles, ſo called by the Engliſh heralds, who give diſtinct names to the different coloured roundles.

POMMÉ, or POMMETTÉ, in heraldry, is a croſs with one or more balls or knobs at each of the ends.

POMMEL, or PUMMEL, in the manege, a piece of braſs, or other matter, at the top and in the middle of the ſaddle-bow.

POMMEL is alſo a round ball of ſilver, ſteel, or the like, fixed at the end of the guard, or graſp of a ſword, to ſerve, in ſome meaſure, as a counterpoiſe.

POMPHOLYX, in the materia medica, ſemi-metallic recrement, very nearly allied in its nature to tutty; being a kind of flowers of zinc or calamine, ſublimed higher than tutty, and carrying leſs of any metalline particles with it.

POMPION, in botany. See CUCURBITA.

POMUM ADAMI. See ADAMI *Pomum*.

POND, or FISH-POND. See FISH-POND.

PONIARD, a little pointed dagger, very ſharp-edged; it is now little uſed, except among aſſaſſins and at the theatres.

PONS VAROLI, in anatomy, the upper part of a duct in the third ventricle of the brain.

PONTIFEX, PONTIF, or HIGH-PRIEST, a perſon who has the ſuperintendance and direction of divine worſhip, as the offering of ſacrifices and other religious ſolemnities. The Romans had a college of pontifs, and over theſe a ſovereign pontif, or *pontifex maximus*, inſtituted by Numa, whoſe function it was to preſcribe the ceremonies each god was to be worſhipped withal, compoſe the rituals, direct the veſtals, and for a good while to perform the buſineſs of augury, till, on ſome ſuperſtitious occaſion, he was prohibited intermeddling therewith. The office of the college of pontifs was to aſſiſt the high-prieſt in giving judgment in all cauſes relating to religion, inquiring into the lives and manners of the inferior prieſts, and puniſhing them if they ſaw occaſion, &c. The Jews too had their pontifs; and among the Romaniſts, the pope is ſtill ſtyled the ſovereign pontif.

PONTIFICATE is uſed for the ſtate or dignity of a pontif, or high-prieſt; but more particularly, in modern writers, for the reign of a pope.

PONTON, or PONTOON, in war, denotes a little floating bridge made of boats and planks. The ponton is a machine conſiſting of two veſſels, at a little diſtance, joined by beams, with planks laid acroſs for the paſſage of the cavalry, the cannon, infantry, &c. over a river, or an arm of the ſea, &c. The late invented ponton is of copper furniſhed with an anchor, &c. to fix it. To make a bridge, ſeveral of theſe are diſpoſed two yards aſunder, with beams acroſs them; and over thoſe are put boards or planks. They are alſo linked to each other and faſtened on each ſide the river by a rope run through a ring in each of their heads, and fixed to a tree or ſtake on either ſhore: the whole makes one firm uniform bridge, over which a train of artillery may paſs.

PONT VOLANT, flying bridge. See the article BRIDGE.

POOL is properly a reſervoir of water ſupplied with ſprings, and diſcharging the overplus by ſluices, defenders, weirs, and other cauſeways.

Mill POOL, a ſtock of water by whoſe force, &c. the motion of a mill is effected.

POOP, the aftmoſt or hindmoſt deck of a ſhip. See DECK.

POOR, in law, an appellation given to all perſons who are in ſo low and mean a condition as that they either are, or may become, a burden to a pariſh.

Hence under the term poor, may be included thoſe who are ſo through impotency; as the aged, the blind, the lame, the fatherleſs and motherleſs, perſons labouring under ſickneſs, or who are idiots, lunatics, &c. for all whom the overſeers of the poor are obliged to provide.

There is alſo another kind of poor, on account of caſualties and misfortunes; as decayed houſe keepers, and thoſe who have been ruined either by fire, water, robbery, or loſſes in trade, &c. all of whom, being able, are to be ſet to work, and otherwiſe relieved by the pariſh; and it is the ſame with reſpect to poor perſons over-charged with children, diſabled labourers, &c. As for vagabonds, ſtrumpets, and other thriftleſs ſorts of poor, they may and ought to be ſent to houſes of correction, and put to hard labour whereby they may be maintained: yet if even theſe fall ſick there, or their work is not ſufficient to maintain them, in that caſe there muſt be an allowance by the overſeers for their ſupport.

Before the reign of queen Elizabeth, we had few or no laws for the relief of the poor of this kingdom; but then a ſtatute was made, enacting, that the churchwardens of every pariſh, and two or more houſholders, are to be nominated and appointed yearly in Eaſter week by two juſtices of the peace, as overſeers of the poor; which ſaid overſeers ſhall meet once a month at the pariſh church, there to conſider of proper ways to relieve the poor, &c. And with the aſſent of the juſtices they may make a rate on every inhabitant of the pariſh, and occupier of lands, houſes, tithes, as alſo perſonal eſtate, to raiſe a ſtock for employing of the poor, relieving the impotent, and others not able to work, the placing poor children out apprentices, and erecting cottages for poor perſons, &c. The overſeers are likewiſe to give a true account to two juſtices within four days after the end of the year, or forfeit twenty ſhillings; and where theſe officers are not appointed, the juſtices incur five pounds penalty, 43 Eliz. c. 2. By this ſtatute the father or grandfather, and mother or grandmother, or even children of poor impotent perſons, where they are of ability, are obliged to relieve ſuch poor, according to ſuch rates as juſtices of peace in their ſeſſions ſhall appoint, under a penalty of twenty ſhillings a month for every failure therein.

It has been adjudged that a grandfather or father-in-law, that is married to the grandmother, or mother, is within this ſtatute; and if the father of any children leaves the pariſh, and there is a grandfather to be found, in caſe he is able to do it, it is ſaid he ſhall be chargeable with the keeping of the children, and not the pariſh where they are.

By a late act, the churchwardens and overſeers of the poor, where a wife or child is left upon a pariſh, by perſons who have eſtates or effects which might maintain them, on a warrant of two juſtices, may ſeize the goods and

and receive the rents of the huſband or father, in order to ſupport ſuch wife or child. 5 Geo. 1. c. 8.

Every pariſh is generally to keep and maintain its own poor; and in caſe any poor perſons demand relief, that are not pariſhioners, they ought to be removed to their proper pariſhes, and there be relieved; for that pariſh the poor were laſt legally ſettled at, is deemed the place that ſhall provide for them. And where perſons are removed by warrant or order of juſtices of peace, they ſhall be received by the churchwardens and overſeers whither ſent, on pain of forfeiting five pounds to the poor of the pariſh whence conveyed, to be levied by diſtreſs and ſale of goods, &c. Nevertheleſs a ſick perſon ſhould not be ſent out of the pariſh where he is, ſo as farther to endanger his health; in which caſe, if the juſtices grant a warrant to remove him, it will be a miſdeameanor in ſuch juſtices.

As to the ſettlement, which entitles poor perſons to relief, it is acquired ſeveral ways, viz. on account of birth, in the caſe of baſtards, vagrants, &c. by continuance for forty days in a pariſh, after public notice given to overſeers, &c. or coming into a pariſh and renting ten pounds a year eſtate, or executing any public annual office, paying a ſhare to the pariſh taxes, &c. Alſo ſervants acquire this title, by ſerving a year in any pariſh; and perſons bound apprentices: and though a perſon be only a lodger, it is held that his ſervant may gain a ſettlement by ſerving a year in any pariſh.

The wife of a perſon is to be ſent to, and ſettled with her huſband, even though he ſhould be only a ſervant; and as generally all children are to their parents. It is however provided, that poor perſons ſhall have the liberty to go to any pariſh, by virtue of a certificate from churchwardens and overſeers, atteſted by two witneſſes, and ſubſcribed by two juſtices of peace, owning them to be pariſhioners; and likewiſe agreeing, when they become chargeable, to receive them again.

It is alſo ordained, that there ſhall be kept in every pariſh a book, wherein the names of all ſuch perſons, as receive any relief, ſhall be regiſtered, with the occaſion thereof; and the pariſhioners are once a year, or oftener, to have a meeting for that purpoſe, when the ſaid liſt ſhall be examined into, by calling over the perſons, and enquiring into the reaſons why they are relieved; and at this time a new liſt muſt be made of thoſe thought fit to be allowed to receive collection; and the perſons thus receiving relief, ought to wear badges on their right ſhoulders, alſo no others ſhall have any benefit, unleſs by order under the hand of one juſtice, &c. 3 & 4 W. & M. c. 11. And no juſtice of peace ſhall make any ſuch order in behalf of any poor perſon, till oath is made of reaſonable cauſe for it, and that he was refuſed to be relieved by the overſeers, &c. And ſuch perſon ſhall be regiſtered in the pariſh books as other poor; nor may churchwardens and overſeers bring to the pariſh account any money given to poor perſons, except on ſudden and emergent occaſions, who are not regiſtered, on pain of five pounds. The churchwardens and overſeers of pariſhes are impowered to purchaſe or hire houſes, and contract with perſons, to maintain the poor, &c. who refuſing to be ſo kept, ſhall be ſtruck out of the pariſh books, &c. 9. Geo. 1 cap. 7. See 3 Geo 2. c. 29.

POPE, Papa, the ſovereign pontif, or ſupreme head of the Romiſh church. The appellation of pope was anciently given to all Chriſtian biſhops, but about the latter end of the eleventh century, in the pontificate of Gregory VII. it was uſurped by the biſhop of Rome, whoſe peculiar title it has ever ſince continued. The ſpiritual monarchy of Rome ſprung up ſoon after the declenſion of the Roman empire.

POPLES, in anatomy, the inner part of the juncture, whereby the thigh-bone is articulated with the tibia.

POPLITÆUS, in anatomy, a ſmall muſcle obliquely pyramidal, ſituated under the ham. It is fixed above by a ſtrong narrow tendon, to the outer edge of the condyle of the inner os femoris, and to the neighbouring poſterior ligament of the joint; from thence it runs obliquely downwards, under the inner condyle of the os femoris; its flat and pretty thick fleſhy body increaſing gradually in breadth, till it is fixed in the backſide of the head of the tibia, all the way to the oblique line obſervable on that ſide.

POPLITEA, in anatomy, a name given to the third vein of the leg, ariſing from the heel, where it is formed out of ſeveral branches, coming both from the heel and ancle. It lies pretty deep in the fleſh, and aſcending up to the ham, terminates in the crural vein.

POPPY, *Papaver*, a medicinal plant with oblong leaves, and round ſtalks, divided into a few branches, each of which is terminated by a large tetrapetalous flower, ſet in a two-leaved cup, that falls off as the flower opens: the flower itſelf likewiſe ſoon falls, leaving a ſmooth roundiſh head or capſule, covered with a radiated crown, and containing a number of ſmooth roundiſh ſeeds. It is annual, and flowers from June to near the end of ſummer.

There are various kinds; ſome wild, ſome cultivated; the chief are the white, black, and red poppy: the former has ſmooth, ſlightly indented leaves, and whitiſh flowers and ſeeds: the black has alſo ſmooth, ſlightly indented leaves, purple flowers, and black ſeeds; and the latter has deep red flowers, dark-coloured ſeeds, hairy leaves and ſtalks, and the leaves cut almoſt, or quite, to the pedicle into indented ſegments. It is common in corn fields; and is ſometimes, like the others, made to vary its flowers by culture.

Theſe plants are found wild, as hath been already obſerved, in ſome parts of Europe; and ſeveral varieties of them, in regard to the flowers, are produced by culture in our gardens. The heads, ſtalks, and leaves, have an unpleaſant ſmell, and a bitteriſh biting taſte, of the ſame kind with thoſe of opium. Their ſmell and taſte is lodged in a milky juice, which abounds chiefly in the cortical part of the heads; which may be collected, in conſiderable quantity, by ſlightly wounding them when almoſt ripe; and which, on being expoſed for a little time to a warm air, thickens into a tenacious dark-coloured maſs, ſimilar to the opium brought from abroad, but ſtronger in ſmell and taſte. The juices, thus obtained from the black and white poppies, appear to be the ſame quality, the difference being only in the quantity afforded: the white, which is the largeſt, is the ſort cultivated by the preparers of opium in the eaſtern countries, and for medicinal uſes in this.

The collection of the pure milky juice of the poppy has not, among us, been as yet practiſed in large, or with a view to the ſupplying of the common demand of opium. Inſtead of this troubleſome proceſs, we extract the narcotic matter by menſtrua; the active parts of opium being completely diſſolvible both by water and rectified ſpirit. A portion of the herbaceous inert ſubſtance of the plant is indeed, at the ſame time, taken up, at leaſt when water is made uſe of, ſo as to render an enlargement of the doſe neceſſary; but this addition to the bulk of a doſe of opium would be of no inconvenience, if the compound was always of the ſame ſtrength, or the narcotic and inert matter in the ſame proportions to one another; a point which cannot be attained with ſo much preciſion as could be wiſhed, but which may nevertheleſs, by due care in the preparation, be adjuſted as nearly as common practice in moſt caſes requires.

The college of London directs the dried heads, cut and cleared from the ſeeds, to be boiled in water, in the proportion of three pounds and a half to ſix gallons, and now and then ſtirred to prevent their burning, till only about one third part of the liquor remains, which will be almoſt entirely ſoaked up by poppies: the decoction is to be ſtrongly preſſed out, boiled down to about four pints, then ſtrained whilſt hot, firſt through a ſieve, and afterwards through a fine woollen cloth, and ſet by for a night to ſettle: to the liquor poured off clear, ſix pounds of double refined ſugar are to be added; and the mixture boiled till its weight come to nine pounds or a little more, that it may become a ſyrup of a proper conſiſtence. An ounce of this ſyrup is reckoned equivalent to about a grain of opium, being found to have nearly the ſame ſoporific power with that quantity of the concrete juice, though it acts in general rather more kindly, and agrees in ſome caſes where opium itſelf cannot well be borne. See Opium.

POPLAR, *Populus*, in botany, a genus of trees producing male and female flowers on ſeparate plants, growing in an oblong amentum, looſely imbricated, and compoſed of

of ſcales which are oblong, plain, and cut at their margin; the corolla has no petals, but conſiſts of a monophyllous nectarium, turbinated at bottom, and tubulated at top; the ſtamina are eight very ſhort filaments, topped with large, tetragonal antheræ. The fruit is an ovate bilocular capſule, containing a number of oval ſeeds covered with a hairy down. There are different ſpecies of this genus, as the white poplar or abele tree, the black poplar, the aſpen tree, the Carolina poplar, &c. They are propagated either by layers, or large cuttings, planted in February, in a moiſt ſoil, where they will readily take root.

The beſt uſe theſe trees can be applied to, is for breaking off the weſterly, or northerly winds, and to be planted in ſuch land where ſcarce any other tree will thrive, for the advantage as will ariſe from its timber; for the wood of theſe trees, eſpecially of the abele, is very good to lay for floors, where it will laſt many years; and for its exceeding whiteneſs, is by many perſons preferred to oak; but being of a ſoft contexture, is very ſubject to take the impreſſion of any thing hard and pointed, which renders it leſs proper for this purpoſe: it is alſo very proper for wainſcotting rooms, being leſs ſubject to ſwell or ſhrink than moſt other ſorts of wood; but for turnery-ware there is no wood equal to this, for its exceeding whiteneſs; ſo that trays, bowls, and many other utenſils, are made of it: and the bellows-makers prefer it for their uſe; as do alſo the ſhoe-makers, for heels for womens ſhoes; and of this wood the ſhoes are made which are worn by the peaſants in France; it is alſo very good to make light carts; and the poles are very proper to ſupport vines, hops, &c. and the loppings will afford good fuel.

PORCELAIN, or PURCELAIN, a fine ſort of earthenware, chiefly manufactured in China, and thence called China-ware. See CHINA-WARE.

PORCELAIN-SHELL, *Porcellana*, in natural hiſtory, a genus of ſhell-fiſh, with a ſimple ſhell without any hinge, formed of one piece, and of a gibboſe figure on the back: the mouth is long, narrow, and dentated on each ſide; and the animal inhabitant is a limax.

PORCH, in architecture, a kind of veſtibule ſupported by columns; much uſed at the entrance of the ancient temples, halls, churches, &c.

A porch, in the ancient architecture, w asa veſtibule, or a diſpoſition of inſulated columns uſually crowned with a pediment, forming a covert-place before the principal door of a temple, or court of juſtice. Such is that before the door of St. Paul's Covent-Garden, the work of Inigo Jones.

PORCUPINE, *Hiſtrix*, in zoology, a very ſingular genus of quadrupeds, belonging to the order of the glires.

The fore-teeth of the porcupine are obliquely truncated, and it has no canine teeth: its ears are of a figure approaching to round, and the body is covered with prickles, or ſpins, and alſo with briſtles, like thoſe of a hog. The ſpines or quills, as they are commonly called, are of two kinds; ſome being ſhorter, thicker, ſtronger, and more ſharp-pointed; and others longer, weaker, and more flexible: theſe laſt are a foot long, and compreſſed at the point. The ſpines of the firſt kind are white at the baſe, and of a duſky cheſnut-colour on the upper part; and the latter kind are white at each extremity, and variegated with black and white in the middle. This terrible covering makes the creature appear much larger than it really is: it ſomewhat reſembles the badger in ſhape; and its length, from the noſe to the tail, is about two feet.

PORE, in anatomy, a little interſtice or ſpace between the parts of the ſkin, ſerving for perſpiration.

The pores are moſt eaſily perceived in the hands and feet. In viewing the hand with a moderate glaſs, after its being well waſhed, we perceive innumerable little ridges of equal ſize and diſtance running parallel to each other, eſpecially on the tips and joints of the fingers, where they are regularly diſpoſed into ſpherical triangles and ellipſes: on theſe ridges, the pores are placed in even rows, and by a good eye may be diſcerned without a glaſs; but with one, every pore looks like a little fountain, in which the ſweat may be ſeen to riſe like clear rock-water. They are placed in the ridges, and not in the furrows between them, that they might be leſs liable to be ſtopped by compreſſion; and on this account, the pores of the hands and feet are larger than the reſt.

PORPESSE, in ichthyology, a ſpecies of the delphinus, with a coniform body, a broad back, and a ſubacute roſtrum; it is a very large fiſh, frequently confounded with the dolphin, from which it is different.

PORPHYROGENITUS, in antiquity, an appellation given to the children of the eaſtern emperors, as being deſcended of parents who wore purple.

PORPHYRY, in natural hiſtory, a kind of ſtone of a plain uniform maſs, ſpotted with ſeparate concretions, of great hardneſs, giving fire with ſteel, not fermenting with acids, and very ſlowly and difficultly calcining in a ſtrong fire.

Porphyry is of ſeveral ſorts, as 1. The porphyry of the ancients, which is a moſt elegant maſs of an extremely firm and compact ſtructure, remarkably heavy and of a fine ſtrong purple, variegated more or leſs with pale, red and white; its purple is of all degrees, from the claret-colour to that of the violet, and its variegations are rarely diſpoſed in veins, but ſpots, ſometimes very ſmall, and at others, running into large blotches. It is leſs fine than many of the ordinary marbles, but it excels them all in hardneſs, and is capable of a moſt elegant poliſh. It is ſtill found in immenſe ſtrata in Egypt. 2. The hard red-lead-coloured porphyry, variegated with black, white and green. This is a moſt beautiful and valuable ſubſtance. It has the hardneſs, and all the other characters of the Oriental porphyry, and even greatly excels it in brightneſs, and in the beauty and variegation of its colours. It is found in great plenty in the iſland of Minorca, and is extremely worth importing, for it is greatly ſuperior to all the Italian marbles. 3. The hard, pale-red porphyry, variegated with black, white and green. This is of a pale fleſh-colour; often approaching to white. It is variegated in blotches from half an inch to an inch broad. It takes a high poliſh, and emulates all the qualities of the Oriental porphyry. It is found in immenſe ſtrata in Arabia Petræa, and in the upper Egypt; and in ſeparate nodules in Germany, England and Ireland.

PORRACEOUS, in medicine, a term applied to the bile, fœces, &c. when their colour approaches to that of a leek.

PORRUM, the leek, in botany, agrees with the cepa, or onion, both in botanical characters and medicinal virtues, being only accounted weaker. See the article ONION.

PORT, a harbour, river, or haven, either formed by nature or art, to receive and ſhelter ſhipping from the ſtorms and waves of the open ſea.

Artificial ports are thoſe which are either formed by throwing a ſtrong mound or rampire acroſs the harbour's mouth to ſome iſland or rock, or erecting two long barriers, which ſtretch from the land on each ſide like arms or the horns of a creſcent, and nearly incloſe the haven; the former of theſe are called mole-heads, and the latter piers. See the articles MOLE-HEAD, PIER, and HARBOUR.

PORT alſo implies the left-ſide of the ſhip, as port the helm, i. e. put the helm to the larboard or left-ſide.

PORTS *of a Ship*, the embraſures or holes thro' which the cannon are fixed.

Bar-PORT, a port whoſe entrance is ſtopped up with a bar, or bank of ſand, and can only be entered at high water, as that of Dublin.

Cinque PORTS. See CINQUE-*Ports*.

Cloſe-PORT, a port within the body of a city, as thoſe of Venice, Rhodes, and Amſterdam.

Free-PORT, in commerce, a port in which merchants of all nations may load and unload their veſſels, without paying any duties or cuſtoms: as thoſe of Leghorn, Genoa, &c.

PORT is alſo a ſtrong wine brought from Port-a-port, alſo called Porto and Oporto. See PORTO.

PORT *of the Voice*, in muſic, the faculty or habit of making the ſhakes, paſſages, and diminutions, in which the beauty of a ſong or piece of muſic conſiſts.

PORT-CRAYON, a pencil-caſe, which is uſually four

or five inches long, and contrived ſo as that the pencil may ſlide up and down. Its inſide is round, and its outſide is ſometimes filed into eight ſides or faces, on which are drawn the ſector-lines; ſometimes it is made round both without-ſide and within, and has its length divided into inches and parts of inches.

PORT-CULLICE, or HERSE. See HERSE.

PORT-GREVE, or PORT-GRAVE, was formerly the principal magiſtrate of maritime towns. The chief magiſtrate of London was anciently called by this name, till Richard I. cauſed the city to be governed by two bailiffs, ſoon after which king John granted the city a mayor.

PORT-VENT, in an organ, is a wooden pipe which ſerves to convey the wind from the bellows to the ſound-board. See ORGAN.

PORTA, or VENA-PORTA, in anatomy, one of the three primary veins of the human body.

The vena-porta in its ſtructure has ſome reſemblance of a tree; the roots or inferior branches of which are divided into the right and left. From the right ariſe all the meſeraic veins of the inteſtines, the internal hæmorrhoidal, and the right epiploics: and from the left, which is called the ſplenic vein, ariſe the gaſtric veins, which are various, and form the coronary vein of the ſtomach; the vaſa brevia, the epiploic, and the gaſtro-epiploic veins; the pancreatic, and ſometimes alſo the internal hæmorrhoidal vein. The trunk of the vena-porta, which goes to the liver, affords the cyſtic veins, the right gaſtric, the duodenal, and this laſt often the pancreatic. In the branches, where the trunk begins to explicate, it conſtitutes the ſinus-portæ in the liver; and from this it is divided into innumerable branches, which are diſperſed through the whole ſubſtance of the liver.

PORTAIL, in architecture, the frontiſpiece of a church viewed on the ſide on which is the great door.

Portail is alſo uſed for the great door of a palace, caſtle, &c.

PORTAL, in architecture, a little gate where there are two gates of a different bigneſs; alſo a little ſquare corner of a room cut off from the reſt by the wainſcot, and forming a ſhort paſſage into the room. The ſame name is alſo ſometimes given to a kind of arch of joiners work before a door.

PORTATE, or a CROSS-PORTATE, in heraldry, a croſs which does not ſtand upright, as croſſes generally do, but lies acroſs the eſcutcheon in bend, as if it were carried on a man's ſhoulder.

PORTICO, in architecture, a kind of gallery on the ground, ſupported by columns, where people walk under covert. Though this word is derived from *porta*, a gate or door, yet it is uſed for any diſpoſition of columns which form a gallery.

PORTION, in law, a part, or proportion, either of money given with a daughter, or of an inheritance.

PORTION, in the canon-law, is that proportion or allowance which a vicar receives out of a rectory or impropriation.

PORTIONER, is where a perſonage is ſerved by two or more clergymen alternately, in which caſe the miniſters are called portioners, becauſe they have only their proportion of the tithes or profits of the living.

PORTMANTEAU, a cloak-bag of cloth, leather, &c. in which the cloak, linen, and other habiliments of travellers are diſpoſed and laid on the horſe's crupper.

PORTRAIT, POURTRAIT, or *Pourtraiture*, in painting, the repreſentation of a perſon, and eſpecially of a face done from the life.

In this ſenſe we uſe the term portrait-painting, in contradiſtinction to hiſtory painting, where a reſemblance of perſon is uſually diſregarded. Portraits, when as large as the life, are uſually painted in oil-colours; ſometimes they are painted in miniature with water-colours, crayons, paſtils, &c.

PORTUGAL, the moſt weſterly kingdom in Europe; it is about three hundred miles long, and one hundred broad, and is ſituated between the ſeventh and tenth deg. of weſt longitude, and between the thirty-ſeventh and forty-ſecond of north latitude; being bounded by Spain on the north and eaſt, and by the Atlantic ocean on the ſouth and weſt. This country is neither ſo hot nor ſo fruitful as Spain; it however produces plenty of grapes, olives, oranges, and lemons.

PORUS BILARIUS, according to ſome, is the ſame with the hepatic duct; but others make a diſtinction between them, and obſerve, that the ductus hepaticus runs from the liver to the ductus choledochus; and that the branches of this diſtributed through the whole liver, make what are called the pori bilarii.

POSE', in heraldry, denotes a lion, horſe, or other beaſt ſtanding ſtill with all his four feet on the ground.

POSITION, or SITUATION, in phyſics, an affection of place, which expreſſes the manner of any body's being therein.

POSITION, in architecture, denotes the ſituation of a building with regard to the points of the horizon. Vitruvius directs the poſition of a building to be ſuch, as that the four corners point directly to the four cardinal winds.

POSITION, *Falſe Poſition*, or *Rule of Falſhood*, in arithmetic, conſiſts in calculating on ſeveral falſe numbers, taken at random, and, from the differences found therein, determining the number ſought.

POSITION is either ſingle or double.

Single POSITION is when there happens in the propoſition ſome partition of numbers into parts proportional, and then, by one operation, the queſtion may be reſolved by this rule:

Imagine a number at pleaſure, and work therewith, according to the tenor of the queſtion, as if it were the true number, and what proportion there is between the falſe concluſion and the falſe poſition, ſuch proportion hath the given number to the number ſought; therefore the number, found by augmentation, ſhall be the firſt term of the rule of three, and the number ſuppoſed ſhall be the ſecond term, and the given number ſhall be the third term.

Double POSITION, is when there can be no partition in the numbers to make a proportion: therefore, you muſt make a ſuppoſition twice, proceeding therein, according to the tenor of the queſtion; and if either of the ſuppoſed numbers happens to ſolve the propoſition, the work is done; but, if not, obſerve the errors, and whether they be greater or leſs than the reſolution requireth; and mark the errors accordingly, with the ſigns + or −.

Then multiply contrariwiſe the one poſition by the other error, and if the errors be both too great, or both too little, ſubtract the one product from the other, and divide the difference of the products by the difference of the errors.

But if the errors be unlike, as the one + and the other −, add the products, and divide the ſum thereof by the ſum of the errors added together: for the proportion of the errors is the ſame with the proportion of the exceſſes or defects of the numbers ſuppoſed to the numbers ſought.

POSITION, in geometry.—A line is ſaid to be given in poſition, when its ſituation, bearing, or direction, with regard to ſome other line, is given.

POSITION is alſo uſed for a theſis or propoſition maintained in the ſchools.

POSITIVE, a term of relation ſometimes oppoſed to negative: hence a poſitive quantity, in algebra, is a real or affirmative quantity, or a quantity greater than nothing: thus called in oppoſition to a privative or negative quantity, which is leſs than nothing, and marked by the ſign −. Poſitive quantities are deſigned by the character + prefixed or ſuppoſed to be prefixed to them.

POSITIVE DEGREE, in grammar, is the adjective in its ſimple ſignification, without any compariſon; or it is that termination of the adjective which expreſſes itſelf ſimply, and abſolutely, without comparing it with any other.

POSITIVE, in muſic, denotes a little organ uſually placed behind or at the feet of an organiſt, played with the ſame wind, and the ſame bellows, and conſiſting of the ſame number of pipes with the larger one, though thoſe much ſmaller, and in a certain proportion: this is properly the choir-organ.

POSSE COMITATUS, in law, ſignifies the power of the county, or the aid and aſſiſtance of all the knights, gentlemen, yeomen, labourers, ſervants, apprentices, &c. and all others within the county that are above the age of fifteen,

fifteen, except women, eccleſiaſtical perſons, and ſuch as are decrepid and infirm.

POSSESSION, in law, the holding or occupying of any thing, either de jure or de facto.

Poſſeſſion de jure is the title a man has to enjoy a thing, though it be uſurped, and in the actual poſſeſſion of another; or where lands are deſcended to a perſon, and he has not yet entered into them: and poſſeſſion de facto, or actual poſſeſſion, is where there is an actual and effectual enjoyment of a thing.

POSSESSIVE, in grammar, a term applied to pronouns which denote the enjoyment or poſſeſſion of any thing, either in particular or in common; as *meus*, mine, and *tuus*, thine; *noſter*, ours, and *veſter*, yours. See PRONOUN.

POSSIBILITY, *Poſſibilitas*, in law, is defined to be any thing that is altogether uncertain, or what may or may not be, and is taken to be either near or remote. A near poſſibility is where an eſtate is limited to one after another's decreaſe, whilſt a remote poſſibility is ſomething extraordinary that is never likely to come to paſs.

POSSIBLE, *Poſſibile*, is ſometimes oppoſed to real exiſtence, and underſtood of a thing which, though it does not actually exiſt, yet may exiſt; as a new ſtar, another world, &c. which are particularly ſaid to be phyſically poſſible. It is alſo oppoſed to impoſſible, in which ſenſe it is applicable to any thing that does not contradict itſelf, or involve contradictory predicates, whether it actually exiſt or not, as a man, fire, &c. theſe are alſo ſaid to be logically poſſible.

POST, a courier or letter-carrier, or one who frequently changes horſes, poſted or placed on the road, for quicker diſpatch. The word is alſo applied to the houſes where ſuch a perſon takes up and lays down his charge.

Penny-POST, a poſt eſtabliſhed for the benefit of London and the adjacent parts; by which any letter or parcel not exceeding ſixteen ounces weight, or ten pounds value, is ſpeedily conveyed to and from all parts within ten miles of London.

POST, in the military art, is any place or ſpot of ground fortified or not, where a body of men may make a ſtand and fortify themſelves, or remain in a condition to fight an enemy. Hence it is ſaid, that the poſt was relieved, the poſt was taken ſword in hand, &c.

Advanced POST is a ſpot of ground ſeized by a party to ſecure the army, and cover the poſts that are behind.

POSTS, in building, large pieces of timber placed upright in houſes. The poſts framed into breſſummers for ſtrengthening the carcaſe of a houſe, are called prick-poſts, and the corner-poſts are called the principal poſts.

Burning a little the ends of the poſts that are to be ſet into the ground, is ſaid to be an excellent method to prevent them from rotting.

POSTS, in ſculpture, are ornaments formed after the manner of rolls or wreathings, ſome of which are ſimple, and others enriched, or flouriſhed.

POSTERIOR, a term of relation implying ſomething behind, or that comes after another, in which ſenſe it is uſed in oppoſition to prior and anterior.

POSTERN, in fortification, is a ſmall gate generally made in the angle of the flank of a baſtion, or in that of the curtin, or near the orillon, deſcending into the ditch; by which the garriſon may march in and out unperceived by the enemy, either to relieve the works, or to make private ſallies, &c.

POSTHUMOUS, a child born after the death of his father, or taken out of the body of a dead mother, from whence it is frequently applied to the works of an author not publiſhed till after his deceaſe.

POSTIL, a name anciently given to a note in the margin of the Bible, and afterwards to one in any other book poſterior to the text.

POSTING, among merchants, the putting an account forward from one book to another, particularly from the journal or waſte-book to the ledger.

POSTIQUE, in architecture, an ornament of ſculpture ſuper-added after the work is done. A table of marble, or other matter, is alſo ſaid to be poſtique, when it is incruſtated in a decoration of architecture, &c.

POSTPONING, putting any thing after or behind another, with regard to time.

POSTSCRIPT, an article added to a letter or memoir, containing ſomething learnt or recollected after the piece was written.

POSTULATE, *Poſtulatum*, in mathematics, &c. is deſcribed to be ſuch an eaſy, and ſelf-evident ſuppoſition, as needs no explication or illuſtration to render it intelligible; as, that a right line may be drawn from one point to another; that a circle may be deſcribed on any center given, of any magnitude, &c. However, authors are not well agreed as to the ſignification of the term poſtulatum; ſome make the difference between axioms and poſtulata to be the ſame as that between theorems and problems; axioms, according to thoſe authors, being indemonſtrable theoretical truths. But others will have it, that axioms are primitive and common to all things, partaking of the nature of quantity, and which therefore may become the objects of mathematical ſcience: ſuch as number, time, extenſion, weight, motion, &c. and that poſtulata relate particularly to magnitudes, ſtrictly ſo called, as to things having local extenſion, ſuch as lines, ſurfaces, and ſolids; ſo that in this ſenſe of the word poſtulatum, Euclid, beſides axioms, or thoſe principles which are common to all kinds of quantities, has aſſumed certain poſtulata to be granted him peculiar to extenſive magnitude. Hence ſeveral of the principles aſſumed in his Elements, and ranked among the axioms by the moderns, are by Proclus ranked among the poſtulata, which has induced Dr. Wallis to judge that the laſt of the two ſenſes given to the term poſtulatum is moſt agreeable to the meaning of the ancient geometers.

POSTURE, in painting and ſculpture, the ſituation of a figure with regard to the eye, and of the ſeveral principal members thereof with regard to one another, whereby its action is expreſſed.

POTABLE, *Potabilis*, ſomething that may be ſwallowed by way of drink.

POT-ASH, the lixivious aſhes of certain vegetables, uſed in the making of glaſs, ſoap, &c. See GLASS, SOAP, &c.

There are two principal ſorts of theſe ſalts brought chiefly from Germany pearl aſh, and pot-aſh. The pearl aſh is either of the whitiſh pearl colour from which it receives its name, or externally of a bluiſh caſt, which theſe kinds of ſalts are apt to receive in calcination from the contact of any inflammable matter. Both the pearl-aſhes are tolerably pure alkalies: diſſolved in water, or deliquiated in the air, they leave only a ſmall quantity of earthy matter, ſcarcely more than every alkaline ſalt does upon repeated ſolutions and calcinations. They are ſometimes, however, adulterated with heterogeneous ſaline matters, particularly ſea-ſalt. The purity of pearl-aſh from ſubſtances of the earthy kind points out the method in which it has been prepared, namely, evaporating a ley of vegetable aſhes till the ſalt remains dry.

Pot-aſh is a much more impure ſaline maſs: that called Ruſſia or Moſcovy pot-aſh is accounted the beſt. This is of a dark-colour, conſiderably hard, and does not eaſily grow moiſt in the air: on boiling it in water, a quantity of earth remains undiſſolved, much larger than that of the ſalt which is extracted. It is nevertheleſs found to be ſtrongly alkaline, to be more pungent to the taſte, to ſaturate more acid, and more powerfully to diſſolve oils, than the purer alkaline ſalts: hence it is preferred by the ſope-boiler.

This ſalt is ſaid to be prepared, by burning wood with a cloſe ſmothering heat; making a ley from the coarſer part of the aſhes, and moiſtening therewith the finer part into the conſiſtence of a paſte, ſtratifying this paſte with ſome of the inflammable kinds of wood, and ſetting the pile on fire. It is not improbable that the ſaline and earthy part of the aſhes would thus run together into hard lumps; but a maſs poſſeſſing the activity of Ruſſia pot-aſh is not to be obtained by any proceſs of this kind. For the diſcovery of the ingredient on which that quality depends, we are obliged to Dr. Home, who, in his Eſſay

on

on bleaching, has proved, by a number of curious experiments, that Ruſſia pot-aſh contains a large admixture of quick-lime.

POTATOE, in botany, the Engliſh name for a ſpecies of the tuberoſe rooted ſolanum.

Culture of POTATOES.—The moſt advantageous way of propagating potatoes is, the planting them at large diſtances, and digging or horſe-hoeing the ground ſeveral times between them.

Mr. Tull gives an example of this, in which the hoeing ſucceeded much better than dung, and without the expence of it. A piece of ground was planted with potatoes, the greater part of it in the common way; but in one part, worſe than the reſt, they had been ſet at a yard diſtance every way. The reſt of the ground was dunged; this poor part had no dung, but was ploughed deep at ſeveral times four different ways, ſo that the ground was ſtirred and broken thoroughly every-where about the potatoes. The conſequence was, that though no dung was uſed here, and though the plants appeared much weaker than in the dung part, yet the crop was greatly better than that of the other part of the field. The roots here were all large, and in the other parts of the field, where the dung had been uſed without ploughing, they were ſo ſmall, that the crop was ſcarce worth taking up.

This is one of many inſtances of the no great uſe in dunging land, without properly ſtirring it up, and ſerves to prove, what the crops of corn and every thing elſe confirm upon trial, that the ſtirring the earth ſufficiently, without any farther trouble, will anſwer better without any other manure, than all the manure in the world without it. *Tull's Horſe-hoeing Huſbandry.*

POTENT, or POTENCE, in heraldry, a term for a kind of a croſs, whoſe ends all terminate like the head of a crutch.

POTENTIA, POWER, that whereby a thing is capable either of acting, or being acted upon. See the article POWER.

POTENTIAL, in the ſchools, is uſed to denote and diſtinguiſh a kind of qualities, which are ſuppoſed to exiſt in the body in potentia only, by which they are capable in ſome manner of affecting and impreſſing on us the ideas of ſuch qualities, though not actually inherent in themſelves; in which ſenſe we ſay, potential heat, potential cold.

POTENTIAL, in medicine. Cauteries are diſtinguiſhed into actual and potential. See the article CAUTERY.

POTENTIAL, in grammar, an epithet applied to one of the moods of verbs. The potential is the ſame in form with the ſubjunctive, and is according to Ruddiman implied in that mood, for which reaſon that grammarian rejects it; but others will have it differ from the ſubjunctive in this, that it always implies in it either *poſſum*, *volo*, or *debeo*. It is ſometimes called the permiſſive mood, becauſe it often implies a permiſſion or conceſſion to do a thing.

POTERIUM, burnet, in botany. See BURNET.

POTION, POTIO, a liquid medicine, conſiſting of as much as can be drank at one draught. The writers on pharmacy diſtinguiſh potions into cathartic, cardiac, and alterative.

POTTERY, the manufacture of earthen-ware, or the art of making earthen veſſels.

The wheel and lathe are the chief, and almoſt the only inſtruments uſed in pottery: the firſt for large works, and the laſt for ſmall. The potters wheel conſiſts principally in the nut, which is a beam or axis, whoſe foot or pivot plays perpendicularly on a free-ſtone, ſole or bottom. From the four corners of this beam, which does not exceed two feet in height, ariſe four iron-bars, called the ſpokes of the wheel; which, forming diagonal lines with the beam, deſcend, and are faſtened at bottom to the edges of a ſtrong wooden circle, four feet in diameter, perfect like the felloes of a coach-wheel, except that it has neither axis nor radii, and is only joined to the beam, which ſerves it as an axis by the iron-bars. The top of the nut is flat, of a circular figure, and a foot in diameter; and on this is laid the clay which is to be turned and faſhioned. The wheel, thus diſpoſed, is encompaſſed with four ſides of four different pieces of wood faſtened on a wooden frame; the hind-piece, which is that on which the workman ſits, is made a little inclining towards the wheel; on the fore-pieces are placed the prepared earth; on the ſide-pieces he reſts his feet, and theſe are made inclining to give him more or leſs room. Having prepared the earth, the potter lays a round piece of it on the circular head of the nut, and fitting down turns the wheel with his feet till it has got the proper velocity; then, wetting his hands with water, he preſſes his fiſt or his fingers-ends into the middle of the lump, and thus forms the cavity of the veſſel, continuing to widen it from the middle; and thus turning the inſide into form with one hand, while he proportions the outſide with the other, the wheel conſtantly turning all the while, and he wetting his hands from time to time. When the veſſel is too thick, he uſes a flat piece of iron, ſomewhat ſharp on the edge, to pare off what is redundant; and when it is finiſhed, it is taken off from the circular head, by a wire paſſed underneath the veſſel.

The potters-lathe is alſo a kind of wheel, but more ſimple and ſlight than the former; its three chief members are an iron-beam or axis three feet and a half high, and two feet and a half diameter, placed horizontally at the top of the beam, and ſerving to form the veſſel upon: and another larger wooden wheel, all of a piece, three inches thick, and two or three feet broad, faſtened to the ſame beam at the bottom, and parallel to the horizon. The beam or axis turns by a pivot at the bottom in an iron-ſtand. The workman gives the motion to the lathe with his feet, by puſhing the great wheel alternately with each foot, ſtill giving it a greater or leſſer degree of motion, as his work requires. They work with the lathe, with the ſame inſtruments, and after the ſame manner as with the wheel. The mouldings are formed by holding a piece of wood or iron cut in the form of the moulding to the veſſel, while the wheel is turning round; but the feet and handles are made by themſelves and ſet on with the hand; and if there be any ſculpture in the work, it is uſually done in wooden moulds, and ſtuck on piece by piece on the outſide of the veſſel. For the glazing of the work, ſee GLAZING.

POTTLE, an Engliſh meaſure containing two quarts. See MEASURE.

POULTICE, or POULTIS, a form of medicine alſo called cataplaſm. See CATAPLASM.

POULTRY, all kinds of domeſtic birds brought up in yards, as cocks, hens, capons, ducks, turkeys, &c.

POUNCE, gum ſandaric pounded and ſifted very fine, to rub on paper, in order to preſerve it from ſinking, and to make it fit to write upon.

POUNCE is alſo a little heap of charcoal duſt, incloſed in a piece of muſlin or ſome other open ſtuff, to be paſſed over holes pricked in a work, in order to mark the lines or deſigns thereof on paper, ſilk, &c. placed underneath; which are to be afterwards finiſhed with a pen and ink, a needle, or the like. This kind of pounce is much uſed by embroiderers, to transfer their patterns upon ſtuffs; by lace-makers, and ſometimes alſo by engravers.

POUND, *Libra*, a ſtandard-weight, for the proportion and ſubdiviſions of which, ſee the article WEIGHT.

POUND alſo denotes a money of account; ſo called, becauſe the ancient pound of ſilver weighed a pound troy.

POUND, among lawyers, denotes a place of ſtrength, in which to keep cattle that are diſtrained, or put in for treſpaſs, until they are replevied or redeemed.

POUNDAGE, a ſubſidy of twelve pence in the pound, granted to the crown on all goods and merchandizes exported or imported; and if by aliens, one penny more.

POURSUIVANT, PURSUIVANT, in heraldry, the loweſt order of officers at arms.

POURTRAIT, or PORTRAIT. See the article PORTRAIT.

POURVEYANCE, or PURVEYANCE, in law, the providing corn, fuel, victuals, &c. for the king's houſehold; and hence, the officer, who did ſo, was termed pourveyor.

POWDER, *Pulvis*, in pharmacy, a dry medicine well broken, either in a mortar, by grinding, or by chemical operations.

POW-

POWDERINGS, among builders, certain devices, ſerving to fill up vacant places in carved works.

POWER, *Potentia*, in phyſiology, the faculty of doing or ſuffering any thing.

Power therefore is two-fold, viz. conſidered as able to make, or able to receive any change; the former of which may be called active power, and the latter paſſive power. Of paſſive power, all ſenſible things abundantly furniſh us with ideas, whoſe ſenſible qualities and beings we find to be in a continual flux, and therefore we look on them as liable to the ſame changes. Nor have we fewer inſtances of active power; ſince whatever change is obſerved, the mind muſt collect a power ſomewhere able to effect it; but, eſpecially, by reflecting on the operations of our own minds, as the power of perception, of volition, &c. See the articles FREEDOM, WILL, PERCEPTION, &c.

Dr. Keil demonſtrates that the phyſical power, or action of bodies, propagated in orbem; as light, heat, odour, &c. has its efficacy increaſed or diminiſhed in a duplicate ratio of the diſtances from the center of radiation, or exertion of that power.

POWER, in mechanics, denotes any force whether of a man, horſe, a ſpring, the wind, water, &c. which being applied to a machine, tends to produce motion. See MACHINE and ENGINE.

The intenſity of a power is its abſolute force; that is, its force, ſuppoſing its velocity equal to its weight: for its moving or acting force may be greater or leſs, according as its velocity is increaſed or diminiſhed, in reſpect of that of the weight. As for example, if a man be the power, and can raiſe from the ground a certain weight, that weight will expreſs or be equal to the intenſity of the power; for in this caſe, whatever engine be made uſe of, that part of the engine, where the weight is duly applied, will move juſt as faſt as that on which a man acts with his whole force.

A power may act in any direction whatever; but a weight has only one direction, viz. towards the center of the earth. See GRAVITATION.

When we ſpeak of the mechanical powers, the word power is taken in a very different ſenſe from that above laid down; ſince, in this caſe, it ſignifies only an organ or inſtrument, whereby a power of a known intenſity is made to act upon a weight: and therefore we muſt take care not to attribute any real force to any ſimple or compound machine, as many are apt to do merely becauſe the name power has been given to mechanical organs, not from their effect, but from the effect which the power produces by their means. For how much ſoever the force of a power is thereby increaſed, in order to ſuſtain or raiſe a weight far ſuperior to it in intenſity; yet this cannot be done without loſing in ſpace and time what is gained in force; contrary to what ſome have vainly imagined, becauſe the vulgar commonly ſpeak of a machine as they do of an animal; attributing that effect to the machine, which is only the effect of the power by means of the machine: thus, it is uſual to ſay, ſuch a machine raiſes ſuch a quantity of water, or performs ſuch and ſuch work; when we ſhould ſay, if we would ſpeak philoſophically, ſuch a running ſtream; ſuch a fall of water, the wind, or ſo many men, horſes, oxen, &c. raiſe ſo much water in ſuch a time, &c. by means of ſuch or ſuch a machine. It were therefore to be wiſhed, that the word power were to be confined to its proper ſenſe, and not uſed to ſignify one of the mechanical organs; however, as it has been cuſtomary to uſe it in that ſenſe, we have done ſo too, but withal thought proper to give the above caution.

The ſimple mechanical organs or powers are the lever, ballance, axis in peritrochio, pully, ſcrew, wedge, and inclined plane. See the articles LEVER, BALLANCE, &c.

POWER, in law, ſignifies in general, a particular authority, granted by any perſon to another to repreſent him, or act in his ſtead.

POWERS, in arithmetic and algebra, are numbers or quantities ariſing from the ſquaring or multiplication of any number or quantity by itſelf, and then that product by the root or firſt number again; and this third product by the root again; and ſo on ad infinitum; as 2, 4, 8, 16, 32, 64, 128, 256, &c. Where 2 is called the root or firſt power, 4 is its ſquare or ſecond power, 8 its cube or third power, 16 its biquadrate or fourth power, &c. And theſe powers in letters or ſpecies are expreſſed by repeating the root as often as the index of the power expreſſes. Thus a is the root or firſt power, $a\,a$, the ſquare or ſecond power, $a\,a\,a$ the cube, $a\,a\,a\,a$ the biquadrate or fourth power. And to avoid the tedioufneſs of repeating the root ſo often, when the powers are high, we only put down the root with the index of the power over it, thus; a^9 is the ninth power of a; b^{16}, b^{94}, are the 16th and 94th powers of b. See the article INVOLUTION.

POWER *of an Hyperbola*, is the ſixteenth part of the ſquare of the conjugate axis, or the one fourth part of the ſquare of the ſemi-conjugate axis; or it is equal to a rectangle under the one fourth of the tranſverſe axis, and one fourth part of the ſum of the tranſverſe axis, and parameter.

POX, or SMALL-POX, *Variolæ*, in medicine, a contagious diſeaſe appearing on the ſurface of the ſkin, which it covers with puſtules, or ulcerous eruptions, that frequently leave ſcars behind them.

The ſmall-pox is commonly divided into two kinds, the diſtinct and the confluent. The diſtinct or regular ſort, according to Sydenham, begins with a ſhuddering chilneſs, which is ſucceeded by an intenſe heat, violent pain of the head and back, vomiting, drowſineſs, and ſometimes epileptic fits, eſpecially in children, which ſhew the pox to be ready to burſt forth, and that they will be mild. The eruptions are uſually on the fourth day from the beginning, at which time the feveriſh ſymptoms either abate or wholly diſappear. The ſpots are at firſt reddiſh, and ſpread themſelves over the neck, breaſt, and the whole body. On the eighth day the ſpaces between the puſtules which were hitherto white, begin to grow red, and ſwell, the eye-lids are puffed up, and cloſe the eyes; next to the face, the hands begin to ſwell; and the puſtules of the face, before ſmooth and red, begin to be rough and whitiſh, and throw out a yellowiſh matter. On the eleventh day, the ſwelling of the face and inflammation diſappear; and the puſtules being ripe, grow dry and fall off: and on the fourteenth or fifteenth day, periſh entirely. In the confluent ſorts there are the ſame ſymptoms, but more violent; and as the diſeaſe increaſes, the eruptions do not ariſe to any conſiderable height: this ſort is attended with ſpitting in adults, and generally with a looſeneſs in children.

But though moſt authors, as we have already obſerved, divide the ſmall pox into the diſtinct and confluent ſorts, Dr. Mead thinks it more accurate, and agreeable to the nature of the diſeaſe, to divide it into ſimple and malignant. The ſimple ſort is that in which the eruption is attended with a ſlight fever of ſhort duration, the puſtules fill kindly, make good matter in a few days, and at laſt fall off in dry ſcabs. The malignant ſort is that in which the eruption is attended with a malignant fever, the puſtules hardly come to any tolerable degree of maturity, and either ſuppurate not at all, or if they do in ſome meaſure, they are with difficulty brought to end in little cruſts. The malignity appearing in various forms, has given various appellations to this diſeaſe, as the cryſtalline, the warty, and the bloody. The puſtules of the cryſtalline ſort, inſtead of a thick well-digeſted matter, contain nothing but a thin pale water, and are in ſome meaſure pellucid. And this ſort is ſometimes obſerved in the diſtinct as well as the confluent: ſometimes this fluid flies off, and leaves hollow bladders. The warty puſtules contain no fluid, but grow hard and prominent above the ſkin like warts; theſe are peculiar to the diſtinct ſort. The bloody puſtules are produced more ways than one; for ſometimes, at the very beginning of the diſeaſe, the puſtules are ſmall tubercles full of blackiſh blood, as if the ſkin was pinched with a forceps; then purple and livid ſpots follow, as in the true plague: but it more frequently happens, that the puſtules coming out very thick; on the third or fourth day after, when they ought to fill, become livid and a little bloody, with black ſpots ſpread over the whole body, which forebode death in a day or two, theſe being real gangrenes. It very often falls out at this time, that a thin blood flows not only out of the patient's mouth, noſe, and eyes, but alſo by every outlet

of the body, but more eſpecially by the urinary paſſages, as it does ſometimes on the firſt days of the diſtemper: theſe are manifeſtly of the confluent kind.

In the management of the patient, in the diſtinct ſort, it is a general rule, ſays Dr. Mead, to keep the patient in bed during the firſt days of the diſtemper, but neither to ſtifle him by heat and cloaths, nor to check the perſpiration by cold; yet care ought to be taken to ſupply him with pure and cool air. With regard to diet, it ought to be very ſlender, moiſtening, and cooling, ſuch as oatmeal or barley-gruel; and in the beginning, the beſt regimen is that which keeps the body open, and promotes urine: this end is obtained by boiling preſerved fruit with their food, and giving them ſubacid liquors for drink, as ſmall beer acidulated with orange or lemon-juice, whey turned with apples boiled in milk, &c.

In the cure, Sydenham adviſes bleeding on any of the three firſt days, and then an ounce or an ounce and an half of emetic wine. Mead alſo, in the firſt place, adviſes bleeding even to children, and affirms that when they are ſeized with convulſions at the onſet of the diſeaſe, ſome evacuation ought to be made, which may be ſafely done by leeches applied to the temples, or behind the ears, and that in moſt young ſubjects, if blood cannot be drawn from the arm, either of the jugulars may be opened. In youths and adults, he ſays, it is often neceſſary to take away blood two or three times, only with an intermiſſion of two or three days between each time; for blood-letting is ſo far from being an obſtacle to the eruption of the puſtules, if the patient is not too weak, that it forwards it conſiderably. He adds, that after bleeding, a vomit ſhould be given, if the ſtomach abound with phlegm or bile, or be loaded with food unſeaſonably taken: otherwiſe a purge may be preſcribed before the eruption of the puſtules, which may be the infuſion of ſena with manna, or manna alone, eſpecially for children. To keep the inflammation of the blood within due bounds, and to aſſiſt the expulſion of the morbific matter through the ſkin, take half an ounce of bezoardic powder, and two drams of purified nitre; mix theſe powders: half a dram of this mixture may be taken by an adult three or four times in a day; diminiſhing the quantity for children according to their age. Sometimes equal quantities of theſe ingredients may be preſcribed; and if the effervеſcence of the fever runs very high, a proper quantity of the ſpirit of vitriol may be added to the patient's drink. When the eruption of the puſtules is completed, an adult patient may take about fourteen drops of liquid laudanum, or an ounce of ſyrup of white poppies, in a little cowſlip-flower-water, every night. But opiates are improper for children.

If this method is proper in the diſtinct ſmall-pox, it will be found more neceſſary in the confluent. In the cryſtalline ſort, the water of the puſtules can never be brought to a laudable ſuppuration; therefore, while the thinner parts are made to tranſpire through the ſkin, the groſſer ought to be drawn off through the urinary paſſages. To this purpoſe nitre may be adminiſtered three or four times a day, from a ſcruple to half a dram, in ſmall wine; and while nitre is thus taken, it will be proper to interpoſe medicines which cheriſh the heart, and promote the flux of the humours into the puſtules, as the cordial confection, or the bezoardic powder, ſometimes with a little ſaffron. Beſides, on the fifth or ſixth day, bliſters are to be applied between the ſhoulders, and to the arms and legs; for which purpoſe the bliſtering epithem is moſt convenient. In the warty ſmall-pox, which is more dangerous than the cryſtalline, the utmoſt endeavours are to be uſed to take off the fever, and to provoke a ſweat, in order to digeſt the morbid humour, by the cordial medicines above-mentioned; and, in this caſe, bliſters are likewiſe to be applied. The bloody ſmall-pox requires peculiar attention; and Mead obſerves, that if there be any room for phyſic, thoſe medicines bid faireſt for ſucceſs, which tend to thicken the blood: the beſt of this kind are the Peruvian bark, alum, and oil of vitriol; which are beſt uſed alternately in this manner, a dram of the bark may be given every ſixth hour, and three hours after a proper quantity of alum; which will be a powerful medicine, if thus compounded, melt three parts of alum with one part of dragon's blood, over the fire; and when the maſs is grown cold, reduce it to a powder: a ſcruple of this, made into a bolus with oil of roſes, will be a proper doſe. The moſt convenient manner of giving the oil of vitriol is in the tincture of roſes; of which tincture five or ſix ſpoonfuls may be taken four or five times a day. In every ſort of this diſeaſe, it is proper to open the body on the decline, that is, on the ninth or tenth day from the eruption; becauſe a putrid fever generally comes on about that time, while the puſtules are drying; or upon the ſubſiding of the ſwelling of the inflamed ſkin, where there is no ſuppuration; gentle cathartics are the ſafeſt means of removing this fever, and ſuch as were directed before the eruption; but if any purulent matter ſhould ſtill lurk under the withered ſkin of the puſtules, the body is not yet to be purged, but rather to be ſupported by proper diet, till the matter is all come away.

French Pox, *Lues Venerea*, is defined a malignant and putredinous dyſcraſy of all the humours, but eſpecially of the ſerum and lymph, ariſing from a venereal taint received into the body; or, according to Sydenham, when a gonorrhœa has continued a long while, or long enough for the poiſonous matter to make its way into the blood; or by aſtringents given unſeaſonably, it cannot make its exit, then the patient is infected with the French pox. See Gonorrhoea.

The buboes in the groin conſtitute the firſt degree of this diſtemper: then follow pains of the head, joints, of the ſhoulders, arms, and ancles, coming on by fits, but at no certain intervals, unleſs in the night, when the patient is warm in bed. See Bubo.

There are alſo ſcabs and ſcurfs in various parts of the body, which are as yellow as a honeycomb; ſometimes they have large ſurfaces, anſwering the deſcription which authors give of the leproſy. All theſe ſymptoms gradually increaſe, eſpecially the pain, which becomes ſo intenſe that the patient is unable to lie in bed.

Afterward, nodes or exoſtoſes ariſe in the ſkull, ſhinbones, and bones of the arms, which being attended with conſtant pain and inflammation, at length grow carious and putrefied. Phagedenic ulcers likewiſe ſeize various parts of the body, but generally firſt begin with the throat, and from thence gradually creep by the palate to the cartilage of the noſe, which they deſtroy, and the noſe being deſtitute of its prop, falls down flat. The ulcers and pains daily increaſing, the patient ſinks under the torment, and one member rotting away after another, is hurried into his grave.

The methods of curing the French pox are principally four: 1. The common one, by ſalivation. 2. By giving quickſilver-pills. 3. By mercurial frictions, which are to be purged off before a ſalivation is raiſed. And, 4. By ſweating, with a decoction of guaiacum. For the firſt of theſe methods, ſee Salivation.

The ſecond method of curing the French pox is by a quickſilver pill. This was brought into reputation by Belloſte; and, though he has kept the compoſition a ſecret, yet there is no reaſon to doubt but it is quickſilver mixed with a certain proportion of cathartic. Turner's imitation of this pill is as follows: take of quickſilver, two drams; turpentine, and pill of calocynth with aloes, of each half a dram; of which make twelve pills. The quickſilver muſt be well incorporated with the turpentine till it becomes inviſible; and then the pill of calocynth with aloes is to be added: ſometimes it will require a little crabs eyes, to give it a conſiſtence. If one of theſe pills be taken night and morning, after the two firſt days, it will give two or three ſtools a day, without gripes or ſickneſs. It may be proper, either night or morning, after the pill, to ſweat the patient with a pint of the ſtrong decoction of guaiacum, drank hot upon it. In the milder ſpecies of this diſeaſe, the patient is directed to obſerve no particular regimen, but may go about his affairs as uſual. The method of cure, as is allowed, may be preſcribed to very good purpoſe in this ſtubborn diſeaſe; but it is not thought ſo effectual as ſalivation; without which, Turner is of opinion, that exoſtoſes and carious tophi cannot be cured.

The third method of curing the French pox is by mercurial frictions, which Deſault gives as follows: when the patient has a pox of a long continuance, and the venereal poiſon is diſperſed all over the body, he ſhould be

be prepared by bathing and drinking whey. But in a recent pox the bath is not neceſſary. After this, inſtead of raiſing a ſalivation, he brings on a flux of the belly, by means of clyſters of a decoction of ſena, and the pulp of caſſia, before the frictions are adminiſtered. When he finds that the looſeneſs does not anſwer the number of frictions, nor the quantity of mercury made uſe of, he purges the patient with powder of jalap, and procures copious ſtools. While the looſeneſs is going on, the friction does the office of a purge; and in proportion as they are repeated, the flux of the belly revives; and when it ſlackens or ſtops, he has recourſe to the clyſters and purges of jalap. He purſues this method till the ſymptoms ceaſe, and till he is perſuaded, by the abundance of the evacuations, the venereal poiſon is entirely drained off. By this means he carries off the pox and gonorrhœa at once. Dr. Douglas not only approved, but uſed this method with ſucceſs. The frictions are to be made with mercurial ointment, and one third of quickſilver, from two or three drams to an ounce or an ounce and a half, every night or every other night.

The fourth and laſt method of curing this diſtemper is with ſtrong decoctions of guaiacum. This we have the firſt account of, from Sir Ulric Hutten, who purſued it himſelf. A pound of guaiacum is to be boiled in a gallon of ſpring-water, to one half, and the ſcum reſerved to anoint the ſores; and a ſecond decoction is to be uſed for common drink. Boerhaave, who recommends this method, ſuppoſes that a ſalivation will be ineffectual, if every drop of fat in the blood is not melted down into water, and carried off; and the patient reduced to a death-like paleneſs. He likewiſe ſuppoſes that guaiacum performs its taſk by reſolving all the unctuous particles, whether incorporated in the maſs of blood, or accumulated in their proper repoſitories; and by emaciating the habit ſo exquiſitely, as not to leave one drop of oil therein. He directs the patient to keep in a room of ſuch a warmth, as that its mere heat will incline him to ſweat; he adviſes alſo, through the whole courſe of the cure, to abſtain from every thing that has the leaſt oilineſs in its nature, eating nothing but ſea biſcuit and raiſins, and drinking only a weaker decoction of guaiacum. He muſt alſo drink eight ounces every day of the ſtrong decoction, the more the better, till ſome days his habit is bloated with it, as if he had the dropſy. After this, let the patient every morning drink faſting as much of the decoction as his ſtomach will hold, and place himſelf in an erect poſture in a ſweating-box; or if he lies a-bed, let a ſtove be put under it. In either place he muſt receive on his naked body the ſteam of kindled ſpirits of wine, and there let him ſweat as long and as plentifully as his ſtrength will allow. After he has ſuffered this heat for half an hour, let the flame be extinguiſhed, and the patient ſweat in his bed about half an hour longer. After which let him take eight or ten ounces of veal-broth boiled in a ſmall quantity of rice, but void of fat. His body muſt now be carefully wiped with warm dry flannel, after which let him riſe and drink of his decoction, as formerly, throughout the day. This muſt be done morning and evening, in every article, for fourteen days ſucceſſively; after this, in the morning fourteen days more.

PRACTICE, in arithmetic, *Practica Italica*, or Italian uſages, certain compendious ways of working the rule of proportion, or golden rule, eſpecially where the firſt term is one or unity. They were thus called from their expediting of practice and buſineſs, and becauſe firſt introduced by the merchants and negotiants of Italy.

The moſt uſeful of theſe practices are as follow: — 1. Since the uſe of the rule of three is to find a fourth proportional to three given numbers, divide the firſt and ſecond, or the firſt and third, by ſome common number, if that can be done exactly; and work with the quantities in their ſtead: as in the following example:

Price of 3 ℔. is 9 ſhillings: What is the price of 7 ℔?

3) 1 3

$\frac{3}{21}$ facit ſhill.

Price of 14 ℔. is 26 ſhillings: What is the price of 7 ℔?

7) 2 2) —

1

facit 13 ſhillings.

2. If the firſt term be 1, and the ſecond an aliquot part of a pound, ſhilling, or penny; divide the third by the aliquot part, the quotient is the anſwer.

Note, to find the aliquot part, thoſe who cannot do it otherwiſe, may ſee the table of aliquot parts of a pound in table hereafter.

E. gr. If 1 ell coſt 10 ſhillings: What coſt 957 ells?

facit 478 l. 10 ſhillings.

3. If the firſt or third number be 1; the other not exceeding large; and the middle term a compound, i. e. conſiſt of ſeveral denominations, it may be wrought without reduction, thus:

Price of 1 ℔. is 3 s. 8 d. 3 q. What is the price of 5 ℔?

5

18 s. 7 d. 3 q.

For, four farthings making a penny, 5 times 3 farthings make 3 d. 3 q. and 12 d. making 1 s. 5 times 8 pence make 3 s. 4 d. which, with the 3 d. from the place of farthings, make 3 s. 7 d. Laſtly, 5 times 3 ſhillings make 15, and with the 3 ſhillings from the place of pence is 18 s. the price required therefore is 18 s. 7 d. 3 q.

4. If the middle term be not an aliquot, but an aliquant part, reſolve the aliquant part into its aliquot parts; divide the middle term by the ſeveral aliquots, the ſum of the quotients is the anſwer. To find the aliquot parts contained in an aliquant, ſee the table of aliquant parts of a pound, hereafter.

For an inſtance of this rule: If 1 ell coſt 15 ſhillings: What coſt 124 ells?

$\frac{1}{2}$ $\frac{1}{4}$

$\frac{1}{2}$) 62

31

facit 93 l.

5. If the firſt or ſecond term be 1, and in the former caſe the ſecond or third, in the latter the firſt, be reſolvible in factors; the whole operation may be performed in the mind without writing down any figures; as in the following example:

Price of 1 ℔. is 24 ſhillings: What is the price of 20 ℔.

4 4

6 80

6

facit 48 : 0 s. — 24 l.

6. Where one of the given numbers is 1, we have ſeveral compendious uſages to ſave multiplication and diviſion. E. gr. If 9 ℔. coſt 20 ſhillings: What does 1 ℔. coſt?

It is obvious the ſum required is had by adding to the tenth part of 20 s. viz. 2 s. the ninth part of the tenth, viz. 3 d. $\frac{1}{2}$, and $\frac{2}{9}$ of a penny; the anſwer therefore is 2 s. 3 d. $\frac{1}{2}$ and $\frac{2}{9}$.

Again, if 5 ℔. coſt 64 s. What coſt 1 ℔?

Since 5 is half of 10, the double of the tenth part of the given price, viz. 10 s. 9 d. 3 q is the ſum required.

Again, if 1 ℔. coſt 18 d. What will 19 ℔. coſt?

Since 19 = 20 — 1; from the given price doubled and increaſed by a cypher, viz. 360, ſubtract the ſimple 18; the remainder is 342 pence = 28 s. 6 d. the ſum required.

7. If two terms of the ſame denomination differ by an unit, we have a peculiar kind of compound, which will be clear from the following examples. E. gr. If 5 ℔. coſt 30 s. What will 4 ℔. coſt?

Since the price of 4 ℔. is $\frac{1}{5}$ part ſhort of that of 5 ℔. divide the given price 30 by 5; the quotient 6 being ſubtracted from the dividend, the remainder, viz. 24 s. is the ſum required.

Again, if 8 ℔. coſt 24 s. What coſt 9 pounds?

Since the price of 9 ℔. exceeds that of 8 by $\frac{1}{8}$ part, divide the given price 24 by 8, and add the quotient 3 to the dividend; the ſum 27 is the anſwer.

8. Sometimes one may uſe ſeveral of theſe compends or practices in the ſame queſtion. E. gr. If 100 ℔. coſt 30 s. 4 d. What coſt 50 ℔? 50) 2. 2

facit 15 s. 2 d.

Again, if 60 ℔. coſt 4 s. What coſt 2520 ℔?

6 42

24 6

7 7

168 l.

A table

A table of the aliquot parts of a pound or 20 s. are

10 s. make half of 20 s.	2 s. 6 d. an eighth.
5 s. a fourth.	1 s. 8 d. a twelfth.
4 s. a fifth.	1 s. 4 d. a fifteenth.
2 s. a tenth.	1 s. 3 d. a ſixteenth.
1 s. a twentieth.	10 d. a twenty-fourth.
6 s. 8 d. a third.	5 d. a forty-eighth.
3 s. 4 d. a ſixth.	

To multiply by aliquot parts, ſee the article MULTIPLICATION.

A table of the aliquant parts of a pound or 20 s. are

3 s. an aliquant part compoſed of a 10th and 20th.	14 s. of a half and a 5th.
6 s. of a fifth and tenth.	15 s. of a half and a 4th.
7 s. of a fourth and tenth.	16 s. of a half a 5th & 10th.
8 s. of two fifths.	17 s. of a half a 4th & 10th.
9 s. of a fourth and fifth.	18 s. of a half and two 5ths.
11 s. of a half and a 20th.	19 s. of a half, a 4th, and a 5th.
12 s. of a half and a 10th.	

To multiply by aliquant parts, ſee the article MULTIPLICATION.

PRAGMATIC SANCTION, in the civil law, is defined by Hottoman to be a reſcript, or anſwer of the ſovereign, delivered by advice of his council, to ſome college, order, or body of people, upon conſulting him on ſome caſe of their community. The like anſwer given to any particular perſon, is called ſimple reſcript. The term pragmatic ſanction, is chiefly applied to a ſettlement of Charles VI. emperor of Germany, who, in the year 1722, having no ſons, ſettled his hereditary dominions on his eldeſt daughter, the archduchess Maria Thereſa, which was confirmed by the diet of the empire, and guarantied by Great-Britain, France, the States-General, and moſt of the powers in Europe.

PRAME, among ſailors, a ſort of lighter employed in different parts of the Baltic ſea, to load and deliver ſhips. See CRAFT and LIGHTER.

PRASIUS, PRASITES, in natural hiſtory, the name of a gem much approaching to the nature of the emerald, but wanting its hardneſs, and being of a coarſer green, with an admixture of yellow.

PRATIQUE, or PRATTIC, in commerce, a negociation, or communication, of commerce, which a merchant veſſel obtains in the port it arrives in, and the countries it diſcovers: hence to obtain a pratique, is to obtain a liberty to frequent a port, to go aſhore, to buy and ſell, &c.

Pratique is particularly uſed for a licenſe to traffic, granted to the maſter of a ſhip in the ports of Italy upon a bill of health; that is, a certificate that the place whence he came is not annoyed with any infectious diſeaſe.

PRAYER, in theology, a petition put up to God, either for the obtaining ſome future favour, or the returning thanks for a paſt one.

Divines diſtinguiſh three kinds of prayer, vocal, which is cloathed in words and ſounds, to be uttered by the mouth; mental, which is only formed or conceived in the mind, and not delivered in words; and ejaculatory, which is a ſhort ſudden flight, without ſtudy, order, or method. Among us prayer is moſt frequently conſidered under the diviſions of preconceived and extemporary: under the firſt come all ſet forms, whether public or private, by which the mind is directed in the order, manner, expreſſion, &c. of its petitions; the ſecond is that where the mind is left to itſelf, and its own conduct, both as to matter, manner, words, &c.

PREACHING, in theology, the promulgation of the word of God in public: or the making a ſermon, or public oration on ſome paſſage in the ſacred Scriptures, in order to inform the judgment and mend the lives of the hearers.

PREADAMITE, a denomination given to the inhabitants of the earth, who, according to ſome people, lived before Adam.

Iſaac de Pereyra, in 1655, publiſhed a book, in which he attempted to prove that the Jews alone were deſcended from Adam; and that the Gentiles, whom he called Preadamites, lived long before Adam: this book was anſwered by Demarets, profeſſor of theology at Groningen.

PREAMBLE, in law, the beginning of an act of parliament, &c. which ſerves to open the intent of the act, and the miſchiefs intended to be remedied by it.

PREBEND, the maintenance a prebendary receives out of the eſtate of a cathedral or collegiate church. Prebends are diſtinguiſhed into ſimple and dignitary; a ſimple prebend has no more than the revenue for its ſupport; but a prebend with dignity, has always a juriſdiction annexed to it.

PREBENDARY, an eccleſiaſtic who enjoys a prebend.

The difference between a prebendary and a canon is, that the former receives his prebend, in conſideration of his officiating in the church; but the latter merely by his being received into the cathedral or college.

Golden PREBENDARY *of Hereford*, called alſo *Prebendarius Epiſcopus*, is one of the twenty-eight minor prebendaries, who has, *ex officio*, the firſt canon's place that falls. He was anciently confeſſor of the biſhop and cathedral, and had the offerings at the altar; on which account he was called the golden prebendary.

PRECEDENCE, or PRECEDENCY, a place of honour to which a perſon is entitled: this is either of courteſy or of right. The former is that which is due to age, eſtate, &c. which is regulated by cuſtom and civility: the latter is ſettled by authority, and when broken in upon gives an action at law.

PRECEDENT, in law, a caſe which has been determined, and which ſerves as a rule for all of the ſame nature: thus the precedents of a court will reverſe a judgment contrary to many precedents.

PRECENTOR, a dignitary in cathedrals, popularly called the chantor, or maſter of the choir.

PRECEPT, in law, a command in writing ſent by a chief juſtice, juſtice of the peace, &c. for bringing a perſon, record, or other matter, before him.

PRECESSION, *Præceſſio*, in aſtronomy, a term applied to a ſlow motion of the equinoctial points towards the weſt: that is, in the language of aſtronomers, *in antecedentia*, or contrary to the order of the ſigns.

This motion of the equinoctial points is occaſioned by the poles of the world revolving round thoſe of the ecliptic; in order to illuſtrate which, let D C H (plate CIII. *fig.* 11.) be a part of the earth's orbit, C its center, E C the axis of the ecliptic, E its pole, C P the axis of the earth, P its pole; through the points E and P draw the great circle E P A, meeting the ecliptic A L in A; the arch P A is equal to the inclination of the axis of the earth to the plane of the ecliptic, viz. the angle P C H, which is found by obſervation to be about 66° 30′, and therefore its complemental arch E P, or angle P C E = 23° 30′.

Through the pole P, from the point E, deſcribe a leſſer circle P F G, which will be parallel to the ecliptic; then, if the axis of the earth be directed at any particular time to P, it is found by obſervations of many years, that it will not be conſtantly directed to the point P, but in ſeventy-two years time be directed to ſome other point Q, ſo that the arch P Q = 1 degree; and therefore, in the ſpace of 360 × 72 = 25920 years, the point P, or pole of the world, will deſcribe the circle P F G, about the pole of the ecliptic E, which revolution is called *annus magnus*, the great year; after which, the ſtars being re-inſtated in their proper places, the ancients imagined there would be a total renovation of all things.

The cauſe of this conical motion of the earth's axis was unknown to all the aſtronomers before Sir Iſaac Newton's time, none of them being able to gueſs from whence it could proceed; but this ſublime geometer ſoon inveſtigated its cauſe, and demonſtrated that it reſults from the laws of motion and gravity, that is, from the ſpheroidical figure of the earth; for if the earth was a perfect ſphere, its axis would always continue parallel to itſelf, and conſequently have no ſuch motion. Hence the reaſon of the preceſſion of the equinoctial points may be eaſily conceived: for the circle E P A, paſſing through both the pole of the ecliptic and equator, will be the ſolſtitial colure, and A the ſolſtitial point, when the axis of the earth points to P; but after ſeventy-two years, when it points to Q, then the great circle E Q B will be the ſolſtitial colure, and B the ſolſtice. And becauſe the equi-

noctial points are always ninety degrees distant from the solstices, they must consequently move in the same time, through the same arch, and the same way, viz. westward, *in antecedentia.*

This retrograde motion, by carrying the equinoctial points to meet the sun in his apparent annual motion, makes him arrive at them sooner every year than he would do if those points continued immoveable: and this arch of regression being 50″ a year, or one degree in seventy-two years, makes the equinoxes happen 20′ in time sooner each year than they would otherwise do. And though this change be not sensible in a few years, yet these points are found to have a very different situation from what they had two thousand years ago.

By reason of this precession of the equinoctial points, the fixed stars seem to move towards the east, and thereby to have their longitude, which is always reckoned upon the ecliptic, from the vernal equinoctial point encreased: and hence the constellations seem to have deserted the places allotted them by the ancient astronomers; for instance, the beginning of the sign Aries, which in Hipparchus's time, was near the vernal equinoctial point, and gave name to that point of the ecliptic, is now removed near a whole sign, or thirty degrees eastward; so that Aries is now where Taurus used to be, Taurus where Gemini used to be, &c. and thus all the constellations of the zodiac have changed their ancient places; but to avoid confusion, astronomers have thought fit to let the several portions of the ecliptic, where these constellations were at first observed to be, retain their old names; so that the vernal equinoctial point is still reckoned the first degree of Aries. However, these portions of the ecliptic, where the constellations were at first, are called *anastra*, to distinguish them from the places where they now are, which are termed *stellata.*

PRECIPITANT, *Præcipitans*, in chemistry, is applied to any liquor, which, when poured on a solution, separates what is dissolved, and makes it precipitate, or fall to the bottom of the vessel.

PRECIPITATE, *Præcipitatus*, in chemistry, a substance which having been dissolved in a proper menstruum, is again separated from its solvent, and thrown down to the bottom of the vessel, by pouring some other liquor upon it.

PRECIPITATION, *Precipitatio*, a process in chemistry, which is a kind of separation, whereby the particles of a body dissolved and suspended in any menstruous liquor, are detached therefrom, and fall down to the bottom of the vessel. These particles sometimes precipitate of their own accord, but oftener by the assistance of some other liquor added to the menstruum. So that precipitation is the reseparating solid bodies from any fluid menstruum, wherein they are dissolved, by the addition of a third body, which, counteracting the power of the menstruum, causes that which was dissolved to regain its solid form, and subside in the state of a powder.

The great law of precipitation, according to Dr. Shaw, is this: whenever one body has dissolved another, and a third be added to the solution; which third has a greater relation to either of the former, than they have to each other; then the union of the two first will be dissolved, and the third uniting itself either with the first or second, leaves the other at liberty to fall to the bottom, or rise to the top, according to its specific gravity: thus if camphor be dissolved in spirit of wine, and water be added to the solution, it is thereby made to float upon the surface; because there is a greater appetite of union between water and the spirit of wine, than there is between camphor and that spirit.

As precipitation is apparently opposite to solution, its application must be necessarily founded on the same principles. The manner of its performance is a simple commixture of the precipitant with the solution to be precipitated; only with this caution in respect to bodies which produce much ebullition on their mixture, that the precipitant should be added gradually, lest they overflow the vessel.

Boerhaave makes the following observations on the different manner, in which precipitation is performed by several different agents. 1. By water poured on oils dissolved in alcohol, where the liquor turns milky. 2. By water poured to solid resins dissolved in alcohol, where also the liquor turns milky. 3. By water in the distillation of oily spirits, if any water run after the spirit is drawn off. 4. By acids on acids: thus silver and mercury are precipitated out of spirit of nitre, in which they have been dissolved by adding spirit of salt. 5. By metals with metals, and other bodies. Thus, for example, dilute an ounce of silver dissolved in spirit of nitre, with twelve times the quantity of rain-water; put polished plates of copper into this liquor, and the silver will be precipitated, and the copper dissolved: then put this solution of copper into another glass, and add to it polished plates of iron; the copper will be precipitated, and case over the iron; finally, the copper falls to the bottom, and the iron dissolves. Pour this solution of iron into a fresh glass, and drop upon it oil of tartar per deliquium; the dissolved iron immediately falls to the bottom, and the alkali unites with the acid, and regenerates true nitre, after so many changes. Thus does this salt travel from one body to another almost unaltered, though it is more attracted by one than another, till at length it rests in that which in this respect is the strongest, and is only thence expelled, when oil of vitriol is poured upon the nitre thus regenerated. On these two principles precipitation depends, and is the true and often abstruse cause of numberless wonderful operations, both in art and nature. Take a grain of white or red precipitate, rub it upon a polished and heated copper-plate, and wherever the matter has passed, the copper will immediately look like silver; for the copper attracts the acid of the nitre from the calx of the mercury, and thus presently makes an amalgam upon the surface of the copper, and then acquires a silver colour. 6. Alkalies often precipitate things dissolved by acids. This happens frequently, but not always, nor in perfection: alkali precipitates copper dissolved by an acid, but the copper is afterwards dissolved by a salt made of the two. 7. Acids generally precipitate things dissolved by alkalies; but in this case also there are some processes which shew us exceptions. 8. Sharp salts, without being changed, and lying perfectly concealed, have strange and unexpected effects by means of precipitation. If an ounce of luna cornea, which is perfectly scentless, insipid, and inactive, and affords no sign of acrimony in the fire, be ground, and united in a strong heat in a glass retort with half an ounce of inodorous and perfectly insipid regulus of antimony, there instantly arises an extremely strong poison, or an exceedingly corrosive butter of antimony, the exhalation of which proves mortal. We see in this one instance how dangerous the art of mixing is, and with what care we ought to go about the compounding of bodies.

PRECONTRACT, in law, properly signifies a contract made before another, but is chiefly applied to marriage contracts.

PRECORDIA, *Præcordia*, in anatomy, a general name for the parts situated about the heart, in the forepart of the thorax; as the diaphragm, pericardium, and even the heart itself, with the spleen, lungs, &c.

PRECURSOR, *Præcursor*, in theology, denotes a fore-runner, or person who goes before any one to notify his coming. The term precursor, however, is peculiarly applied to St. John the Baptist, who is styled the precursor of Jesus Christ.

PREDESTINATION, in general, signifies a decree of God, whereby from all eternity he ordained such a concatenation of causes as must produce every event by a kind of fatal necessity, and maugre all opposition.

Nothing has occasioned more disputes than this thorny subject of predestination; the Lutherans speak of it with horror, whilst the Calvinists contend for it with great zeal; the Molinists and Jesuits preach it down as a most dangerous doctrine, whilst the Jansenists assert it as an article of faith; the Arminians, Remonstrants, and Pelagians, are all avowed enemies to predestination.

PREDETERMINATION, in philosophy, that concurrence of God, which determines men in all their actions, both good and evil; and this concurrence, or influence, is called physical predetermination, or premotion: for divines maintain, that God has no share in the

ſins of mankind, inaſmuch as he only affords his concurrence to the phyſical part of their actions, not to the moral part.

PREDIAL TITHES, are thoſe that are paid of things ariſing and growing from the ground only; as corn, hay, fruit, &c.

PREDICABLE, among logicians, denotes a general quality which may be predicated, or aſſerted of ſeveral things: thus animal is predicable of mankind, beaſts, birds, fiſhes, &c.

PREDICAMENT, among logicians, the ſame with category. See CATEGORY.

PREDICATE, *Prædicatum*, in logic, that part of a propoſition which affirms or denies ſomething of the ſubject: thus, in theſe propoſitions, *ſnow is white*, *ink is not white*, whiteneſs is the predicate which is affirmed of ſnow, and denied of ink.

PREDICTION, *Prædictio*, the foretelling of what is to come, either by divine revelation, art, or conjecture.

PREDOMINANT, *Prædominans*, that which prevails, or has ſome ſuperiority, over another thing.

PREENING, in natural hiſtory, the action of birds dreſſing their feathers, to enable them to glide the more readily through the air, &c.

For this purpoſe they have two peculiar glands on their rump, which ſecrete an unctuous matter into a bag that is perforated, out of which the bird occaſionally draws it with its bill.

PRE-EXISTENCE, *Præ-Exiſtentia*, the ſtate of a thing actually in being before another.

PREFACE, *Præfatio*, ſomething introductory to a book, to inform the reader of the deſign, method, &c. obſerved therein; and generally whatever is neceſſary to facilitate the underſtanding of a book.

PREGNANCY, *Graviditas*, the ſtate of a woman who has conceived, or is with child. See GENERATION, CONCEPTION, FOETUS, &c.

PRELATE, an eccleſiaſtic raiſed to ſome eminent and ſuperior dignity in the church; as biſhops, archbiſhops, patriarchs, &c. See BISHOP, &c.

PRELIMINARY, in general, denotes ſomething to be examined and determined, before an affair can be treated of to the purpoſe.

PRELUDE, *Præludium*, in muſic, is uſually a flouriſh or irregular air, which a muſician plays off-hand, to try if his inſtrument be in tune, and ſo lead him into the piece to be played.

PREMISES, or PREMISSES, *Præmiſſæ*, in logic, an appellation given to the two firſt propoſitions of a ſyllogiſm, as going before, or preceding the concluſion.

PREMISES, in law, properly ſignifies the land, &c. mentioned in the beginning of a deed. See the article DEED.

PREMIUM, or *Præmium*, properly ſignifies a reward or recompence; but it is chiefly uſed in a mercantile ſenſe for the ſum of money given to an inſurer whether of ſhips, houſes, lives, &c.

PREMONSTRATENSES, in church hiſtory, a religious order, inſtituted by St. Norbert, about the year 1119.

PREMUNIRE, or *Præmunire*, in law, is taken two ways; either for a writ, or for the offence for which it is granted.

Formerly the church of Rome carried its pretended right of ſupremacy to ſuch a height, that ſeveral ſtatutes were made to check and reſtrain the growing power of the pope; but more eſpecially ſtat. 16 Rich. II. c. 5. commonly known by the name of the ſtatute of premunire, which ordains the puniſhment of offenders on this ſtatute to be this: that they ſhould be out of the king's protection, attached by their bodies, i. e. impriſoned at the king's pleaſure, and loſe their lands, goods, and chattels.

Premunire is now chiefly uſed for the above puniſhment, which is incurred not only by thoſe who aſſert the pope's ſupremacy; but alſo by thoſe who refuſe to take the oath of allegiance, or of the king's ſupremacy, &c.

It is ſaid no perſon, who has incurred a premunire, can bring any action; and a writ of premunire lies as well for a party grieved, as for the king; but the laws making offences a premunire are ſo very ſevere, that they are ſeldom put in execution.

PRENDER, in law, ſignifies the power or right a perſon has to take a thing before it is offered him.

PREPARATION, *Præparatio*, in mathematics, ſomething preparatory to the demonſtration of a propoſition. Thus if a propoſition in geometry is to be demonſtrated, the preparation conſiſts in drawing certain lines; and if a propoſition in arithmetic, in ſome computation to be previouſly made to come at the demonſtration.

PREPARATION, in pharmacy, &c. the manner of preparing and managing any medicine, in order to fit it to ſerve the purpoſe for which it is intended.

PREPARATION, in anatomy, the art of preſerving the parts of animals for anatomical uſes; which is done either by drying them thoroughly, or putting them in a proper liquor.

In drying parts which are thick, when the weather is warm, care muſt be taken to prevent putrefaction, fly-blows, inſects, &c. This is eaſily done by the uſe of a ſolution of corroſive ſublimate in ſpirit of wine, in the proportion of two drams of ſublimate to a pound of ſpirit: the part ſhould be moiſtened with this liquor as it dries, and by this method the body of a child may be kept ſafe even in ſummer. Dried preparations are apt to crack and moulder away in keeping; to prevent this their ſurface ſhould be covered with a thick varniſh, repeated as often as occaſion requires.

Though ſeveral parts prepared dry are uſeful, yet others muſt be ſo managed as to be always flexible, and nearer a natural ſtate; which may be done in a well rectified colourleſs ſpirit of wine, to which is added a ſmall quantity of the ſpirit of vitriol or nitre. When theſe are properly mixed, they neither change their colour nor the conſiſtence of the parts, except where there are ſerous or mucous liquors contained in them. The brain, even of a young child, in this mixture grows ſo firm as to admit of gentle handling, as do alſo the vitreous and cryſtalline humours of the eye. The liquor of the ſebaceous glands and the ſemen are coagulated by this ſpirituous mixture; and it heightens the red colour of the injection of the blood-veſſels, ſo that after the part has been in it a little time, ſeveral veſſels appear which were before inviſible. If you will compare theſe effects with what Ruyſch has ſaid of his balſam, you will find the liquor above-mentioned to come very near to it. The proportion of the two ſpirits muſt be changed according to the part prepared: for the brain and humours of the eye, you muſt put two drachms of ſpirit of nitre to one pound of ſpirit of wine. In preſerving other parts which are harder, thirty or forty drops of the acid will be ſufficient; a larger quantity will make bones flexible, and even diſſolve them. The part thus preſerved ſhould be always kept covered with the liquor, therefore great care ſhould be taken to ſtop the mouth of the glaſs with a waxed cork and a bladder tied over it, to prevent the evaporation of the ſpirit.

Some prefer malt-ſpirit to ſpirit of wine, becauſe this laſt is apt to change into a brown colour; whereas the malt-ſpirit never loſes its limpid appearance.

PREPOSITION, *Præpoſitio*, in grammar, one of the parts of ſpeech, being an indeclinable particle, which yet ſerves to govern the nouns that follow it; ſuch as *per*, *pro*, *propter*; and *through*, *for*, *with*, &c.

PREPUCE, *Præputium*, in anatomy, the foreſkin; being a prolongation of the cutis of the penis, covering the glans.

PREROGATIVE, *Prærogativa*, a pre-eminence which one perſon has over another.

PREROGATIVE *of the King*, *Prærogativa regis*, that power which the king hath, not only over other perſons, but over the ordinary courſe of the common law, in right of his crown.

PREROGATIVE *Court*, a court belonging to the archbiſhop of Canterbury, wherein wills are proved and adminiſtrations granted that belong to the archbiſhop by his prerogative; that is, where the party, at his death, had five pounds, or upwards, out of the dioceſe where he died, and within the archbiſhop's province. See WILL, PROBATE, &c.

PRE-

PRESAGE, *Præſagium*, in antiquity, denotes an augury, or ſign of ſome future event; which was chiefly taken from the flight of birds, the entrails of victims, &c.

Among phyſicians, the term preſage is ſometimes uſed for prognoſtic ſign. See PROGNOSTIC.

PRESBYTA, πρεσβυτης, in optics, a perſon whoſe eyes being flat, can ſee diſtant objects diſtinctly, but thoſe near confuſedly: which defect of ſight got this appellation, becauſe old people are naturally ſubject to it.

Spectacles, or convex glaſſes, are the only remedy for this defect; for if theſe are well fitted to the degree of flatneſs of the eyes, they cauſe the rays of light to converge in ſuch a manner from near objects, as to make them fall exactly on the retina, and thereby produce diſtinct viſion. See the article VISION.

PRESBYTER, in the primitive chriſtian church, an elder, one of the ſecond order of eccleſiaſtics; the other two being biſhops and deacons.

PRESBYTERIANS, a ſect of proteſtants, ſo called from their maintaining that the government of the church appointed in the New Teſtament was by preſbyteries; that is, by miniſters and ruling elders, aſſociated for its government and diſcipline.

PRESCIENCE, in theology, fore-knowledge, or the knowledge which God has of events before they come to paſs.

PRESCRIPTION, in law, is a right or title acquired by uſe and time, introduced for aſſuring the property of effects, in favour of perſons who have for a certain time had them in their poſſeſſion.

PRESCRIPTION, in medicine, is the aſſigning a proper and adequate remedy to a diſeaſe, from an examination of its ſymptoms, and an acquaintance with the virtues and effects of the materia medica.

PRESENT, *Præſens*, in grammar, the firſt tenſe of a verb, expreſſing the preſent time, or that ſomething is now performing; as *ſcribo*, I write, or am writing. See TENSE.

PRESENTATION, in law, the act of a patron offering his clerk to be inſtituted in a benefice of his gift, the ſame being void.

PRESENTE'E, the clerk preſented to a benefice by the patron.

PRESENTMENT, in law, a denunciation of jurors, or a juſtice of the peace, or other officers, without information of an offence inquirable by the court, to which it is preſented; or it may be ſaid to be an information made by the jury in a court before a judge, who has authority to puniſh any offence committed contrary to law; and it is what the grand jury finds and preſents to the court, without any bill of indictment delivered; yet it is afterwards reduced into the form of an indictment.

PRESEPE, or PRÆSEPE, in aſtronomy, the name given to three nebulous ſtars in the breaſt of Cancer.

PRESERVATION, in general, denotes the art of preſerving things in a ſtate of perfection; or, at leaſt, from being ſo far corrupted and ſpoiled, as to be no longer uſeful.

PRESERVATIVE, among phyſicians, denotes a medicine taken by way of precaution; or, to ſecure a man from a diſeaſe that threatens him.

PRESIDENT, *Præſes*, an officer created or elected to preſide over a company, in contradiſtinction to the other members, who are called reſidents.

PRESIDIAL, a bench of judges eſtabliſhed in the ſeveral cities of France, to judge ultimately of all the cauſes brought before them by way of appeal from the ſubaltern judges.

PRESS, *Prelum*, in the mechanic arts, a machine of wood, or iron, ſerving to ſqueeze any body very cloſe. Thus, let A B (plate CIV. *fig.* 1.) be a cheeſe-preſs, where C E, F G, are levers, moving about the points D, E, F, G, by applying the hand at C; S, the ſtone, or weight; and H, the cheeſe to be preſſed. Now if C D $=5$, D E $=2$, F G $=6$, G H $=2$, F R $=1$, F H $=4$; then in the lever C E, D is the fulcrum. Call the power at C 1; then the force at E or F is $\frac{2}{5}$. And in the lever F G, whoſe fulcrum is G, if the power at F be 1, the force at R is $\frac{6}{5}$; and therefore the power at C is to the weight S, as 1 to $\frac{2}{5} \times \frac{6}{5}$, or 3. Alſo the weight of the ſtone at R is to the preſſure at H, as 2 to 5, or 1 to $\frac{5}{2}$; and the power at C is to the preſſure at H, as 1 to $3 \times \frac{5}{2}$, or $7\frac{1}{2}$.

Preſſes uſually conſiſt of ſix pieces; two flat ſmooth planks, between which the things to be preſſed are laid; two ſcrews or worms faſtened to the lower plank, and paſſing through two holes in the upper; and two nuts in form of an S, that ſerve to drive the upper plank, which is moveable, againſt the lower, which is fixed.

PRESSES *uſed for expreſſing Liquors* are in moſt reſpects the ſame with the common preſſes, only the under plank is perforated with a great number of holes for the juice to run through. Others have only one ſcrew, or arbor, paſſing through the middle of the moveable plank, which deſcends into a kind of ſquare box, full of holes, through which the juices flow, as the arbor is turned.

But that the reader may be enabled to form a more diſtinct idea of theſe preſſes, we ſhall give a draught of the common and great wine-preſs uſed for ſqueezing the juice out of grapes.

A B (plate CIV. *fig.* 2.) is the baſe or pedeſtal and other ſupporters of the common wine-preſs. C, C, the cheeks, which are upright beams, the lower extremities of which are ſunk in the earth, where they are ſtrongly fixed by croſs-bars and maſonry: they are traverſed at top by two beams, the lowermoſt of which is the nut, or receptacle of the ſcrew. D is the ſcrew with its wheel. E the bearer, or large piece of timber on which the wheels reſt, in order to ſink the beams croſſing the planks that cover the grapes, F. G, G, the maye, or planks on which the grapes are diſpoſed, in order to be ſqueezed; theſe planks are cut in notches, to receive the liquor and convey it to a veſſel appropriated to receive it. The maye is ſupported on a maſſive work of maſonry. H is the wheel that ſerves to force down the ſcrew and bearer upon the grapes, which are laid upon the maye in a ſquare heap: this it does by winding off the cord from the wheel of the ſcrew D, by which means the ſcrew and the bearer E, are preſſed down upon the grapes, which are uſually covered with croſs-beams reared above each other. I is a leather-pipe, terminating in two wooden tubes, for conveying the wine from one veſſel to another. K is a large bellows to agitate the wine when it has ſettled into an even ſurface in both veſſels. L the ſame bellows in profile. M is a large fountain, which affords a quick flow. And N is a ſtopple to cloſe the veſſel newly filled, and prevent the wine from running over, upon withdrawing the wooden tube.

A B (*fig.* 3.) repreſents the baſe and other ſupports of the great wine-preſs; C, C, &c. the cheeks, or ſide-beams; D, D, great beams, two in number at leaſt, and frequently four, or even ſix; E, the ſcrew; F, the nut of the preſs; G, the wheel, which, by the help of five or ſix men, turns the ſcrew; and H, the cage, which is an aſſemblage of ſeveral ſtrong pieces of timber formed into a ſquare, and lined with maſonry within. This cage is ten feet long, and four and an half broad on each ſide, and may be either raiſed out of, or ſunk into the pit of maſon-work I; from whence it is exhibited as aſcending in the figure referred. It uſually weighs three thouſand pounds; and being ſuſpended in the manner repreſented, forms, in conjunction with the ſcrew, a lever of an immenſe force for ſqueezing down a bearer upon grapes placed upon the maye K, as in the former figure. See the article WINE.

Cyder PRESS. See CYDER.

Oil PRESS. See OIL-MILL.

PRESS *uſed by Joiners* to keep cloſe the pannels, &c. of wainſcot, conſiſts of two ſcrews, and two pieces of wood four or five inches ſquare, and two or three feet long, whereof the holes at two ends ſerve for nuts to the ſcrews.

PRESS *uſed by Inlayers* reſembles the joiners-preſs, only the pieces of wood are thicker, and only one of them moveable; the other, which is in form of a treſſel, being ſuſtained by two legs joined into it at each end.

This ſerves for ſawing and cleaving of wood required in marquetry. See MARQUETRY.

Founders-PRESS, is a ſtrong ſquare frame, conſiſting of four pieces of wood firmly joined together with tenons, &c. It is of various ſizes: two of them are required to each

each mould, at the two extremes whereof they are placed; ſo as that, by driving wooden wedges between the mould and ſides of the preſs, the two parts of the mould for the metal may be preſſed cloſe together. See the article FOUNDERY.

The book-binders-preſs conſiſts of two large wooden cheeks joined by two ſtrong wooden ſcrews; which, being turned by an iron-bar, draw together or ſet aſunder the cheeks at pleaſure. See the article BOOK-BINDER.

The cheeks are placed flat on a wooden ſtand, in form of a cheſt, into which the cuttings fall. A-ſide of the cheeks are two pieces of wood of the ſame length with the ſcrews, ſerving to direct the cheeks. Upon the cheeks is the ſhaft or ſuſt, to which the cutting-knife is faſtened by a ſcrew, which has its key to diſmount it on occaſion.

The ſhaft conſiſts of ſeveral parts; a wooden ſcrew, which catching within the nut of the two feet that ſuſtain it, brings the knife to the paper, which is faſtened in the preſs. This ſcrew, which is pretty long, has two directories, which reſemble thoſe of the ſcrew of the cheeks. To make the ſhaft ſlide ſquare, that foot of the ſhaft where the knife is not fixed, has a kind of groove directed by a thread faſtened along one of the cheeks. Laſtly, the knife is a piece of ſteel ſix or ſeven inches long, pointed a-top, and ſquare all the reſt.

PRESS, in the woollen manufactory, is a large wooden machine, ſerving to preſs cloaths, ſerges, &c. to render them ſmooth, and give them a gloſs. See plate CIV. *fig.* 4. where ND is a preſs with an iron-ſcrew, and KE a preſs with a wooden ſcrew.

The principal parts of this machine are the cheeks of the preſs, marked A, A, &c. the nut, in which the box is fixed, marked B, B; the windlas, C; an iron-ſcrew, D; a wooden ſcrew, E; a female ſcrew, or box, to receive the male one, F; the bed to lay the folded ſtuff on, K; an iron-lantern, L; and a wooden one, M; and N, the ſtuff in the preſs.

PRESS *for Linens, Silks, &c.* is called a calender. See CALENDER.

For the Rolling and Printing PRESS. See the article PRINTING.

PRESSING, in the manufactures, is the violently ſqueezing a cloth, ſtuff, &c. to render it ſmooth and gloſſy.

There are two methods of preſſing, viz. cold or hot.

As to the former, or cold preſſing, after the ſtuff has been ſcoured, fulled, and ſhorn, it is folded ſquare in equal plaits, and a ſkin of vellum, or paſteboard, put between each plait. Over the whole is laid a ſquare wooden plank, and ſo put into the preſs; which is ſcrewed down tight by means of a lever. After it has lain a ſufficient time in the preſs, they take it out, removing the paſteboards, and lay it up to keep.

Some only lay the ſtuff on a firm table, after plaiting and paſteboarding, cover the whole with a wooden plank, and load it with a proper weight.

The method of preſſing hot is this: when the ſtuff has received the above preparations, it is ſprinkled a little with water, ſometimes gum-water, then plaited equally, and between each two plaits are put leaves of paſteboard; and between every ſixth or ſeventh plait, as well as over the whole, an iron or braſs-plate well heated in a kind of furnace. This done, it is laid upon the preſs, and forcibly ſcrewed down.

Under this preſs are laid five, ſix, &c. pieces at the ſame time, all furniſhed with their paſteboards and iron-plates. When the plates are well cold, the ſtuffs are taken out and ſtitched a little together to keep them in the plaits.

This manner of preſſing was only invented to cover the defects of the ſtuffs; and accordingly it has been frequently prohibited.

PRESSURE, or PRESSION, in general, denotes the ſqueezing a thing cloſe together. See the articles FLUID, AIR, &c.

PREST, a duty in money paid by the ſheriff upon his account in the exchequer, for money remaining in his hands.

PREST-MONEY, the money given to new liſted ſoldiers, ſo called becauſe it binds thoſe who receive it, to be ready at all times.

PRESTATION ſignifies the payment of a certain ſum by arch-deacons, and other clergymen, annually to their biſhop.

PRESTER, in phyſiology, a meteor conſiſting of an exhalation, thrown from the clouds downwards with ſuch violence, as by the colliſion it is ſet on fire. It differs from the thunderbolt in the manner of its inflammation, and its burning and breaking every thing it touches with greater vehemence.

PRESTO, in the Italian muſic, intimates to perform very quick, as *preſtiſſimo* does extremely ſo.

PRESUMPTION, in law, ſignifies an opinion or belief of a thing.

PRESUMPTIVE HEIR, the ſame with heir at law. See HEIR.

PRETERIT, *Præteritum*, in grammar, a tenſe which expreſſes the time paſt, or an action completely finiſhed; as, *ſcripſi*, I have wrote.

PRETERITION, in rhetoric, a figure whereby, in pretending to paſs over a thing untouched, we take a ſummary view of it.

PRETEXT, a colour or motive, whether real or feigned, for doing ſomething.

PRETOR, or PRÆTOR, a magiſtrate among the ancient Romans, not unlike our lord chief juſtices, or lord chancellor, or both in one; as being veſted with the power of diſtributing juſtice among the citizens.

PRETORIAN GUARDS, *Prætoriæ Cohortæ*, in Roman antiquity, were the emperor's guards, who at length were increaſed to ten thouſand; they had this denomination, according to ſome, from their being ſtationed at a place in the palace called Pretorium: their commander was ſtyled *præfectus prætorii*.

PRETORIUM, *Prætorium*, among the Romans, denoted the hall or court wherein the pretor lived, and wherein he adminiſtered juſtice.

PREVENTER, among ſeamen, a term given to ſeveral ropes whoſe uſes are to ſupply the places of others, which may be carried away by the great force which they ſuſtain, as

PREVENTER-BRACE implies an additional or ſtrengthening brace to ſupport the yard, and act in concert with the common braces, when the yard ſuffers an extraordinary ſtrain, as by a weight of ſail in a quartering wind. See BRACE.

PREVENTER-SHROUD, and PREVENTER-STAY, alſo denote thoſe which are placed to ſupport and co-operate with the common ones. See the articles SHROUD and STAY.

PRIAPISM, πριαπισμος, in medicine, a continual and painful erection of the penis.

PRIAPUS, in medicine, denotes the genital parts in men.

It denotes, in antiquity, a fabulous deity, revered very much for the extraordinary ſize of his parts.

PRICKING, in the ſea-language, is to make a point on the plat or chart, near about where the ſhip then is, or is to be at ſuch a time, in order to find the courſe they are to ſteer.

PRIEST, *Sacerdos*, a perſon ſet apart for the performance of ſacrifice, and other offices of religion.

PRIEST, *Preſbyter*, in the Chriſtian church, is a perſon inveſted with holy orders; in virtue of which he has a power to preach, marry, adminiſter the ſacraments, &c.

PRIMÆ VIÆ, among phyſicians, denote the whole alimentary duct; including the oeſophagus, ſtomach, and inteſtines, with their appendages.

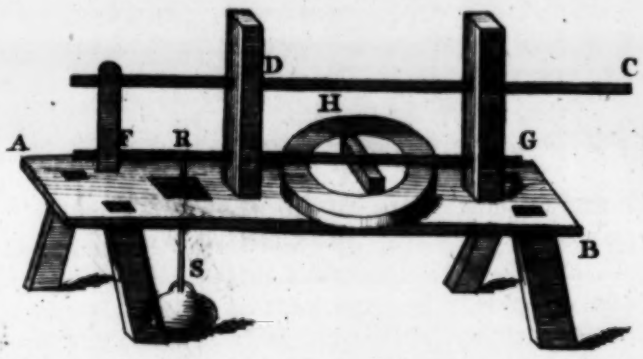
PRIMAGE, in commerce, a ſmall duty at the water-ſide, uſually about twelve-pence per ton, or ſix-pence a bale, due to the maſter and mariners of a ſhip; to the maſter, for the uſe of ropes, &c. to diſcharge the goods; and to the mariners, for the loading or unloading of the veſſel.

PRIMARY-PLANET, in aſtronomy, one that revolves round the ſun as a center.

PRIMATE, *Primas*, in church-polity, an arch-biſhop who is inveſted with a juriſdiction over other biſhops.

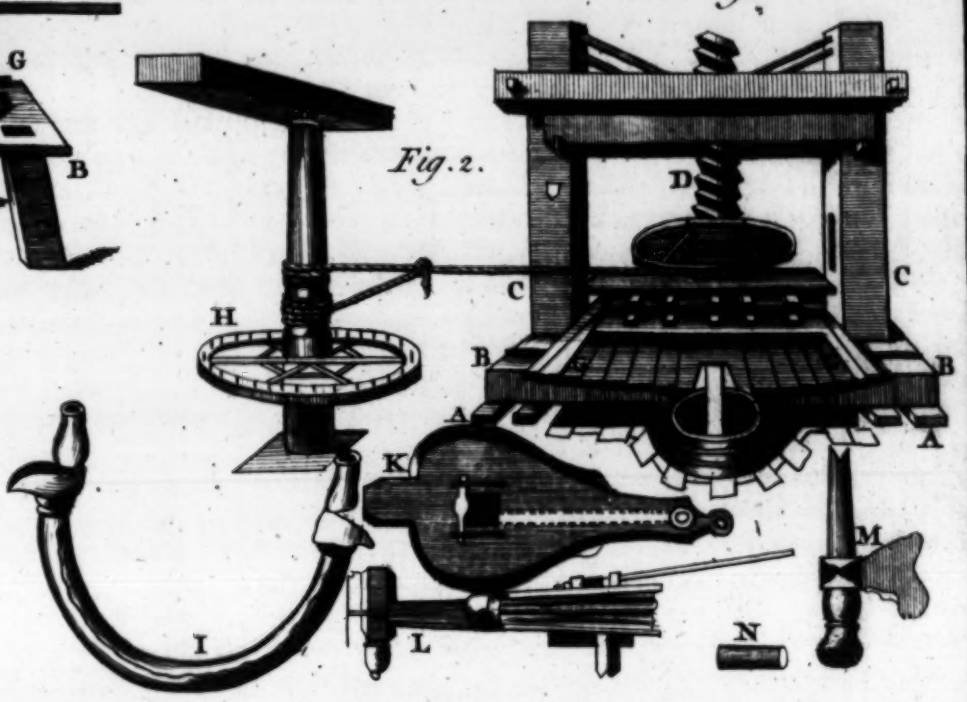
PRIME, *Primus*, an appellation given to whatever is firſt in order, degree, or dignity, among ſeveral things of the

Fig. 1. Cheese Preſs.



The Common Wine Preſs.

Fig. 2.



The Great Wine Preſs.

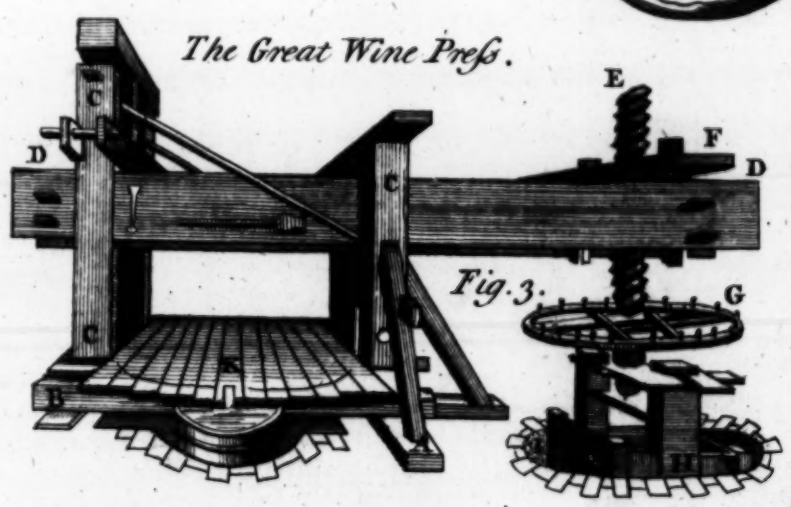


Fig. 3.

Printing Preſs.

Fig. 6.

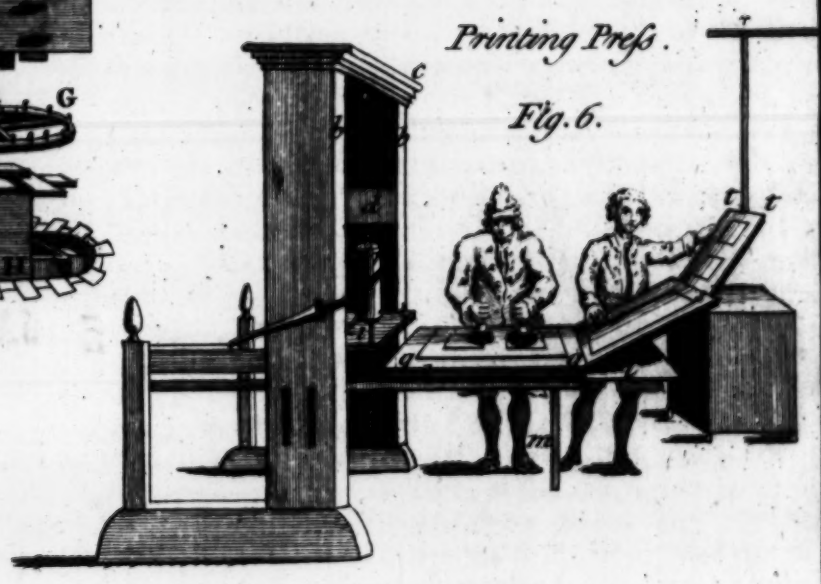
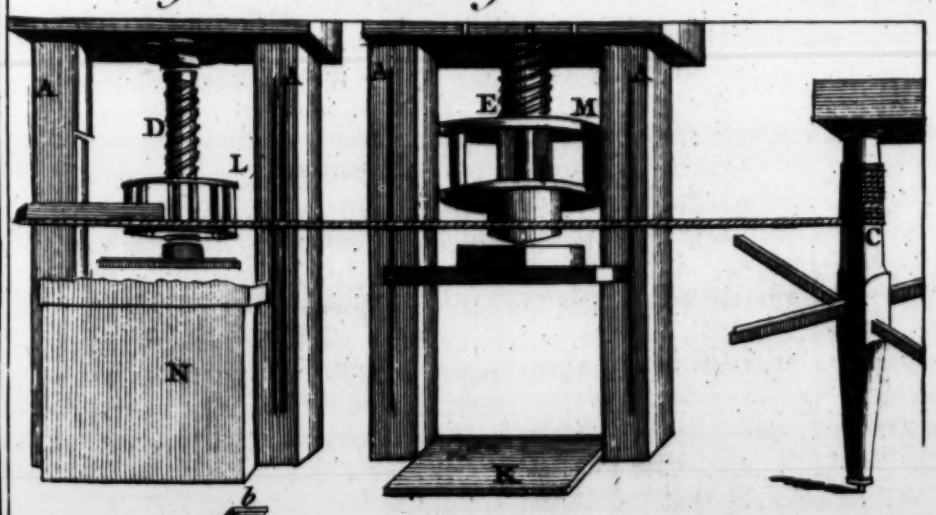
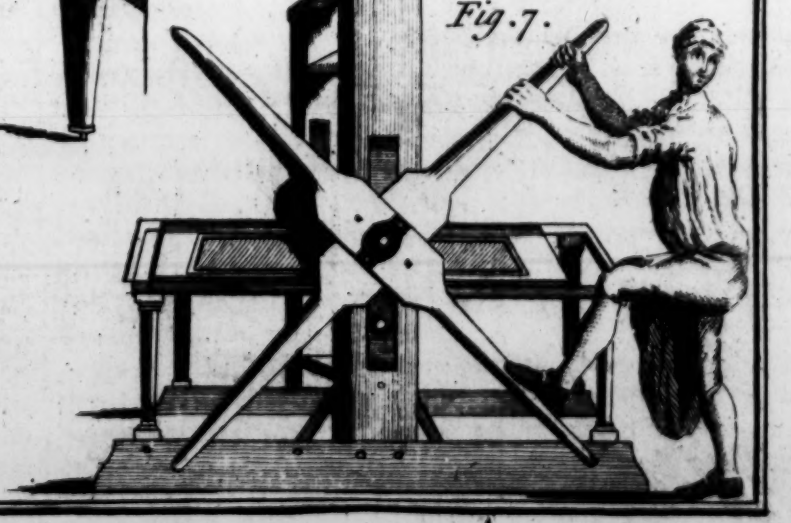


Fig. 4. The Clothiers Preſs.



Rolling Preſs.

Fig. 7.



Printing.

Fig. 5.

Prism.

Fig. 8.

5 JA 59

the ſame or like kind; thus, we ſay, the prime miniſter, prime coſt, &c.

PRIME is ſometimes uſed to denote the ſame with decimal, or the tenth part of an unit. See the article DECIMAL.

In weights, it ſtands for the twenty-fourth part of a grain. See the articles WEIGHT and GRAIN.

PRIME *Figure*, in geometry, one which cannot be divided into any other figures more ſimple than itſelf, as a triangle among planes, and the pyramid among ſolids. See FIGURE.

For PRIME *Numbers*, in arithmetic, ſee the article NUMBER.

PRIME *of the Moon* is the new moon, when ſhe firſt appears, which is about three days after the change. See MOON, and GOLDEN *Number*.

PRIME *Vertical* is that vertical circle, which paſſes through the poles of the meridian, or the eaſt and weſt points of the horizon; whence dials projected on the plane of this circle are called prime vertical, or north and ſouth dials.

PRIMING, or *Prime of a Gun*, is the gunpower put into the pan or touch-hole of a piece, to give it fire thereby. And this is the laſt thing done in charging.

PRIMING, among painters, ſignifies the laying on of the firſt colour.

PRIMITIÆ, the firſt fruits gathered of the earth, of which the ancients made preſents to the gods.

PRIMITIVE, in grammar, is a root or original word in a language, in contradiſtinction to derivative: thus, *God* is a primitive, *godly* derivative, and *god-like* a compound.

PRIMOGENITURE, *Primogenitura*, the right of firſt-born.

PRIMUM MOBILE, in the Ptolemaic ſyſtem of aſtronomy. See MOBILE.

PRINCE, *Princeps*, in polity, a perſon inveſted with the ſupreme command of a ſtate, independent of any ſuperior.

PRINCE alſo denotes a perſon who is a ſovereign in his own territories, yet holds of ſome other as his ſuperior.

PRINCE *of the Senate*, in old Rome, the perſon who was called over firſt in the roll of ſenators, whenever it was renewed by the cenſors: he was always of conſular and cenſorian dignity. See SENATE.

PRINCE'S FEATHER, in botany, the ſame with amaranth. See AMARANTHUS.

PRINCIPAL, *Principalis*, the chief and moſt neceſſary part of a thing.

In commerce, principal is the capital of a ſum due or lent, ſo called in oppoſition to intereſt.

It alſo denotes the firſt fund put by partners into a common ſtock, by which it is diſtinguiſhed from the calls or acceſſions afterwards required.

PRINCIPAL *Point*, in perſpective, is a point in the perſpective plane, upon which a line drawn from the eye perpendicular to the plane falls. It is in the interſection of the horizontal and vertical plane, and called the point of ſight and point of the eye.

PRINCIPAL RAY, in perſpective, that which paſſes perpendicularly from the ſpectator's eye to the perſpective plane.

PRINCIPLE, *Principium*, in general, is uſed for the cauſe, ſource, or origin of any thing.

PRINCIPLES, in phyſics, are often confounded with elements, or the firſt and ſimpleſt parts whereof natural bodies are compounded, and into which they are again reſolvible by the force of fire. See ELEMENT.

PRINT, the impreſſion taken from a copper-plate.

A print may be taken off, ſo as that the out-lines and principal ſtrokes may be exactly copied for graving, in the following manner. If the print be not above a year or two old, the paper need only be well moiſtened with water, as for printing; but if it be more ancient, it ſhould be laid to ſoak all night in water, and afterwards hung in the air till it becomes dry enough for the preſs. The paper thus prepared is to be laid with its printed ſide next the plate, thinly caſed over with white wax; and is thus to be communicated to the rolling-preſs, whereby an impreſſion of the cut will be gained.

PRINTER, a perſon who compoſes and takes impreſſions from moveable characters ranged in order, or from plates engraven, by means of ink, and a preſs; or from blocks of wood cut in flowers, &c. and taken off in various colours on calicoes, linens, ſilks, &c.

PRINTING, the art of taking impreſſions from characters or figures moveable, or immoveable, on paper, linen, ſilk, &c. There are three kinds of printing; the one from moveable letters for books; the other from copper-plates for pictures; and the laſt from blocks, in which the repreſentation of birds, flowers, &c. are cut for printing calicoes, linens, &c. the firſt called common preſs-printing, the ſecond rolling preſs-printing, and the laſt calicoe, &c. printing. The principal difference between the three conſiſts in this, that the firſt is caſt in relievo in diſtinct pieces, the ſecond engraven in creux, and the third cut in relievo, and generally ſtamped, by placing the block upon the material to be printed, and ſtriking upon the back of it.

Progreſs of PRINTING. Who the firſt inventors of the European method of printing books were, in what city, and what year it was ſet on foot, are queſtions long diſputed among the learned. In effect, as the Grecian cities contended for the birth of Homer, ſo do the German printers for that of printing. Mentz, Haerlem, and Straſburg, are the warmeſt on this point of honour, and theſe are left in poſſeſſion of the queſtion, which is not yet decided; though it muſt be owned that Mentz has always had the majority of voices. John Guttemburg, and John Fuſt, of Mentz; John Meutel of Straſburg, and L. John Koſter of Haerlem, are the perſons to whom this honour is ſeverally aſcribed, by their reſpective countrymen; and they have all their advocates among the learned. However, their firſt eſſays were made on wooden blocks, after the Chineſe manner. The book at Haerlem, the vocabulary called Catholicon, and the pieces in the Bodleian library, and that of Bennet-college, are all performed in this way; and the impreſſion appears to have been only given on one ſide of the leaves; after which the two blank ſides were paſted together. But they ſoon found the inconveniences of this method, and therefore bethought themſelves of an improvement; which was by making ſingle letters diſtinct from one another, and theſe being firſt done in wood gave room for a ſecond improvement, which was the making them of metal; and, in order to that, forming moulds, matrices, &c. for caſting them. See LETTER.

From this ingenous contrivance we ought to date the origin of the preſent art of printing, contradiſtinguiſhed from the method practiſed by the Chineſe. And of this Schoeffer, or Scheffer, firſt ſervant, and afterwards partner and ſon in-law of Fuſt, at Mentz, above-mentioned, is pretty generally allowed to be the inventor; ſo that he may properly be reckoned the firſt printer, and the Bible, which was printed with moveable letters in 1450, the firſt printed book; the next was Auguſtine *De Civitate Dei*, then Tully's Offices, printed about the year 1461. In theſe books they left the places of the initial letters blank, and gave them to the illuminers to have them ornamented and painted in gold and azure, in order to render the work more beautiful, and, as ſome think, to make their books paſs for manuſcripts. Thus at preſent in ſome curious works, the initial letter at the beginning of a book, or chapter, is ſometimes left out, and a ſpace is left for its being afterwards printed with various ornaments from a copper-plate.

Some authors tell us, that Fuſt carrying a parcel of Bibles with him to Paris, and offering them to ſale as manuſcripts; the French, upon conſidering the number of books, and their exact conformity to each other, even to a point, and that it was impoſſible for the beſt book-writers to be ſo exact, concluded there was witch-craft in the caſe, and, by their actually indicting him as a conjurer, or threatening to do ſo, extorted from him the ſecret: and hence the origin of the popular ſtory of Dr. Fauſtus.

From Mentz, the art of printing ſoon ſpread itſelf throughout a good part of Europe; Haerlem and Straſburg had it very early; which, as the current of authors repreſent it, occaſioned their pretending to the honour of the invention. From Haerlem it paſſed to Rome in 1467;

and into England in 1468, by means of Tho. Bourchier, archbiſhop of Canterbury, who ſent W. Turner, maſter of the robes, and W. Caxton, merchant, to Haerlem to learn the art. Theſe privately prevailing with Corſeilles, an under workman, to come over, a preſs was ſet up at Oxford, and an edition of Ruffinus on the Creed was printed the ſame year in octavo. From Oxford, Caxton brought it to London about the year 1470, and the ſame year it was carried to Paris. Hitherto there had been nothing printed but in Latin, and the vulgar tongues; and this firſt in Roman characters, then in Gothic, and at laſt in Italic: but in 1480, the Italians caſt a ſet of Greek types, and they have alſo the honour of the firſt Hebrew editions, which were printed about the ſame time with the Greek. Towards the end of the ſixteenth century there appeared various editions of books in Syriac, Arabic, Perſian, Armenian, Coptic, or Egyptian characters, ſome to gratify the curioſity of the learned, and others for the uſe of the Chriſtians of the Levant. Out of Europe the art of printing has been carried into the three other parts of the world: for Aſia, we ſee impreſſions of books at Goa, and in the Philippines; at Morocco, for Africa; at Mexico, Lima, Philadelphia, New York, Boſton, &c. for America. The Turks, indeed, rigorouſly prohibit printing throughout their empire, as imagining that the too frequent communication with books might occaſion ſome change in their religion and government; yet the Jews have ſeveral editions of their books printed at Theſſalonia, and even at Conſtantinople.

Method of PRINTING. The printing-letters or types, as they are ſometimes called, we have already taken notice of, and have deſcribed the method of forming and caſting them under the articles LETTER and LETTER-FOUNDERY.

The workmen employed in the art of printing are of two kinds; compoſitors, who range and diſpoſe the letters into words, lines, pages, &c. according to the copy delivered them by the author; and preſſmen, who apply ink upon the ſame, and take off the impreſſion. The types being caſt, the compoſitor diſtributes each kind by itſelf among the diviſions of two wooden frames, an upper and an under one, called caſes; each of which is divided into little cells or boxes. Thoſe of the upper caſe are in number ninety-eight; theſe are all of the ſame ſize, and in them are diſpoſed the capitals, ſmall-capitals, accented letters, figures, &c. the capitals being placed in alphabetical order. In the cells of the lower caſe, which are fifty-four, are placed the ſmall letters with the points, ſpaces, &c. The boxes are here of different ſizes, the largeſt being for the letters moſt uſed; and theſe boxes are not in alphabetical order, but the cells which contain the letters oftenеſt wanted, are neareſt the compoſitor's hand. Each caſe is placed a little aſlope, that the compoſitor may the more eaſily reach the upper boxes. The inſtrument in which the letters are ſet is called a compoſing-ſtick, ſee plate CIV. *fig.* 5. which conſiſts of a long and narrow plate of braſs or iron, &c. *c c*, on the right ſide of which ariſes a ledge *b b*, which runs the whole length of the plate, and ſerves to ſuſtain the letters, the ſides of which are to reſt againſt it: along this ledge is a row of holes, which ſerves for introducing the ſcrew *f*, in order to lengthen or ſhorten the extent of the line, by moving the ſliders *e*, *d*, farther from, or nearer to, the ſhort ledge at the end *a*. Where marginal notes are required in a work, the two ſliding pieces *e*, *d*, are opened to a proper diſtance from each other; in ſuch a manner as that while the diſtance between *d* and *c* forms the length of the line in the text, the diſtance between the two ſliding pieces forms the length of the lines for the notes on the ſide of the page. Before the compoſitor proceeds to compoſe, he puts a rule, or thin ſlip of braſs-plate, cut to the length of the line, and of the ſame height as the letter, in the compoſing ſtick, againſt the ledge, for the letter to bear againſt. Things thus prepared, the compoſitor having the copy lying before him, and his ſtick in his left hand, his thumb being over the ſlider *d*; with the right he takes up the letters, ſpaces, &c. one by one, and places them againſt the rule, while he ſupports them with his left thumb, by preſſing them to the end of the ſlider *d*; the other hand being conſtantly employed in ſetting in more letters: the whole being performed with a degree of expedition and addreſs not eaſy to be imagined.

A line being thus compoſed, if it end with a word or ſyllable, and exactly fill the meaſure, there needs no farther care; otherwiſe more ſpaces are to be put in, or elſe the diſtances leſſened between the ſeveral words, in order to make the meaſure quite full; ſo that every line may end even. The ſpaces here uſed are pieces of metal exactly ſhaped like the ſhanks of the letters; theſe are of various thickneſſes, and ſerve to ſupport the letters, and to preſerve a proper diſtance between the words; but not reaching ſo high as the letters, they make no impreſſion when the work is printed. The firſt line being thus finiſhed, the compoſitor proceeds to the next; in order to which he moves the braſs-rule from behind the former, and places it before it, and thus compoſes another line againſt it, after the ſame manner as before: going on thus till his ſtick is full, when he empties all the lines contained in it into the gally. See GALLY.

The compoſitor then fills and empties his compoſing ſtick, as before, till a complete page be formed, when he ties it up with a cord or packthread, and ſetting it by, proceeds to the next, till the number of pages to be contained in a ſheet is completed: which done, he carries them to the impoſing-ſtone, there to be ranged in order, and faſtened together in a frame called a chaſe, and this is termed impoſing. The chaſe is a rectangular iron-frame, of different dimenſions, according to the ſize of the paper to be printed, having two croſs pieces of the ſame metal, called a long and ſhort-croſs, mortiſed at each end ſo as to be taken out occaſionally. By the different ſituation of theſe croſſes the chaſe is fitted for different volumes: for quartos and octaves, one tranſverſes the middle lengthwiſe, the other broadwiſe, ſo as to interſect each other in the center: for twelves and twenty-fours, the ſhort croſs is ſhifted nearer to one end of the chaſe: for folios, the long croſs is left entirely out, and the ſhort one left in the middle; and for broad-ſides, both croſſes are ſet aſide.

To dreſs the chaſe, or range and fix the pages therein, the compoſitor makes uſe of a ſet of furniture, conſiſting of ſlips of wood of different dimenſions, and about half an inch high, that they may be lower than the letters: ſome of theſe are placed at the top of the pages, and called head-ſticks; others between them to form the inner margin; others on the ſides of the croſſes to form the outer margin, where the paper is to be doubled; and others in the form of wedges to the ſides and bottom of the pages. Thus all the pages being placed at their proper diſtances, and ſecured from being injured by the chaſe and furniture placed about them; they are all united, and faſtened together by driving ſmall pieces of wood called quoins, cut in the wedge-form, up between the ſlanting ſide of the foot and ſide ſticks and the chaſe, by means of a piece of hard wood and a mallet; and all being thus bound faſt together, ſo that none of the letters will fall out, it is ready to be committed to the preſſman. In this condition the work is called a form; and as there are two of theſe forms required for every ſheet, when both ſides are to be printed, it is neceſſary the diſtances between the pages in each form ſhould be placed with ſuch exactneſs, that the impreſſion of the pages in one form ſhall fall exactly on the back of the pages of the other, which is called regiſter.

As it is impoſſible but that there muſt be ſome miſtakes in the work, either through the overſight of the compoſitor, or by the caſual tranſpoſition of letters in the caſes; a ſheet is printed off, which is called a proof, and given to the corrector; who reading it over, and rectifying it by the copy, by making the alterations in the margin, it is delivered back to the compoſitor to be corrected. For the characters uſed in correcting a ſheet for the compoſitor, ſee CORRECTION.

The compoſitor, then unlocking the form upon the correcting-ſtone, by looſening the quoins or wedges which bound the letters together, rectifies the miſtakes by picking out the faulty or wrong letters with a ſlender ſharp-pointed ſteel-bodkin, and puts others into their places; but when there are conſiderable alterations, and particularly where inſertions or omiſſions are to be made, he

he is under a neceſſity of over-running. Thus, if one or more words to be inſerted in a line cannot be got in, by changing the ſpaces of a line for leſſer ones, part of the line muſt be put back into the cloſe of the preceding one, or forward into the beginning of the ſubſequent one, and this continued till the words are got in. After this another proof is made, ſent to the author, and corrected as before; and, laſtly, there is another proof, called a reviſe, which is made in order to ſee whether all the miſtakes marked in the laſt proof are corrected.

The preſſman's buſineſs is to work off the forms thus prepared and corrected by the compoſitor; in doing which there are four things required, paper, ink, balls, and a preſs. To prepare the paper for uſe, it is to be firſt wetted by dipping ſeveral ſheets together in water: theſe are afterwards laid in a heap over each other; and to make them take the water equally, they are all preſſed cloſe down with a weight at the top. The ink is made of oil and lamp-black, for the manner of preparing which, ſee *Printing* INK.

The balls by which the ink is applied on the forms, are a kind of wooden funnels with handles, the cavities of which are filled with wool or hair, as is alſo a piece of alum-leather or pelt nailed over the cavity, and made extremely ſoft by ſoaking in urine, and by being well rubbed. One of theſe the preſſman takes in each hand, and applying one of them to the ink-block, dabbs and works them together to diſtribute the ink equally, and then blackens the form which is placed on the preſs, by beating with the balls upon the face of the letter.

The printing-preſs repreſented in plate CIV. *fig.* 6. is a very curious, tho' complex machine; the body conſiſts of two ſtrong cheeks *a a*, placed perpendicularly, and joined together by four croſs-pieces; the cap *b*; the head *c*, which is moveable, being partly ſuſtained by two iron-pins, or long bolts, that paſs the cap; the ſhelves *d d*, which ſerve to keep ſteady a part called the hoſe, and the winter *e*, which bears the carriage, and ſuſtains the effort of the preſs beneath. The ſpindle *f* is an upright piece of iron pointed with ſteel, having a male-ſcrew which goes into the female one in the head about four inches. Through the eye *g* of this ſpindle is faſtened the bar *k*, by which the preſſman makes the impreſſion. Part of the ſpindle is incloſed in a ſquare wooden frame called the hoſe, *h*, and its point works into a braſs-pan ſupplied with oil, which is fixed to an iron-plate let into the top of the platten. At each corner of the hoſe, there is an iron-hook faſtened with pack-thread to thoſe at each corner of the platten *i*, in ſuch a manner as to keep it perfectly level. The carriage *l l* is placed a foot below the platten, having its fore-part ſupported by a prop called the fore-ſtay, while the other reſts on the winter. On this carriage, which ſuſtains the plank, are nailed two long iron-bars or ribs, and on the plank are nailed ſhort pieces of iron or ſteel called cramp-irons, equally tempered with the ribs, and which ſlide upon them when the plank is turned in or out. Under the carriage is fixed a long piece of iron called the ſpit, with a double wheel in the middle, round which leather-girts are faſtened, nailed to each end of the plank; and to the outſide of the ſpit is fixed a rounce *m*, or handle to turn round the wheel. Upon the plank is a ſquare frame or coffin, in which is incloſed a poliſhed ſtone on which the form *n* is laid; at the end of the coffin are three frames, viz. the two tympans and friſket: the tympans *o* are ſquare, and made of three ſlips of very thin wood, and at the top a piece of iron ſtill thinner; that called the outer tympan is faſtened with hinges to the coffin; they are both covered with parchment; and between the two are placed blankets, which are neceſſary to take off the impreſſion of the letters upon the paper. The friſket *p* is a ſquare frame of thin iron, faſtened with hinges to the tympan; it is covered with paper cut in the neceſſary places, that the ſheet, which is put between the friſket and the great or outward tympan, may receive the ink, and that nothing may hurt the margins. To regulate the margins, a ſheet of paper is faſtened upon this tympan, which is called the tympan-ſheet, and on each ſide is fixed an iron-point, which makes two holes in the ſheet, which is to be placed on the ſame points, when the impreſſion is to be made on the other ſide. In preparing the preſs for working, the parchment which covers the outer tympan is wetted till it is very ſoft, in order to render the impreſſion more equable; the blankets are then put in, and ſecured from ſlipping by the inner tympan; then while one preſſman is beating the letter with the balls *q*, covered with ink taken from the ink-block; the other perſon places a ſheet of white paper on the tympan-ſheet, turns down the friſket upon it to keep the paper clean and prevent its ſlipping; then bringing the tympans upon the form, and turning the rounce, he brings the form with the ſtone, &c. weighing about 300 pounds weight, under the platten; pulls with the bar, by which means the platten preſſes the blankets and paper cloſe upon the letter, whereby half the form is printed; then eaſing the bar, he draws the form ſtill forward, gives a ſecond pull, and letting go the bar, turns back the form, takes up the tympans and friſket, takes off the printed ſheet and lays on a freſh one; and this is repeated till he has taken off the impreſſion upon the full number of ſheets the edition is to conſiſt of. One ſide of the ſheet being thus printed, the form for the other is laid upon the preſs, and worked off in the ſame manner.

Chineſe PRINTING is performed from wooden planks or blocks, cut like thoſe uſed in printing of callico, paper, cards, &c.

Rolling-Preſs-PRINTING is employed in taking off prints or impreſſions from copper-plates engraven, etched, or ſcraped as in mezzotintos.

This art is ſaid to have been as ancient as the year 1540, and to owe its origin to Finiguerra, a Florentine goldſmith, who pouring ſome melted brimſtone on an engraven plate, found the exact impreſſion of the engraving left in the cold brimſtone, marked with black taken out of the ſtrokes by the liquid ſulphur: upon this he attempted to do the ſame on ſilver plates with wet paper, by rolling it ſmoothly with a roller; and this ſucceeded: but this art was not uſed in England till the reign of king James I. when it was brought from Antwerp by Speed. The form of the rolling-preſs, the compoſition of the ink uſed therein, and the manner of applying both in taking off prints, are as follow.

The rolling-preſs A L (plate CIV. *fig.* 7.) may be divided into two parts, the body and carriage: the body conſiſts of two wooden cheeks, P, P, placed perpendicularly on a ſtand or foot L M, which ſuſtains the whole preſs. From the foot likewiſe ariſe four other perpendicular pieces *c*, *c*, *c*, *c*, joined by other croſs or horizontal ones, *d*, *d*, *d*, which ſerve to ſuſtain a ſmooth even plank or table H I K, about four feet and a half long, two feet and a half broad, and an inch and a half thick. Into the cheeks go two wooden cylinders or rollers, D E, F G, about ſix inches in diameter, borne up at each end by the cheeks, whoſe ends, which are leſſened to about two inches diameter, and called trunnions, turn in the cheeks between two pieces of wood in form of half moons, lined with poliſhed iron to facilitate the motion. Laſtly, to one of the trunnions of the upper roller is faſtened a croſs, conſiſting of two levers, A, B, or pieces of wood traverſing each other, the arms of which croſs ſerve inſtead of the bar or handle of the letter-preſs, by turning the upper roller, and when the plank is between the two rollers, giving the ſame motion to the under one, by drawing the plank forward and backward.

The ink uſed for copper-plates, is a compoſition made of the ſtones of peaches and apricots, the bones of ſheep, and ivory, all well burnt, and called Frankfort-black, mixt with nut oil that has been well boiled, and ground together on a marble, after the ſame manner painters do their colours.

The method of printing from copper-plates is as follows: they take a ſmall quantity of this ink on a rubber made of linen-rags, ſtrongly bound about each other, and therewith ſmear the whole face of the plate as it lies on a grate over a charcoal fire. The plate being ſufficiently inked, they firſt wipe it over with a foul rag, then with the palm of the left hand, and then with that of the right; and to dry the hand and forward the wiping, they rub it from time to time on whiting. In wiping the plate perfectly clean, yet without taking the ink out of the engraving, the addreſs of the workman conſiſts. The plate thus prepared is laid on the plank of the preſs; over the

plate is laid the paper, firſt well moiſtened, to receive the impreſſion, and over the paper two or three folds of flannel. Things thus diſpoſed, the arms of the croſs are pulled, and by that means, the plate with its furniture, paſſed through between the rollers, which pinching very ſtrongly, yet equally, preſſes the moiſtened paper into the ſtrokes of the engraving, whence it licks out the ink.

PRIOR, in general, ſomething before or nearer the beginning than another, to which it is compared.

PRIOR, more particularly, denotes the ſuperior of a convent of monks, or the next under the abbot.

Grand PRIOR is the ſuperior of a large abbey, where ſeveral ſuperiors are required.

PRISAGE, *Priſagium*, that part or ſhare which belongs to the king, or admiral, out of prizes taken at ſea from an enemy: this is uſually a tenth part. See the article PRIZE.

PRISCILLIANISTS, in church hiſtory, Chriſtian heretics, ſo called from their leader Priſcillian, a Spaniard by birth, and biſhop of Avila. He is ſaid to have practiſed magic, and to have maintained the principal errors of the Manichees; but this peculiar tenet was, that it is lawful to take falſe oaths, in order to ſupport one's cauſe and intereſt.

PRISM, *Priſma*, in geometry, an oblong ſolid contained under more than four planes, whoſe baſes are equal, parallel, and alike ſituated.

The word is Greek, ſignifying any thing ſawn, and derived from πριω, or πριζω, to ſaw.

The priſm is generated by the motion of a rectilinear figure, as A, B, C (plate CIV. *fig.* 8.) deſcending always parallel to itſelf, along the right line A E.

If the deſcribent be a triangle, the body is ſaid to be a triangular priſm; if ſquare, a quadrangular one, &c.

From the geneſis of the priſm, it is evident it has two equal and oppoſite baſes; and it is terminated by as many parallelograms as the baſe conſiſts of ſides; and that all the ſections of a priſm parallel to its baſe are equal.

Every triangular priſm may be divided into three equal pyramids.

PRISM, in dioptrics, a triangular glaſs-priſm, much uſed in experiments about the nature of light and colours.

PRISMOID, *Priſmoides*, in geometry, a ſolid figure, bounded by ſeveral planes, whoſe baſes are right-angled parallelograms, parallel, and alike ſituated.

PRISON, a goal, or place of confinement. See the article GOAL.

PRISONER, a perſon reſtrained or kept in priſon upon an action civil or criminal, or upon commandment: and one may be a priſoner on matter of record or matter of fact. A priſoner upon matter of record is he who being preſent in court, is by the court committed to priſon; and the other is one carried to priſon upon an arreſt, whether it be by the ſheriff, conſtable, or other officer.

PRIVATEERS, in maritime affairs, a kind of private ſhips of war, fitted out by private perſons at their own expence; who have leave granted them to keep what they can take from the enemy, allowing the admiral his ſhare.

PRIVATION, in general, denotes the abſence or want of ſomething; in which ſenſe, darkneſs is only a privation of light. See LIGHT.

PRIVATIVE, in grammar, a particle which, when prefixed to a word, changes it into a contrary ſenſe.

Among the Greeks the α is uſed as a privative, and among the Latins, *in*. The Engliſh, French, &c. borrow both the Greek and Latin privatives.

PRIVATIVE QUANTITY, or NEGATIVE QUANTITY, in algebra, denotes a quantity leſs than nothing, in oppoſition to affirmative or poſitive; and is expreſſed by the ſign (−) minus, prefixed thereto.

PRIVILEGE, in law, ſome peculiar benefit granted to certain perſons or places, contrary to the uſual courſe of the law.

Privileges are ſaid to be perſonal or real. Perſonal privileges are ſuch as are extended to peers, embaſſadors, members of parliament and of the convocation, and their menial ſervants, &c.

PRIVY, in law, denotes one who is partaker, or has an intereſt in an affair.

PRIZE, or PRISE, in maritime affairs, a veſſel taken at ſea from the enemies of a ſtate, or from pirates; and that either by a man of war, a privateer, &c. having a commiſſion for that purpoſe.

PROBABILITY is nothing but the appearance of the agreement or diſagreement of two ideas by the intervention of proofs whoſe connection is not conſtant and immutable, or is not perceived to be ſo; but is, or appears for the moſt part to be ſo, and is enough to induce the mind to judge the propoſition to be true or falſe, rather than the contrary.

Of probability there are degrees from the neighbourhood of certainty and demonſtration, quite down to improbability and unlikeneſs, even to the confines of impoſſibility; and alſo degrees of aſſent, from certain knowledge, and, what is next to it, full aſſurance and confidence, quite down to conjecture, doubt, diſtruſt, and diſbelief.

That propoſition then is probable for which there are arguments or proofs to make it paſs or be received for true. Probability being then to ſupply the defect of our knowledge, is always converſant about a thing whereof we have no certainty, but only ſome inducements to receive it for true. The grounds of it are, in ſhort, theſe two following:

Firſt, the conformity of any thing with our own knowledge, experience, or obſervation.

Secondly, the teſtimony of others vouching their obſervation and experience. In the teſtimony of others is to be conſidered, 1. the number; 2. the integrity; 3. the ſkill of the witneſſes; 4. the deſign of the author, if it be a teſtimony cited out of a book; 5. the conſiſtency of the parts and circumſtances of the relation; 6. contrary teſtimonies. The mind, before it rationally aſſents or diſſents to any probable propoſition, ought to examine all the grounds of probability, and ſee how they make more or leſs for or againſt it; and, upon a due ballancing the whole, reject or receive it, with a more or leſs firm aſſent, according to the preponderancy of the greater grounds of probability on one ſide or the other.

PROBABILITY, in poetry, the appearance of truth in the fable or action of a poem.

PROBATE of a will or teſtament, in law, is the exhibiting and proving of laſt wills and teſtaments before the eccleſiaſtical judge delegated by the biſhop who is ordinary at the place where the party died.

PROBATION, in the univerſities, is the examination and trial of a ſtudent who is about to take his degrees.

PROBATION, in a monaſtic ſenſe, ſignifies the year of novitiate which a religious moſt paſs in a convent, to prove his virtue and vocation, and whether he can bear the ſeverities of the rule.

PROBATIONER, in the church of Scotland, a ſtudent in divinity, who bringing a certificate from a profeſſor in an univerſity of his good morals, and his having performed his exerciſes to approbation, is admitted to undergo ſeveral trials.

PROBATOR, in law, one who undertakes to prove a crime charged upon another; properly, an accomplice in the crime who impeaches others.

PROBATUM EST, *it is proved*, a term frequently ſubjoined to a receipt for the cure of ſome diſeaſe.

PROBE, a ſurgeon's inſtrument for examining the circumſtances of wounds, ulcers, and other cavities, ſearching for ſtones in the bladder, &c.

PROBLEM, προβλημα, in logic, a propoſition that neither appears abſolutely true or falſe; and, conſequently, may be aſſerted either in the affirmative or negative.

PROBLEM, in geometry, is a propoſition, wherein ſome operation, or conſtruction is required; as to divide a line, or angle, erect or let fall perpendiculars, &c.

PROBLEM, in algebra, is a queſtion or propoſition which requires ſome unknown truth to be inveſtigated, and the truth of the diſcovery demonſtrated. So that a problem is to find a theorem.

Kepler's PROBLEM, in aſtronomy, is the determining a planet's

a planet's place from the time; ſo called from Kepler, who firſt propoſed it. It was this, to find the poſition of a right line, which, paſſing through one of the foci of an ellipſis, ſhall cut off an area deſcribed by its motion, which ſhall be in any given proportion to the whole area of the ellipſis. See ANOMALY.

Deliacal PROBLEM, or a problem for finding two mean proportionals between two given lines, in geometry, is the doubling of the cube; it was ſo called from the people of Delos, who, upon conſulting the oracle for a remedy againſt a plague, were anſwered, that the plague ſhould ceaſe when Apollo's altar, which was in form of a cube, ſhould be doubled. See the article DUPLICATION.

PROBLEMATICAL RESOLUTION, in algebra, a method of ſolving difficult queſtions by certain rules, called canons.

PROBOSCIS, in natural hiſtory, is the trunk or ſnout of an elephant, and ſome other animals and inſects.

PROCATARCTIC CAUSE, in medicine, the pre-exiſting, or pre-diſpoſing cauſe or occaſion of a diſeaſe. See DISEASE.

PROCEDURE, or PROCEEDINGS, in law, the courſe of the ſeveral acts, inſtructions, &c. of a proceſs or lawſuit.

It is either civil or criminal: civil procedure relates to the eſtate alone; criminal or extraordinary procedure, where the perſon is proſecuted.

PROCEED, among merchants, whatever ariſes from any thing.

PROCESS, in law, denotes the proceedings in any cauſe, real or perſonal, civil or criminal, from the original writ to the end thereof.

PROCESS, in chemiſtry, the whole courſe of an experiment or ſeries of operations, tending to produce ſomething new.

PROCESS, *Proceſſus*, in anatomy, denotes any protuberance or eminence in a bone.

PROCLAMATION, a public notice given of any thing of which the king thinks proper to advertiſe his ſubjects.

PROCONDYLUS, a name given to the firſt joint of each finger.

PROCONSUL, a Roman magiſtrate, ſent to govern a province with conſular authority.

PROCONSUL, in our ancient law books, is the ſame with juſtice in eyre. See JUSTICE.

PROCREATION, the begetting and bringing forth children. See GENERATION.

PROCTOR, a perſon commiſſioned to manage another perſon's cauſe in any court of the civil or eccleſiaſtical law.

PROCTORS, in an univerſity, are two officers choſen from among the ſtudents, to ſee good order and exerciſes daily performed.

PROCURATOR, a perſon who has a charge committed to him to act for another.

PROCYON, in aſtronomy, a fixed ſtar of the ſecond magnitude in the conſtellation called Canis Minor.

PRODUCING, in geometry, ſignifies the drawing out a line farther, till it have any aſſigned length.

PRODUCT, in arithmetic and geometry, the factum of two or more numbers, or lines, &c. into one another: thus $5 \times 4 = 20$, the product required.

PRODUCTION, in anatomy, the ſame with proceſs. See PROCESS.

PROEM, a term ſometimes uſed for prelude or preface.

PROEMPTOSIS, in aſtronomy, the appearance of the new moon a day later, by reaſon of the lunar equation. See MOON.

PROFESSOR, in the univerſities, a perſon who teaches or reads public lectures in ſome art or ſcience from a chair for the purpoſe.

PROFILE, in architecture, the draught of a building, fortification, &c. wherein are expreſſed the ſeveral heights, widths, and thickneſſes, ſuch as they would appear, were the building cut down perpendicularly from the roof to the foundation. It is alſo called ſection, or orthographical ſection, and by Vitruvius, ſciagraphy. This is the ſame as elevation, in oppoſition to a plan, which is called ichnography.

PROFILE alſo denotes the out-line of a figure, building, member of architecture, &c. Hence profiling ſometimes denotes deſigning or deſcribing the member with a rule, compaſs, &c.

PROFILE, in ſculpture and painting, denotes a head, portrait, &c. when repreſented ſidewiſe, or in a ſide-view. On almoſt all medals, faces are repreſented in profile.

PROGNOSTIC, προγνωσις, among phyſicians, ſignifies a judgment concerning the event of a diſeaſe, as whether it ſhall end in life or death, be ſhort or long, mild or malignant, &c.

PROGRAMMA, anciently, ſignified a letter, ſealed with the king's ſeal.

PROGRAMMA is alſo an univerſity term for a billet or advertiſement, poſted up, or given into the hand, by way of invitation to an oration, &c. containing the argument, or ſo much as is neceſſary for underſtanding thereof.

PROGRESSION, in general, denotes a regular advancing, or going forward, in the ſame courſe and manner.

PROGRESSION, in the mathematics, is either arithmetical or geometrical.

Arithmetical PROGRESSION is a ſeries of numbers or quantities increaſing or decreaſing by an equal interval, or common difference.

Theſe numbers or quantities are ſaid to be the moſt ſimple or natural progreſſion that begin their ſeries of increaſe or decreaſe with a cypher.

Thus, $\begin{cases} 0 : a : 2a : 3a : 4a : 5a : 6a : \&c. \text{ increaſing,} \\ 0 : -a : -2a : -3a : -4a : -5a : -6a : \&c. \text{ decreaſing} \end{cases}$

Or univerſally putting a for the firſt term in the progreſſion, and e for the common exceſs or difference.

Then, $\begin{cases} a : a+e : a+2e : a+3e : a+4e : a+5e : a+6e : \&c. \\ a : a-e : a-2e : a-3e : a-4e : a-5e : a-6e : \&c. \end{cases}$

In the firſt of theſe ſeries it is evident that, if there be but three terms, the ſum of the extremes will be double to the mean.

As in theſe, $0 : a : 2a$: Or, $a : 2a : 3a$: Or, $2a : 3a : 4a$: &c. viz. $2a + 0 = a + a$: Or, $a + 3a = 2a + 2a$, &c.

Alſo, in the ſecond ſeries increaſing or decreaſing, it is evident, that if the terms be $a : a + e : a + 2e$, &c. increaſing, then $a + a + 2e$, viz. $2a + 2e$, the ſum of the extremes, is double to $a + e$, the mean; or if they be $a : a - e : a - 2e$, &c. decreaſing; then $a + a - 2e$, viz. $2a - 2e$, the ſum of the extremes, is double to $a - e$, the mean. And ſo it will be in any three of the terms. Secondly, if there are four terms, then the ſum of the two extremes will be equal to the ſum of the two means. As in theſe, $a : a + e : a + 2e : a + 3e$, in the ſeries increaſing; here $a + a + 3e = a + e + a + 2e$. Alſo, in theſe, $a : a - e : a - 2e : a - 3e$, in the ſeries decreaſing; here $a + a - 3e = a - e + a - 2e$, &c. in any other four terms.

Conſequently, if there are never ſo many terms in the ſeries, the ſum of the two extremes will always be equal to the ſum of the two means that are equally diſtant from thoſe extremes.

As in theſe, $a : a + e : a + 2e : a + 3e : a + 4e : a + 5e$, &c.

Here $a + a + 5e = a + e + a + 4e = a + 2e + a + 3e$, &c.

And if the number of terms be odd, the ſum of the two extremes will be double the middle term, &c.

Whence it follows, that if the ſum of the two extremes be multiplied into the number of all the terms in the ſeries, that product will be double the ſum of all the ſeries.

And if the difference betwixt the two extremes be divided by the number of terms leſs 1, the quotient will be the common difference of the ſeries.

Geometrical PROGRESSION is a ſeries of numbers, or quantities, increaſing by one common multiplicator, or decreaſing by one common diviſor.

The moſt natural and ſimple ſeries of geometrical progreſſionals is when it begins with unity or 1.

As $1 . a . aa . aaa . aaaa . a^5 . a^6$. &c. in $\div$

For $1 : a :: a : aa :: aa : aaa :: aaa : aaaa$, &c.

Or $a . b . \frac{bb}{a} . \frac{bbb}{aa} . \frac{bbbb}{aaa} . \frac{b^5}{a^4}$. &c. are terms in $\div$

For $a : b :: b : \frac{bb}{a} :: \frac{bb}{a} : \frac{bbb}{aa} :: \frac{bbb}{aa} : \frac{b^4}{a^3} :: \frac{b^4}{a^3} : \frac{b^5}{a}$, &c.

That is, when all the middle terms betwixt the two extremes are both conſequents and antecedents, that ſeries is in geometrical progreſſion.

Therefore, in every ſeries of quantities in ÷, all the terms, except the laſt, are antecedents; and all the terms, except the firſt, are conſequents.

But univerſally putting a the firſt term in the ſeries, and e the ratio, viz. the common multiplier or diviſor, then there will be,

$a . ae . aee . aeee . aeeee . ae^5 . ae^6$. &c. in ÷

Or $a \frac{a}{e} . \frac{a}{ee} . \frac{a}{eee} . \frac{a}{eeee} . \frac{a}{e^5}$. &c. are in ÷

For $a : ae :: ae : \frac{aaee}{a} = aee$, &c.

And $a : \frac{a}{e} :: \frac{a}{e} : \frac{aa}{aee} = \frac{a}{ee} : \frac{a}{e} :: \frac{a}{ee} : \frac{a}{eee}$, &c.

In any of theſe ſeries it is evident, that if three quantities are in ÷, the rectangle of the two extremes will be equal to the ſquare of the mean. See PROPORTION.

PROHIBITED GOODS, in commerce, the ſame with contraband goods.

PROHIBITION, in law, is a writ that iſſues out of the chancery, King's Bench, or Common Pleas, to prohibit ſome other court, either ſpiritual or ſecular, to proceed in a cauſe there depending, upon a ſuggeſtion that the cauſe does not belong to the court.

PROJECTILE, or *Project*, in mechanics, any heavy body put into motion by an external force impreſſed thereon, and diſmiſſed from the agent, and left to purſue its courſe.

A projectile is any body A (plate CV. *fig.* 1.) thrown or projected in an upright, oblique, or horizontal direction; as a ſtone from the hand, an arrow from the bow, or a ball or bomb from a cannon or piece of ordnance. The force with which the body is projected, is called the impetus, and the diſtance to which it is thrown, is called the horizontal random, or amplitude of the projection.

Every projectile is acted upon by two forces or powers, viz. the impetus of the projectile force, and that of gravity. By the firſt, the body paſſes over equal ſpaces, A B, B C, C D, &c. in equal times; and, by the ſecond, it deſcends through the ſpaces A G, A H, A I, which are as the ſquares of the times; and, therefore, by theſe two forces compounded, the body will deſcribe, not a right line, but a curve A Q; and of that ſort which we call a parabola; and this will be the caſe in all directions but that in the perpendicular, when the path of the projectile will be (to appearance) a right line. The greater the angle of elevation K A M (*fig.* 2.) of the cannon is, the greater will be the height D B to which the projected body will riſe. Alſo the greater will be the diſtance or amplitude of the projection, till the ſaid angle becomes equal to 45 degrees K A O; upon which elevation, the random A Q will be the greateſt poſſible, and equal to twice the altitude A G of the perpendicular projection. On any elevation A M or A R, equally above or below 45 deg. as on 40 and 50, 30 and 60, 20 and 70 degrees, the random A C will be the ſame; which caſe an engineer frequently finds of great uſe.

If the object be ſituated above the horizon, then, in order to ſtrike it with the leaſt impetus, let a piece of looking-glaſs be fixed to the cannon perpendicular to its axis; and holding a plumb-line over the glaſs directly under the eye, the cannon is to be elevated till the object appears exactly under the plummet, and there fixed; if then it be diſcharged, it will ſtrike the object required.

From what has been ſaid, we may eaſily underſtand how a body projected upright, from the earth's ſurface, does really deſcribe a parabola, though, to appearance, it aſcends and deſcends in a right line. For it is urged by two forces, viz. the projectile upwards, and the force ariſing from the motion of the earth about its axis from weſt to eaſt; in which caſe it muſt neceſſarily deſcribe a parabola.

In the parabola it is demonſtrated, that the ſeveral abſciſſæ A G, A H, A I, &c. (*fig.* 1.) are as the ſquares of the ordinates G M, H N, I O, &c. and ſince this is the property of the curve which the projectile deſcribes, it is evident the projectile deſcribes a parabola.

Let A M (*fig.* 2.) repreſent the force with which a ball is projected from the cannon in the direction A M; this may be reſolved into two others A L and L M, of which the former is perpendicular, and the latter parallel to the horizon. The perpendicular force or velocity A L is that by which the ball riſes, and the heights to which it will riſe with the velocities A L and A M, are as the ſquares of the velocities, viz. as $\overline{AL}^2$ to $\overline{AM}^2$; but (becauſe A L : A M :: A M : A G) $\overline{AL}^2 : \overline{AM}^2 :: AL : AG$; therefore, ſince A G repreſents the height to which the ball will riſe with the velocity A M, A L will be the height to which it will riſe with the velocity A L, or in the proportion of the elevation A M; thus B D = A L.

The velocity of the projection L M (*fig.* 3.) in the horizontal direction is every way uniform, or carries the ball through equal ſpaces A R, R S, S T, T V, V W, in equal times. For, by the ſingle impetus of the powder, the ball deſcribes equal ſpaces A B, B C, C D, &c. in equal times in the direction A F, as has been ſhewn; therefore, by the ſimilarity of triangles A R, R S, S T, &c. will be as A B, B C, C D, &c. that is, the horizontal ſpaces paſſed over in the projection will, in equal times, be equal.

Now, ſince the perpendicular velocity is to the horizontal velocity, as A L to L M, (*fig.* 2.) and A L is the ſpace paſſed through by the former in half the time of the projection, L M would be the ſpace paſſed through in the horizontal direction in the ſame time, if the velocity L M were of the ſame ſort with A L, viz. uniformly retarded and accelerated; but ſince L M is not retarded, but uniform, it will carry the body through twice the ſpace L M in the ſame time; that is, through A D = L B = 2 L M.

And ſince the time of the aſcent from A to B is equal to the time of deſcent, the ball will paſs over D C = A D in the time of the deſcent from B to C; therefore, the horizontal ſpace A C, which the ball paſſes over during the whole time of the projection, is equal to 4 times L M, wherever the point M is taken in the circumference A O G.

Hence, when A O is the direction of the cannon (O being the middle point of the ſemi-circle) the line N O, which is the horizontal velocity, will be the greateſt poſſible (from the nature of the circle) and conſequently 4 N O = A Q, the greateſt poſſible horizontal random; which, therefore, is made of an angle O A K = 45 deg. For O A K = A O N = O A N, becauſe N O = A N; therefore, ſince A N O = 90°, A O N = O A N = O A K = 45°.

Hence, A N = F E (= N O = ¼ A Q) will be the height of the projection on the angle O A K = 45°. Whence A Q will be the parameter, or latus rectum of the parabola A F Q. If M O = O R, then will L M = T R, and, conſequently, the horizontal random on the elevation A M, and A R, will be equal, viz. A C; but the height of the projection on A R will be A T = S D. Whence the height S D is to the height D B (as R K to M K) as the tangent of the angle of elevation R A K to the tangent of the angle M A K. From what has been demonſtrated it is eaſy to underſtand, that an object ſituated on the horizon may be hit by a ball diſcharged in an elevation of 45° with a leſs charge of powder, than on any other angle of elevation.

The time of the projection A B C is equal to the time of the perpendicular aſcent and deſcent through L A or B D (becauſe the horizontal velocity does no way affect that in the perpendicular) but the time of aſcent and deſcent in A L is to that in A G, as $\sqrt{AL}$ to $\sqrt{AG}$; that is (ſince $AL : AG :: \overline{AM}^2 : \overline{AG}^2$) as A M to A G; that is (becauſe A G : A M :: A M : A L = M K) as M K to A M, or as the ſines of the angle of elevation to the radius A G.

Therefore, the times of two different projections A B C, A S C, will be as the chords A M and A R, or as the ſines of the angles of the elevation to the radius A G.

Suppoſe it required to know from what height a body ought to fall to acquire ſuch a velocity, that being reflected

flected in the direction AF, it ſhould deſcribe the given parabola AOQ.

In order to this we are to conſider, that (the equation being $xp = yy$) the velocity of a ball, ſhot from the cannon, commences in the direction of the axis AL (or abſciſs x) in the point A; but that in the direction AF, or of the ordinate y, is from firſt to laſt the ſame; conſequently there muſt be a certain point to which the ball having deſcended, acquires a velocity equal to that in the direction AF, which is uniform; and this muſt be when $\dot{x} = \dot{y}$, to determine which, putting the equation $xp = yy$ in fluxions, we have $\dot{x}p = 2y\dot{y}$; but ſince, in this caſe, we have $\dot{x} = \dot{y}$; therefore, $p = 2y$, and $\frac{p}{2} = y = \sqrt{xp}$ (per equation;) therefore, $\frac{1}{4}p^2 = xp$; that is, $\frac{1}{4}p = x$.

Conſequently, if an heavy body fall from the height of $\frac{1}{4}$ of the parameter of the given point A, and in that point it be reflected (with the velocity there acquired) in the direction AF, it will deſcribe the given parabola AOQ.

If it be required to ſtrike the point B (*fig.* 4.) whoſe diſtance AD and height BD are given, with the leaſt impetus of all that will hit it, then, in order to find the elevation of the cannon, draw AB and EA perpendicular to AC; on the point A deſcribe the arch *abc*; which biſect in *b*; then a line AF, drawn through that point, will be the elevation of the cannon, as required; and the leaſt impetus will be equal to $\frac{AB + BD}{2}$. See the demonſtration of this by the inventor, Dr. Halley, in the *Philoſophical Tranſactions*, and by Dr. Keill, *Introduct.* page 280, 281. From a bare view of the diagram, the reaſon of the uſe of the looking-glaſs and plummet mentioned before is evident.

If a ball be projected perpendicularly upright in the direction AF (*fig.* 5.) with a velocity that will carry it to the height of one mile, or 5280 feet; it will be 18 ſeconds (nearly) in the aſcent, and as much in the deſcent (for as 16,2 feet : 5280 feet :: $1^2 : x^2$; whence $x = 18''$ (nearly) the time of aſcent or deſcent) now, in the parallel of London, the motion of the earth's ſurface, and of all bodies upon it, is at the rate of 10,8 miles per minute, or 950 feet per ſecond, from weſt to eaſt; therefore, in 36 ſeconds, the time of the aſcent and deſcent, the ball will be carried over 34,214 feet, or more than 6 miles, in the horizontal direction eaſtwards, from the point A to H. Now, ſince the ball is carried at the ſame time with a retarded force upwards, and an uniform force forwards, it will deſcribe the parabola ADH. And becauſe the horizontal motion in the ſpectator and in the project is the ſame, they will be carried through equal ſpaces AN, OB; AM, PC; AL, FD, &c. in the ſame time; and, conſequently, the projected ball will always appear perpendicularly over the ſpectator in every point of the curve, which is the occaſion of the deception abovementioned.

Hence the objection uſually urged againſt the motion of the earth, from the apparent aſcent and deſcent of projectiles in a right line, is the reſult of ignorance; as, indeed, are all other arguments of this kind.

PROJECTILE. See the article RANGE.

PROJECTION, in mechanics, the act of giving a projectile its motion.

If the direction of the force, whereby the projectile is put in motion, be perpendicular to the horizon, the projection is ſaid to be perpendicular; if parallel to the apparent horizon, a horizontal projection: if it make an oblique angle, the projection is oblique.

The angle RAC (plate CV. *fig.* 2.) which the line of direction AR makes with the horizontal line AC, is called the angle of elevation of the projectile.

PROJECTION, in perſpective, denotes the appearance or repreſentation of an object on the perſpective plane.

The projection of a point A (plate XCIV. *fig.* 5.) is a point *a*, through which the optic ray OA paſſes from the objective point through the plane to the eye; or it is the point *a*, wherein the plane cuts the optic ray.

And hence is eaſily conceived what is meant by the projection of a line, a plane, or a ſolid.

PROJECTION *of the Sphere*, in plano, a repreſentation of the ſeveral points of the ſurface of the ſphere, and the circles deſcribed thereon, or any aſſigned parts thereof, ſuch as they appear to the eye ſituate at a given diſtance upon a tranſparent plane placed between the eye and the ſphere.

The projection of the ſphere is either orthographic, ſtereographic, or gnomonic.

Orthographic PROJECTION *of the Sphere*, is that wherein the circles of the ſphere are drawn on a plane, the eye being placed at an infinite diſtance, vertically to one of the hemiſpheres.

Let ABDE (plate CV. *fig.* 6.) be the primitive circle, or plane of the projection, which we may ſuppoſe to be meridian; and let AED be a great circle elevated above the plane in any angle BAE. Suppoſe this circle be projected on the plane into the curve AFD, by perpendiculars, paſſing through every point thereof; it is required to find the nature of the projected curve AFD.

In order to this, let EF and HG be two perpendiculars: draw GI parallel to CE, and HI parallel to CF, and G*g* to CI; and from *g* let fall the perpendicular *gh*; then is the right-angled triangle GHI equal and ſimilar to *ghC*, and *ghC* is ſimilar to EFC. Wherefore, putting $AC = EC = a$, $CI = x$, $GI = y$, $CF = b$, and $HI = y$; then, by the property of the circle, we have $AI \times ID = GI^2$; that is, $yy = aa - xx$, and $y = \sqrt{a^2 - x^2} = GI$; but $GI : HI :: (gC : hC ::) EC : FC$, that is, $y : y :: a : b$; therefore, $y = \frac{by}{a} = \frac{b}{a}\sqrt{a^2 - x^2}$; which ſhews the curve AFD to be an ellipſe, whoſe ſemi-axes are AC and CF.

Hence the circles of a ſphere viewed at an infinite diſtance are projected into ellipſes. Thus, the circle of illumination on the diſk of the moon is an ellipſe. Thus alſo, a ſphere ſet in the ſun-beams will have its circles all projected into elliptic ſhadows. And hence it is we conſtruct the orthographic projection, called the analemma. See MAP.

Now becauſe CE : CF :: radius : co-ſine of ECF, it appears that the ſemi-diameter CE of every circle is projected into the co-ſine FC of its elevation above the plane of projection. Hence alſo it appears, that in this projection the ſame number of degrees in a right circle, as BCE, will be projected into very different portions of the diameter of the plane BE. Thus 10 degrees from the pole of the primitive will be projected into the arch CK, but 10 degrees from the periphery will be projected into EM. But CK is to EM, as the right ſine of 10 degrees to the verſed ſine of the ſame; that is, as 1736 to 152, or nearly as 12 to 1. Hence the reaſon why the ſpots in the ſun appear to move ſo much faſter over the middle parts of the diſk than on the outſide, and why their motion is always unequal, with other phænomena of the like nature.

Stereographic PROJECTION *of the Sphere*, that on which our maps are commonly made, and depends on this principle, that if the plane of any meridian be ſuppoſed the plane of the projection, then an eye, placed in one pole of that meridian, will project all the circles in the oppoſite hemiſphere into circular arches on the ſaid plane. Thus, let AGDE (plate CV. *fig.* 7.) be any meridian; then the diameter AD, dividing it into the upper and nether hemiſpheres, is called the line of meaſures; and an eye, placed at the pole E, will project every point B, F, G, in the oppoſite ſemi-circle, into the points H, I, C, into the line of meaſures AD, by the viſual rays EB, EF, EG.

Hence, if the arch $AB = FG = 10$ degrees, then will their repreſentations in the line of meaſures be AK and IC; and the points H and I are thoſe through which the circles of 10 degrees and of 80 degrees do paſs in projection, viz. the circles GHE and GIE, as is evident from conſidering the figure. Hence the reaſon why the meridians do all lie nearer to each other in the middle parts of the map than on the outſides; and, conſequently, why the ſeveral parts of the earth cannot be duly repreſented on ſuch maps, either in reſpect of magnitude or poſition. See MAP.

On E, as a center, deſcribe the arch CM, and draw the

the line EK; the arch GK will be projected into the line CL, which is the tangent of the angle CEL. But the angle CEL is equal to half the angle GCK, or arch GK; therefore, any arch GK is projected into a line CL equal to the tangent of the angle CEL. But the angle CEL is equal to half the angle GCK, or arch GK; therefore, any arch GK is projected into a line CL equal to the tangent of half that arch. Hence the line CD is called the line of half-tangents, in reſpect of the quadrant GKD.

We ſhall here repreſent the caſes of theſe aſtronomical problems, as they are performable by the circles of the celeſtial globe, or by the ſtereographical projection of the ſphere in plano, thus: Let ÆNQS (*fig.* 8.) be the general meridian. NS the axis of the ſphere. ÆQ the equinoctial line. HO the horizon of London. ♋C ♑ the ecliptic or ſun's path. ZD the prime vertical, or azimuth. EP the axis of the ecliptic. NAS an hour circle or meridian. ZAD an azimuth circle. EYP a circle of longitude. ♋I ♋ the tropic of Cancer. ♑ ♑ the tropic of Capricorn.

By means of theſe circles, various ſpherical triangles are formed for calculation. Thus, let A be the place of the ſun in the ecliptic; then, in the right-angled triangle AXC, we have CA, the ſun's place, or longitude from the equinox C; AX, the ſun's declination north; CX, the ſun's right aſcenſion; ACX, the angle of obliquity of the ecliptic. And ſuppoſing the ſun riſing in the horizon at M on the day of the ſummer tropic, and NMS an hour circle, then there is formed the right-angled triangle NOM, in which we have NO = ÆZ = the latitude of the place Z; MO the amplitude from the north; NM the complement of the ſun's declination RM; ONM the angle of the hour from midnight; OMN the angle of the ſun's poſition. On the ſame tropical day the ſun is at I at ſix of the clock, becauſe the hour circle of ſix is projected upon the axis NCS; therefore, in the right-angled triangle ICK, we have IK the ſun's altitude at ſix. CK the azimuth from the eaſt at ſix; CI the declination north; ICK the latitude of the place. Again, when the ſun on the ſame day comes to the prime vertical ZCD, his place, when due eaſt and weſt, is at G; therefore, in the right-angled triangle GBC, we have GB the ſun's declination north; GC the ſun's altitude, when eaſt or weſt; BC the hour of his being due eaſt or weſt; BCG the latitude of the place.

Suppoſe the ſun in the horizon at M, once more; then in the right-angled triangle MCR, we have CM the amplitude from eaſt to weſt; MR the declination north; CR the aſcenſional difference; RCM the co-latitude of the plane; RMC the angle of poſition. In the oblique triangle AZN, we have ZN the co-latitude of the place Z; AN the co-declination; AZ the complement of the altitude AF; ANZ the hour from noon, equal to ÆX; AZN the azimuth from the north. And the ſame may be done for any ſtar at A, or any other place. Laſtly, let Y be any ſtar, then, in the oblique triangle YNE, we have YE the co-latitude of the ſtar, viz. YK; YE the co-declination of the ſtar; NE = Æ♋ = the obliquity of the ecliptic; NEY the ſtar's longitude in the ecliptic; ENY the hour for midnight.

Gnomonic PROJECTION *of the Sphere*, is the projection of the ſeveral circles of the ſphere, on a plane which touches the ſurface of the ſphere, the eye being placed in the center. See DIALLING.

PROJECTURE, in architecture, the out-jetting, prominency, or emboſſing, which the mouldings and other members have beyond the naked wall, column, &c. and is always in proportion to its height. The word is alſo applied to galleries, balconies, &c. which jet out beyond the face of the wall. Vitruvius gives it as a general rule, that all projecting members in building have their projectures equal to their height; but this is not to be underſtood of particular members, or mouldings, as dentils, coronas, the faſciæ of architraves, the abacus of the Tuſcan and Doric capital, &c. but only of the projectures of intire corniches. Some modern architects are of opinion that the great point in building conſiſts in knowing how to vary the proportions of projectures agreeably to the circumſtances of the building. Thus, they ſay, the nearneſs and remoteneſs, making a difference in the view, require different projectures; but it is plain, that the ancients had no ſuch intention. M. Perrault obſerves, that the projecture of the baſe and corniche is greater in the antique than the modern building by one third; which ſeems to follow in a good meaſure from the ancients proportioning the projecture to the height of the pedeſtal, whereas the moderns make the projecture the ſame in all the orders, though the height of the pedeſtal be very different.

PROLAPSUS, in ſurgery, a prolapſion, or falling out of any part of the body from its natural ſituation: thus we ſay, *prolapſus inteſtini*, a prolapſion of the inteſtine, &c.

PROLAPSUS ANI is ſuch a prolapſion of the inteſtinum rectum, that it is frequently inverted, or prolapſed to ſuch a degree both in adults and infants, as to appear near a handbreadth hanging out of its natural ſituation. Heiſter thinks, that the cauſe of this diſorder may be a great weakneſs or relaxation in the rectum, which frequently happens to croſs and clamorous children, or from a teneſmus, violent pains of the piles, a dyſentery, a ſtone, or ulcer in the bladder, a difficult expulſion of the birth, or the fæces, &c. The diſorder is not difficult to cure when recent and the patient not weak; but in the contrary circumſtances, to effect a perfect cure is next to impoſſible. If a gangrene or cancer ſhould infect the rectum, as in ſuch caſes it may, the abovementioned author adviſes the application of diſcutient and emollient remedies, and if they prove unſucceſsful, an extirpation of the morbid part. The reduction of the inteſtine, which ſhould be effected as ſoon as poſſible, is done and retained in the ſame manner as is directed in returning and retaining the prolapſed inteſtines in wounds of the abdomen. See ABDOMEN.

PROLAPSUS OCULI is a diſtemperature of the eye, in which it is ſo violently inflamed and ſwelled, that it cannot be contained in its orbit, but protrudes itſelf out of its natural ſeat. The cauſes of this diſorder are various, proceeding ſometimes from a violent inflammation, or a redundancy of humours in the eye, from an obſtruction of the reductory veſſels, and ſometimes from a ſchirrhus, cancer, or ſome external violence. When the diſorder is recent, and occaſioned by humours, they may be generally diſperſed, according to Heiſter, by bleeding, purging, and veſicatories, with internal attenuants and diluents, and external diſcutient fomentations. But if the caſe is too obſtinate to yield to remedies, recourſe muſt be had to the chirurgical operation of the paracenteſis, as in other dropſical caſes.

At every dreſſing a concave plate of lead muſt be firmly ſecured upon the eye, till it recover its natural figure. After the paracenteſis, which our author chooſes to do in the ſclerotica, rather than the cornea, he dips his compreſs in ſpirit of wine. When the eye is infected, even to the root, with a ſchirrhus or cancer, there is no ſafer method of relieving the patient, than by extirpating it clean out of the orbit, deterging and healing the wound. See the article WOUND.

PROLAPSUS INTESTINI, or a prolapſion of the inteſtine. See the articles ENTEROCELE and OSCHEOCELE.

PROLAPSUS OMENTI, or a falling of the omentum into the ſcrotum. See EPIPLOCELE.

PROLAPSUS UTERI is when the uterus falls down and appears out of the vagina; whereas when it only deſcends into the vagina, it is termed a deſcent, or bearing down of the womb. The apparent and moſt general cauſe of a prolapſus uteri is from too great a relaxation and weakneſs of its ligatures, and of the vagina, and is obſerved moſt frequently to follow a difficult labour, or other violent ſtraining, though it may ſometimes happen even to maids and young girls: as to the other ſpecies of this diſorder called the deſcent of the womb, wherein the prolapſed uterus is inverted like a bag, ſo that its internal ſurface appears outermoſt, which at the ſame time lies concealed in the vagina, it is never obſerved but when the uterus is forced down together with the ſecundines, or after a difficult labour; and if it is not ſpeedily reduced, the caſe ſoon becomes paſt cure, and kills the patient. In order to reduce the uterus, after the patient has diſcharged her urine, ſhe is to be placed in a proper poſture, and

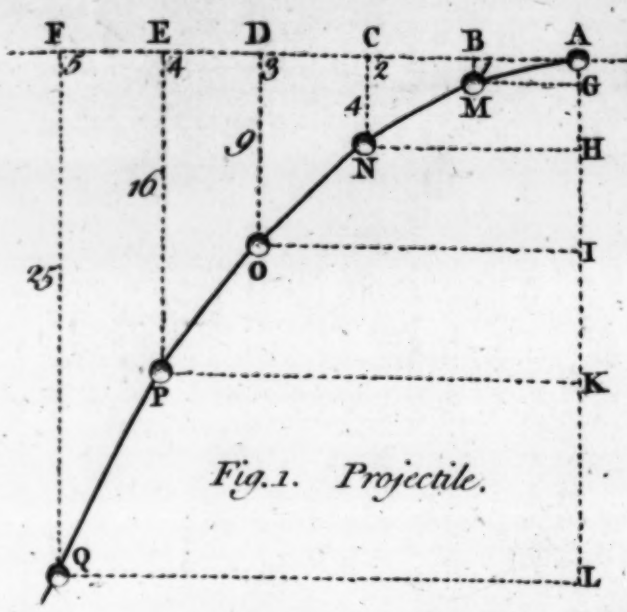


Fig. 1. Projectile.

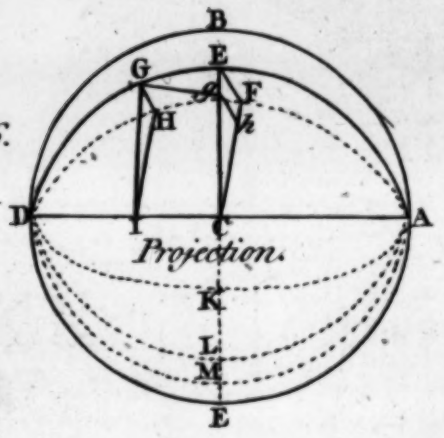


Fig. 6. Projection.

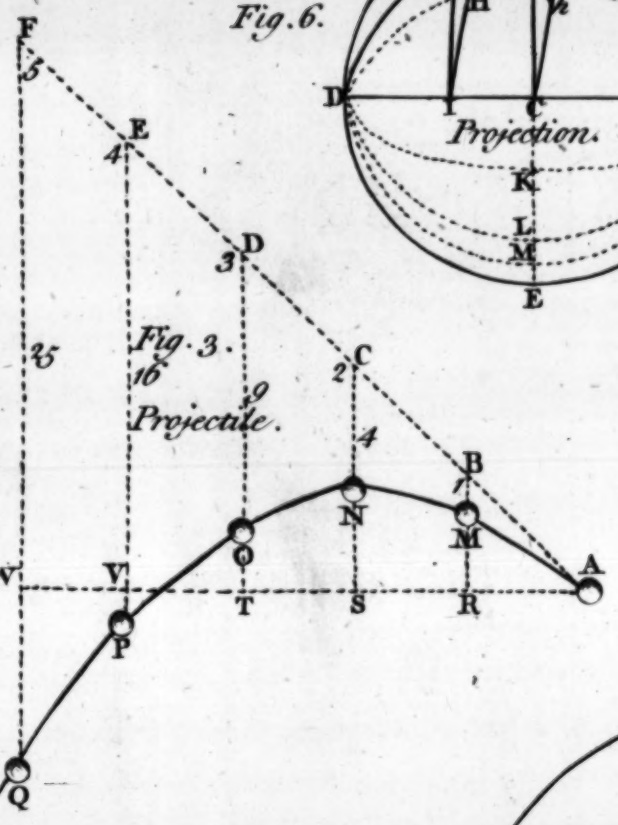
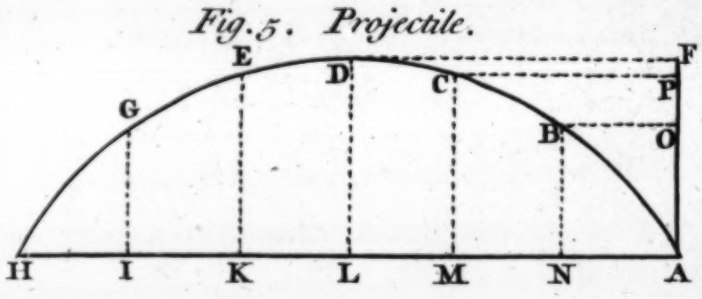


Fig. 3. Projectile.

Fig. 5. Projectile.



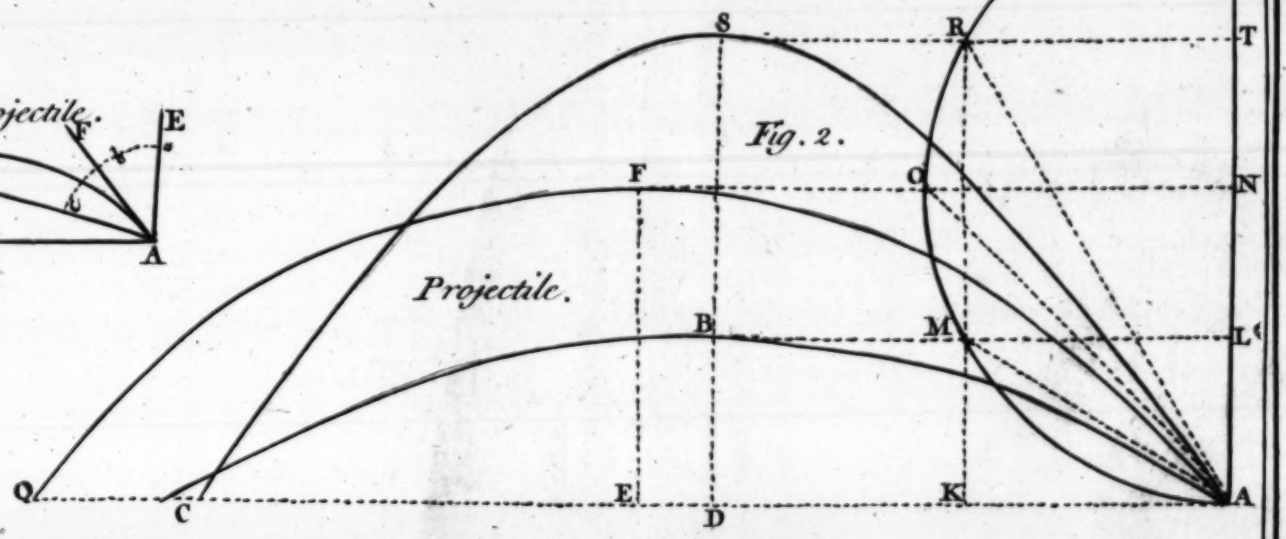


Fig. 2. Projectile.

Fig. 4. Projectile.

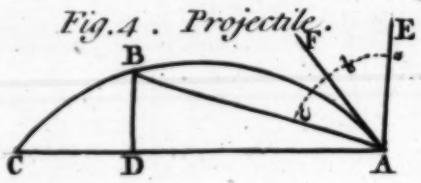


Fig. 7. G F Projection.

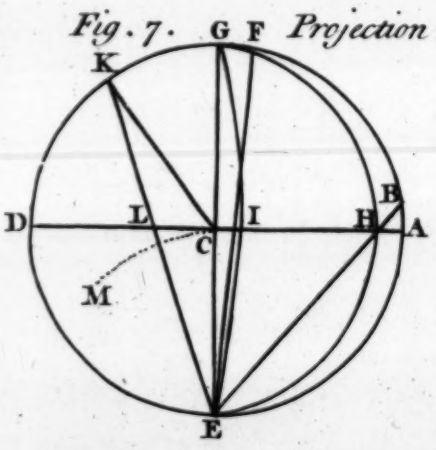


Fig. 8. Z Projection.

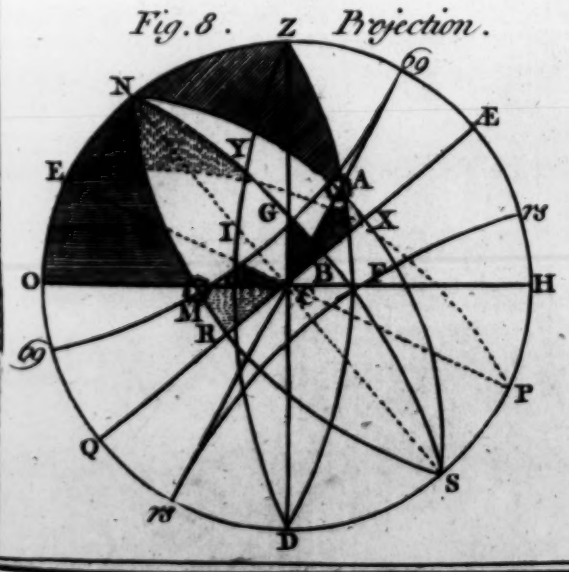
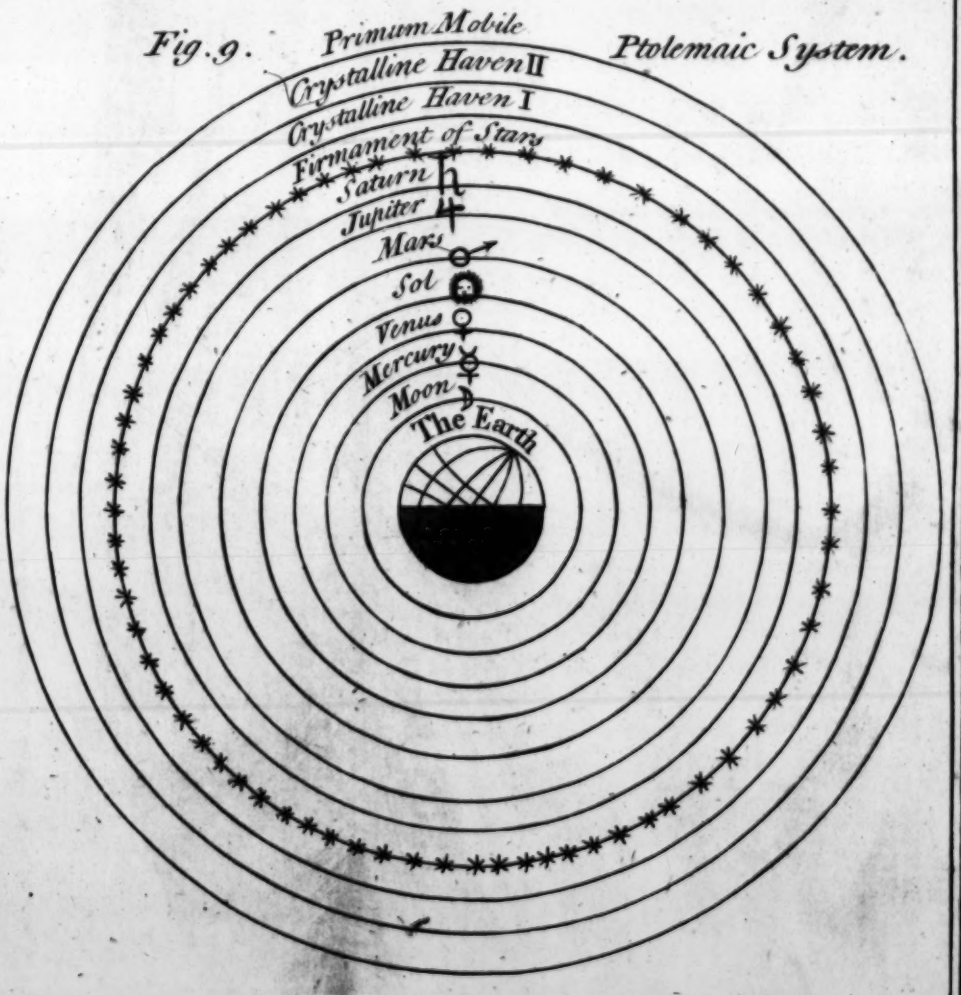


Fig. 9. Primum Mobile — Ptolemaic System.



5 JA 59

carefully ſeparating the placenta, if it adheres to the uterus, the latter is to be replaced with the fingers, by returning the pendulous part firſt with the three middle fingers, and then with the whole hand into the cavity of the abdomen. When the parts have recovered their former ſituation, the patient is to keep in bed, lying on her back, with her legs cloſe together; and reſting in this poſture is of itſelf very often ſufficient: however, it may not be improper to ſecure the womb from falling down again, either in coughing, ſneezing or otherwiſe, by retaining the lips of the pudenda together by a proper bandage. If there is an inflammation, bleeding and fomentation of the part with milk and water muſt be uſed. This diſorder is not ſo dangerous when the womb appears externally from a relaxation of its ligaments, but without inverſion, and not in the time of labour, as it is not likely to be attended with inflammation or mortification; but when it happens in a weak habit, it is often impracticable to ſuſtain it in its proper ſituation. In this caſe it muſt be aſſiſted by a proper bandage, and a retaining inſtrument internally, ſuch as a peſſary, or any other inſtrument for that purpoſe. See PESSARY.

PROLAPSUS VAGINÆ, or a bearing down of the vagina, is often confounded with the prolapſus uteri, inſomuch that they are often called by the ſame name; not being eaſily diſtinguiſhable from each other. Heiſter takes a prolapſus of the vagina to happen when that body appears either wholly or in part without the labia pudendi; and a total prolapſion ſhews itſelf without the relaxed labia, like a fleſhy ring, red or bloody, and ſwelled more or leſs, according to particular circumſtances. With regard to the treatment, when it is without inflammation, the prolapſed parts ſhould be returned without the leaſt delay, to prevent any inflammation, ſchirrhus, or gangrene, after being fomented with ſome aſtringent and diſcutient liquor; after which the patient ſhould keep her bed for ſeveral days, retaining her thighs cloſe together, without moving her body. In ſome caſes it will be proper to heat the patient with ſome mineral waters of the chalybeat kind, and ſome preparations of ſteel; but if the diſorder is inveterate, endeavours muſt be uſed to palliate it, by ordering the patient conſtantly to wear the T bandage. See BANDAGE.

If the prolapſed parts are inflamed, diſcutient ſomentations and cataplaſms are to be applied externally, and bleeding and the other internal medicines directed under the article INFLAMMATION.

PROLAPSUS UVULÆ, a diſorder of the uvula, which is ſometimes ſo much enlarged and elongated as even to reach the larynx and pharynx, and obſtruct the actions both of reſpiration and deglutition. If it proceeds from a recent inflammation, as may be judged from the pain, heat, and redneſs of the circumjacent parts, the patient may be relieved with cooling gargles, and injections of wine and water, or a decoction of proper herbs with a little alum; but at the ſame time proper coolers muſt be uſed internally, with bleeding, purges, and clyſters, to prevent the inflammation from ſpreading through the fauces, and exciting a quinſy. When this diſorder continues, notwithſtanding the uſe of remedies, it will be neceſſary, depreſſing the tongue with a ſpatula, to clip off the redundant part of the uvula with a pair of ſciſſars; after which the blood being permitted to run a little time, it may be reſtrained by a gargle of warm wine, vinegar, or if it ſtill continues, apply a little alum, or a cautery, till the hæmorrhage ceaſes.

PROLATE, in geometry, an epithet applied to a ſpheroid produced by the revolution of a ſemi-ellipſis about its larger diameter.

PROLATION, in muſic, the art of ſhaking or making ſeveral inflections of the voice or ſound on the ſame note or ſyllable.

PROLEGOMENA, in philology, certain preparatory obſervations or diſcourſes prefixed to a book, &c. containing ſomething neceſſary for the reader to be appriſed of, to enable him the better to underſtand the book, or to enter deeper into the ſcience, &c.

PROLEPSIS, προλη‡ις, a figure in rhetoric, by which we anticipate or prevent what might be objected by the adverſary; thus, *it may be objected*, &c.

PROLEPTIC, προλεπ‡ικ⊙, an epithet applied to a periodical diſeaſe which anticipates, or whoſe paroxyſm returns ſooner and ſooner every time, as is frequently the caſe in agues.

PROLOCUTOR *of the Convocation*, the ſpeaker or chairman of that aſſembly.

PROLOGUE, *Prologus*, in dramatic poetry, a diſcourſe addreſſed to the audience before the drama or play begins. The original intention was to advertiſe the audience of the ſubject of the piece, and to prepare them to enter more eaſily into the action, and ſometimes to make an apology for the poet. The laſt article ſeems intirely to have taken poſſeſſion of the prologue in the Britiſh drama. The French have left off the uſe of prologues: thoſe few they uſe have nothing in them of the genuine prologue, as bearing no relation to the ſubject, but being mere flouriſhes or harangues in praiſe of the king, &c. In the ancient theatre the prologus was properly the actor who rehearſed the prologue: the prologus was eſteemed one of the dramatis perſonæ, and never appeared in the piece in any other character: the prologue, therefore, among them, though not an eſſential, was yet an acceſſary part of the piece; with us it is no part at all, but ſomething intirely diſtinct and ſeparate: with them the drama was opened with the appearance of the prologus; with us it is not opened till after the prologus is retired. With us he always directs his ſpeech to the audience, conſidered as in a play-houſe; but with them he ought in propriety to have ſpoken to a chorus of byſtanders, or perſons to be preſent at the real action: but this being in a great meaſure inconſiſtent with the deſign of a prologue, it was directed to the audience. The prologue is of much more ancient ſtanding than the epilogue. See the article EPILOGUE.

PROMETHEUS, in the ancient aſtronomy, the name of the conſtellation now called Hercules. See HERCULES.

PROMISE, in law, is when upon any valuable conſideration one binds himſelf by word of mouth to another to perform a thing agreed on. It is held upon ſuch a promiſe that action will lie for breach, which will not if the promiſe be without conſideration, that being a naked bargain, from which no action can ariſe.

PROMONTORY, in geography, a high point of land or rock projecting out into the ſea; the extremity of which towards the ſea, is called a cape, or headland.

PROMPTER, in the drama, an officer whoſe buſineſs it is to watch attentively the actors ſpeaking on the ſtage, in order to ſuggeſt and put them forward, when at a ſtand, to correct them when amiſs, &c. in their parts.

PROMULGATED, or PROMULGED, ſomething publiſhed or proclaimed, and generally applied to a law, to denote the publiſhing or proclaiming it to the people.

PRONAOS, in the ancient architecture, a porch to a church, palace, or other ſpacious building. See the article PORCH.

PRONATORS, *Pronatores*, in anatomy, two muſcles of the radius, which ſerve to turn the palm of the hand downwards, and are diſtinguiſhed by the names of rotundus and quadratus. The pronator quadratus, or tranſverſus, is a ſmall fleſhy muſcle, lying tranſverſely on the inſide of the lower extremity of the fore arm. It is fixed by one ſide in the long eminence at the lower part of the internal angle of the ulna, and by the other in the concave ſide of the lower extremity of the radius. It is nearly as broad as it is long, and is wholly fleſhy, without any mixture of tendinous fibres. The pronator rotundus, or obliquus, is a ſmall muſcle more broad than thick, ſituated on the upper part of the ulna, oppoſite to the ſupinator brevis. It is fixed to the internal condyle of the os humeri, and from thence paſſes obliquely before the extremity of the tendon of the brachiæus, and reaches to the middle part of the convex ſide of the radius, where it becomes flat, and is inſerted below the ſupinator brevis, by an extremity almoſt altogether fleſhy.

PRONG-HOE, in huſbandry, the name of an inſtrument uſed to hoe or break the ground near and among the roots of plants. The prong-hoe conſiſts of two hooked points, of ſix or ſeven inches length; and when ſtruck into the ground, will ſtir and remove it the ſame depth

as the plough does; and thus anſwer both the ends of cutting up the weeds, and opening the land. The prong-hoe comes into excellent uſe, even in the horſe-hoeing huſbandry; and in this the hoe-plough can only come within three or four inches of the rows of the corn, turneps, and the like; but this inſtrument may be uſed afterwards; and with it the land may be raiſed and ſtirred, even to the very ſtalk of the plant.

PRONOUN, *Pronomen*, in grammar, a declinable part of ſpeech, which being put inſtead of a noun, points out ſome perſon, or thing.

Pronouns are divided into the ſix following claſſes, viz. demonſtrative pronouns; relative pronouns; poſſeſſive pronouns; gentile pronouns, or ſuch as denote a perſon's country, as *noſtras*, *veſtras*, and *cujas*; interrogative pronouns, and reciprocal pronouns. See DEMONSTRATIVE, RELATIVE, &c.

PRONOUNCING, or PRONUNCIATION, in painting, the marking and expreſſing the parts of all kinds of bodies with that degree of force, neceſſary to make them more or leſs diſtinct and conſpicuous.

PRONUNCIATION, *Pronunciatio*, in grammar, the manner of articulating or ſounding the words of a language.

Pronunciation makes much the moſt difficult part of a written grammar; in regard that a book expreſſing itſelf to the eyes, in a matter that wholly concerns the ears, ſeems next akin to that of teaching the blind to diſtinguiſh colours: hence it is that there is no part ſo defective in grammar as that of the pronunciation, as the writer has frequently no term whereby to give the reader an idea of the ſound he would expreſs; for want of a proper term, therefore, he ſubſtitutes a vicious and precarious one. To give a juſt idea of the pronunciation of a language, it ſeems neceſſary to fix as nearly as poſſible all the ſeveral ſounds employed in the pronunciation of that language. Cicero tells us, that pronunciation underwent ſeveral changes among the Romans; and indeed it is more precarious in the living languages, being, as Du Bos tells us, ſubſervient to faſhion in theſe. The French language is clogged with a difficulty in pronunciation from which moſt others are free; and it conſiſts in this, that moſt of their words have two different pronunciations, the one in common proſe, the other in verſe.

PRONUNCIATION is alſo uſed for the fifth and laſt part of rhetoric, which conſiſts in varying and regulating the voice agreeably to the matter and words, ſo as moſt effectually to perſuade and touch the hearers. It is much the ſame with what is otherwiſe called emphaſis.

PROOF, in arithmetic, an operation whereby the truth and juſtneſs of a calculation is examined and aſcertained. The proper proof is always by the contrary rule: thus ſubtraction is the proof of addition, and multiplication of diviſion; and *vice verſa*.

PROOF, in law, &c. denotes the mediums or arguments uſed to evince the truth of any thing.

PROOF is alſo uſed in a ſynonymous ſenſe with ſtandard; thus we call that proof ſpirit, which is of the ſtandard ſtrength, or half alcohol half phlegm.

PROPAGATION, *Propagatio*, the act of multiplying the kind, or of producing the like in the natural way of generation.

PROPER, *Proprium*, ſomething naturally and eſſentially belonging to any thing.

PROPER, in grammar, is applied to nouns, or names, which are diſtinguiſhed into proper and appellative.

PROPER FRACTION. See the article FRACTION.

PROPERTY, *Proprietas*, in a general ſenſe, that which conſtitutes or denominates a thing proper; or it is a particular virtue or quality which nature has beſtowed on ſome things excluſive of all others: thus colour is a property of light; extenſion, figure, diviſibility, and impenetrability, are properties of body, &c.

PROPERTY, in law, is defined to be the higheſt right a perſon has, or can have, to any thing; it being uſed to denote that right which one has to lands or tenements, goods or chattels, in no reſpect depending upon another's courteſy.

PROPHECY, προφητεια, a prediction made by divine inſpiration.

Mr. Whiſton condemns all allegorical explanations of the prophecies of the Old Teſtament cited in the New, as weak, enthuſiaſtic, &c. and adds, that if a double ſenſe of the prophecies be allowed, and there be no other method of ſhewing their completion than by applying them ſecondarily and typically to our Lord, after having been in their firſt and primary intention long ago fulfilled in the times of the Old Teſtament, we loſe all the real advantages of the ancient prophecies as to the proof of chriſtianity. He therefore ſets up a new ſcheme in oppoſition thereto: he owns that taking the preſent text of the Old Teſtament for genuine, it is impoſſible to expound the apoſtles citations of the prophecies of the Old Teſtament on any other than the allegorical foundation; and therefore, to ſolve the difficulty, he is forced to have recourſe to a ſuppoſition contrary to the ſenſe of all Chriſtian writers before him, viz. that the text of the Old Teſtament has been greatly corrupted ſince the apoſtolical age by the Jews.

Perſons pretending to prophecies are puniſhable at common law; by ſtatute, likewiſe, if any perſon publiſh ſuch prophecies with an intent to raiſe ſedition, they ſhall forfeit 10 l. for the firſt offence, and ſuffer a year's impriſonment; and for the ſecond, incur the forfeiture of all their goods, &c.

PROPHET, προφητης, in general, a perſon who foretels future events, but is particularly applied to ſuch inſpired perſons among the Jews as were commiſſioned by God to declare his will and purpoſes to that people. Among the canonical books of the Old Teſtament, we have the writings of ſixteen prophets, four of which are denominated the greater prophets, viz. Iſaiah, Jeremiah, Ezekiel, and Daniel, ſo called from the length or extent of their writings, which exceed thoſe of the others, viz. Hoſea, Joel, Amos, Obadiah, Jonas, Micah, Nahum, Habakkuk, Haggai, Zachariah, and Malachi, who are called the leſſer prophets from the ſhortneſs of their writings. The Jews do not place Daniel among the prophets, becauſe, they ſay, he lived the life of a courtier rather than that of a prophet. An account of the ſeveral writings of the prophets may be ſeen each under its particular head.

PROPHYLACTICE, προφυλακτικη, in medicine, that part thereof which inſtructs as to the method of preſerving health and averting diſeaſes.

PROPITIATION, in theology, a ſacrifice offered to God to aſſwage his wrath, and render him propitious. Among the Jews there were both ordinary and public ſacrifices, as holocauſts, &c. offered by way of thankſgiving; and extraordinary ones, offered by particular perſons guilty of any crime, by way of propitiation. The Romiſh church believe the maſs to be a ſacrifice of propitiation for the living and the dead. The reformed churches allow of no propitiation but that one offered by Jeſus Chriſt on the croſs. Propitiation was alſo a feaſt among the Jews, celebrated on the tenth of the month Tiſri, in commemoration of the pardon proclaimed to their forefathers by Moſes on the part of God, who thereby remitted the puniſhment due to the crime of their worſhipping the golden calf.

PROPITIATORY, or MERCY-SEAT, among the Jews, was the cover or lid of the ark of the covenant. See ARK.

The cherubims ſpread their wings over the propitiatory.

PROPLASM is ſometimes uſed for a mould, where any metal or ſoft matter, which will afterwards grow hard, is caſt: hence,

PROPLASTICE, the art of making moulds for caſting things in.

PROPOLIS, the name of a certain ſubſtance more glutinous and tenacious than wax, with which the bees ſtop up all the holes or cracks in the ſides of their hives.

PROPORTION, in arithmetic, the identity or ſimilitude of two ratios, magnitudes or quantities, A, B, C, D, are ſaid to be proportional, the firſt A to the ſecond B, and the third C to the fourth D, when the ratio of the firſt A to the ſecond B is the ſame thing with the ratio of the third C to the fourth D; or which is the ſame thing, when the firſt A as often contains or is contained in the ſecond B, as the third C contains or is contained in

in the fourth D. Thus the numbers, 4, 8, 12, 24, are proportional numbers, becauſe the firſt number 4 is as often contained in the ſecond number 8, as the third number 12 is contained in the fourth number 24, that is, twice; and which is therefore called the common ratio.

Whence it follows, that magnitudes, which to one and the ſame magnitude have the ſame ratio, are equal the one to the other, and, if a magnitude have the ſame ratio to other magnitudes, thoſe magnitudes are equal one to the other. Which is the ninth prop. of Euc. v.

Now, in the comparing the quantities A B C D together, if the ratio of the ſecond B to the third C is found to be the ſame with the ratio of the firſt A to the ſecond B, and of the third C to the fourth D; then theſe four quantities A, B, C, D, are ſaid to be in geometric proportion continued, or ſometimes in geometric progreſſion, and are therefore called progreſſional numbers; and ſo for any greater number, viz. 5, 6, 7, &c. Thus, the numbers $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, 4, 8, 16, 32, &c. or, 81, 27, 9, 3, 1, $\frac{1}{3}$, $\frac{1}{9}$, &c. are in geometric proportion continued, becauſe there is the ſame conſtant ratio between them, and are therefore called progreſſional numbers, or geometrical ſeries; the firſt of which is called an increaſing ſeries, becauſe it is generated by a continual multiplication; the ſecond is called a decreaſing ſeries, inaſmuch as it is generated by continual diviſion.

When 3, 4, or more quantities, A, B, C, D, &c. are continually proportional, the firſt A ſhall have a duplicate ratio to the third, C, of that it has to the ſecond B, as being compounded of the ratios of the firſt to the ſecond, of the ſecond to the third, and of the third to the fourth; ſo always in order one more, as the proportion ſhall be expreſſed.

In comparing the quantities A, B, C, D, together, if the ratio of the ſecond quantity B to the third C be greater or leſſer than the ratio of the firſt A to the ſecond B, or of the third C to the fourth D; then thoſe quantities A, B, C, D, are ſaid to be in geometric proportion diſcontinued; thus in the numbers, 4, 8, 24, 48, becauſe the ratio of the ſecond 8 to the third 24 is triple greater than the ratio of the firſt 4 to the ſecond 8, or of the third 24 to the fourth 48, which is but double, therefore, thoſe 4 numbers are in geometric proportion diſcontinued, and the ſign for diſcontinued proportion is :: and, where the ſign is placed, it ſhews that there the proportion is interrupted, and begins a-new, and accordingly, where four quantities are thus expreſſed A : B :: C : D, they are thus to be read, as A is to B, that is, in proportion to B, ſo is C to D.

From theſe premiſſes duly conſidered, all the various properties of proportional numbers or quantities will be eaſily inveſtigated.

Firſt, If four quantities be in proportion either continued or diſcontinued, the product of the extremes is equal to the product of the means.

Thus, if in diſcontinued proportion it be $ra : a :: rb : b$, the product of the extremes is $r \times a \times b = rab$, evidently equal to that of the means, $a \times r \times b = arb$.

Again, if in continued proportionals it be $a : ar :: arr : arrr$, the product of the extremes is $a \times arrr = aarrr$, evidently equal to the product of the means $ar \times arr = aarrr$. Whence, on the contrary,

If, of four quantities, the product of the means is equal to the product of the extremes, then theſe four quantities are all in geometric proportion.

If three quantities are in geometrical proportion continued, the product of the extremes is equal to the ſquare of the mean or middle term. Thus, if three terms be a, ar, arr, the product of the extremes is $a \times arr = aarr$, evidently equal to the ſquare of the mean or middle term $ar \times ar = aarr$.

If there be never ſo many continual proportionals, the product of the extremes is equal to the product of any two of the means, equally diſtant from the extremes; as alſo to the ſquare of the middle term, if the number of terms be odd. As in the ſeries a, ar, arr, ar^3, ar^4, ar^5, ar^6, &c. the product of the extremes, and of any two terms equally remote from them, and the ſquare of the middle term is $= aar^6$, as is manifeſt from multiplying them together.

If ſeveral quantities are proportionals continued, or diſcontinued, as one antecedent is to its conſequent, ſo is the ſum of all the antecedents to the ſum of all the conſequents.

If they are diſcontinued, as $a : ar :: b : br :: c : cr$; then, as $a : ar :: a + b + c : ar + br + cr$; for $\overline{a+b+c} \times ar = ar \times \overline{br + cr} \times a = aar + abr + acr$ evidently equal.

If they are continued, as a, ar, ar^2, ar^3, ar^4, ar^5, &c. then I ſay as $a : ar :: a + ar, + ar^2 + ar^3 + ar^4$, &c. : $ar + ar^2 + ar^3 + ar^4 + ar^5$, &c. For $a \times ar + ar^2$, $+ ar^3 + ar^4 + ar^5$, $= ar \times a + ar$, $+ ar^2$, $+ ar^3$, $+ ar^4$, $= aar + aar^2$, $+ aar^3$, $+ aar^4$, $+ aar^5$, evidently equal.

Hence we may eaſily find the ſum of any geometric progreſſion.

For ſuppoſe G the greateſt term, L the leaſt, and the proportion of the greateſt to the next leſſer, as R to 1. Suppoſe the ſum of the whole progreſſion S: now ſince the antecedent is to the conſequent as R to 1; and the ſum of all the antecedents is S − L, and the ſum of all the conſequents S − G; it will be R : 1 :: S − L : S − G; and therefore by the firſt, RS − RG = S − L; and taking away S on both ſides, and adding RG, we ſhall have RS − S = RG − L; and dividing both ſides of the equation by R − 1, we ſhall have $S = \frac{RG - L}{R - 1}$.

Example. Suppoſe 64, 32, 16, 8, 4, 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, and it be required to find its ſum.

Here R = 2, G = 64, L $\frac{1}{4}$, and conſequently $R \times G - L = 127\frac{1}{4}$, and ſince $R - 1 = 1$, therefore the ſum is $127\frac{1}{4}$. By this theorem may the ſum of any infinite progreſſion decreaſing be found. For here L the leaſt term, being leſs than any aſſignable quantity, may be rejected as nothing; from this caſe it really vaniſhes, and then the theorem will be $S = \frac{R \times G}{R - 1}$.

Example. Suppoſe this decreaſing ſeries $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, $\frac{1}{64}$, $\frac{1}{128}$, &c. infinitely continued, the whole ſum will be 1, or unity for $R \times G = \frac{1}{2} = 1$, which, divided by $R - 1 = 1$, makes 1, = ſum. Again,

Suppoſe this ſeries $\frac{1}{3}$, $\frac{1}{9}$, $\frac{1}{27}$, $\frac{1}{81}$, &c. infinitely continued, the ſum will be $\frac{1}{2}$; for R is 3, and G $\frac{1}{3}$, and therefore $R \times G = 3 \times \frac{1}{3} = 1$, which, divided by $R - 1 = 2$, makes $\frac{1}{2}$ for the ſum; and univerſally let any quantity be propoſed, if I take a part thereof denominated by a, viz. $\frac{1}{a}$, and of this a part denominated by a, and ſo on infinitely, whatever be the number a, the whole progreſſion will be a part denominated by $a - 1$, that is, $\frac{1}{a}$ $\frac{1}{aa}$ $\frac{1}{aaa}$ $\frac{1}{a^4}$, &c. infinitely continued $= \frac{1}{a - 1}$.

If there be two ranks of quantities in geometrical proportion, their products and quotients ſhall likewiſe be proportional thus:

Suppoſe $a : ar :: b : br$

And $c : cs :: d : ds$.

Their products $ac : acrs :: bd : bdrs$; and quotes $\frac{a}{c} : \frac{ar}{cs} :: \frac{b}{d} : \frac{br}{ds}$ are evidently proportional; for firſt the product of the extremes $acbdrs$ is equal to the product of the means $acrsbd$; and, in the ſecond, the product of the extremes $\frac{abr}{cds}$ is = to the product of the means $\frac{arb}{csd}$.

If four quantities are proportional, either continually or diſcretely, the product of the extremes is equal to the product of the means.

For if a, ra, rra, $rrra$, ∴, or 2. 4. 8. 16. ∴, it is plain the product of the extremes and of the means is the ſame quantity $rrraa$ or 32.

In diſcrete proportionals, let $a : ra :: b : rb$; that is, 2 : 4 :: 15 : 30. The product of the extremes and of the means can here be no other than $rab = 60$.

On which proportion is grounded the golden rule, or Rule of Three in arithmetic; ſo called, becauſe having three numbers

numbers (as 2. 4. 15.) it teaches how to find an unknown fourth proportional: for, although this fourth be unknown, yet its product by 2 the firſt term is known, becauſe it is the ſame with the product of the means 4 and 15. Wherefore the rule directs us to multiply the third by the ſecond, that you may thereby obtain the product of the means; which, divided by one of the extremes, viz. the firſt, muſt needs give the other, that is, the fourth ſought. See RULE *of Three direct*.

Inverſe, or *Reciprocal* PROPORTION, is when, of four numbers or quantities, the third bears the ſame proportion to the firſt, as the ſecond does to the fourth. See RULE *of Three inverſe*.

Harmonical PROPORTION is when four numbers or quantities are taken in a certain order, the firſt having the ſame ratio to the fourth, as the difference of the firſt and ſecond has to the difference of the third and fourth. Example, 9, 12, 16, 24, are harmonically proportional, viz. 9 : 24 :: 12−9 : 24−16 (or 9 : 24 :: 3 : 8) but if the firſt is to the fourth, as the difference of the firſt and ſecond, it is called contra-harmonical proportion; as 2, 8, 4, 6, where 2 : 6 :: 6−4 : 8−2 (i. e. 2 : 6 :: 2 : 6.)

This kind of proportion may exiſt alſo between three numbers, one of which is compared as a middle term to both the extremes; that is, if the firſt has the ſame ratio to the third, as the difference of the firſt and ſecond to the difference of the ſecond and third; or as the difference of the ſecond and third to that of the firſt and ſecond; for ſuch coincide with the former, by taking the middle term twice. Example, 3. 4. 6, are harmonical, becauſe 3 : 6 :: 4−3 : 6−4 (viz. 3 : 6 :: 1 : 2) and theſe contra-harmonical, 3, 5, 6; becauſe 3 : 6 :: 6−5 : 5−3 (viz. 3 : 6 :: 1 : 2.) And if in a ſeries of numbers every 3 terms are harmonical, it is a harmonical ſeries or progreſſion (i. e. a ſeries of conjunct or continued harmonials.) Example, 10. 12. 15. 20. 30. 60. wherein every 3 terms next together are harmonical. And when of 4 terms the 2 middle are different, that may be called disjunct harmonical proportion.

But this conſiderable difference is to be obſerved between this kind of proportion and the former, that in a ſeries of continued harmonials every four terms adjacent will not alſo be harmonical, as they are geometrical or arithmetical in theſe kinds of progreſſion. Example. Though 10, 12, 15, are harmonical, and alſo 12, 15, 20; yet 10, 12, 15, 20, are not ſo.

If we take the word proportion ſtrictly, according to the general definition, for an equality of ſimilar relations between two numbers, then it muſt be owned there is no new ſpecies of proportion here; for there is no new kind of relation in any two terms, but only a mixed compariſon between two numbers and their differences from others; and the proportion conſtituted is really a geometrical one, or an equality of ratios; not, indeed, of the given numbers, but of the ratio of the extremes compared to the ratio of the differences of theſe extremes with the middle terms: but though this is not ſtrictly a proportion among the given numbers immediately together, yet it is certainly a complex and new relation (diſtant from the immediate arithmetical or geometrical relation between the ſeveral couplets or numbers themſelves) to which, alſo, the name proportion is applied.

This denomination of harmonical ariſes from muſic; becauſe the relations or proportions of ſounds that make harmony, are found to be of the kind here defined, of which a more particular explanation may be ſeen under the article CONCORD.

PROPORTION is alſo uſed for the relation between unequal things of the ſame kind, whereby their ſeveral parts correſpond to each other with an equal augmentation or diminution.

Thus, in reducing a figure into little, or enlarging it, care is taken to obſerve an equal diminution, or enlargement, through all its parts; ſo that if one line, e. gr. be contracted by one-third of its length, all the reſt ſhall be contracted in the ſame proportion.

The making reductions of this kind is the great uſe of the proportional compaſſes.

PROPOSITION, *Propoſitio*, in logic, part of an argument wherein ſome quality, either negative or poſitive, is attributed to a ſubject; or, according to Chauvinus, it is a complete conſiſtent ſentence, indicating or expreſſing ſomething either true or falſe, without ambiguity, as, God is juſt.

PROPOSITION, in mathematics, is either ſome truth advanced and ſhewn to be ſuch by demonſtration, or ſome operation propoſed, and its ſolution ſhewn. If the propoſition be deduced from ſeveral theoretical definitions compared together, it is called a theorem; if from a praxis, or ſeries of operations, it is called a problem.

PROPOSITION, in poetry, the firſt part of a poem, wherein the author propoſes briefly, and in general, what he is to ſay in the body of his work. It ſhould comprehend only the matter of the poem, that is, the action and the perſons that act. Horace preſcribes modeſty and ſimplicity in the propoſition, and would not have the poet promiſe too much, nor raiſe in the reader too great ideas of what he is going to relate.

PROPREFECT, *Propræfectus*, among the Romans, the prefect's lieutenant, or an officer whom the prefect of the pretorium commiſſioned to do any part of his duty in his place.

PROPRETOR, a Roman magiſtrate, who, having diſcharged the office of pretor at home, was ſent into a province to command there with his former pretorial authority. It was alſo an appellation given to thoſe who, without having been pretors at Rome, were ſent extraordinarily into the provinces to adminiſter juſtice with the authority of pretors.

PROPRIETOR, or PROPRIETARY, he who has the property of any thing.

PROPRIETY, in grammar, is where the direct and immediate ſignification of a word agrees to the thing it is applied to; in which ſenſe it is uſed in oppoſition to figurative, or remote ſignification.

PROQUESTOR, *Proquæſtor*, the queſtor's lieutenant, or a perſon who diſcharged the office of queſtor in his ſtead.

PRO RATA, in commerce, a term ſometimes uſed by merchants for, in proportion; as, "Each perſon muſt reap the profit or ſuſtain the loſs pro rata to his intereſt, that is, in proportion to his ſtock."

PROROGATION, *Prorogatio*, the act of prolonging, adjourning, or putting off to another time. The difference between a prorogation and an adjournment of parliament is, that by prorogation the ſeſſion is ended, and ſuch bills as paſſed in either houſe, or both houſes, and had not the royal aſſent, muſt, at the next aſſembly, begin again; becauſe that every ſeſſion of parliament is in law a ſeveral parliament: whereas, if the parliament be only adjourned, there is no new ſeſſion, and conſequently all things continue in the ſame ſtate they were in before the adjournment. See ADJOURNMENT and PARLIAMENT.

PROSCRIPTION, *Proſcriptio*, a publication made in the name of the chief or leader of a party, whereby he promiſes a reward to any one who ſhall bring him the head of one of his enemies.

PROSE, *Proſa*, the natural language of mankind, looſe and unconfined, by poetical meaſures, rhymes, &c. in which ſenſe it ſtands oppoſed to verſe.

PROSECUTOR, in law, he that purſues a cauſe in another's name.

PROSELYTE, a new convert to ſome religion or religious ſect.

PROSODY, *Proſodia*, that part of grammar which treats of the quantites and accents of ſyllables, and the manner of making verſes.

PROSOPOPOEIA, Προσωποποιία, a figure in rhetoric, whereby we raiſe qualities, or things inanimate, into perſons. This figure is divided into two parts: 1. when good and bad qualities, accidents, and things inanimate, are introduced as living and rational beings.

The ſecond part of this figure is when we give a voice to inanimate things, and make rocks, woods, rivers, buildings, &c. expreſs the paſſions of rational creatures.

PROSTATÆ, in anatomy, a gland generally ſuppoſed to be two ſeparate bodies, though in reality but one, of a roundiſh, or ſomewhat heart-faſhioned ſhape, ſituated juſt before the neck of the bladder, and ſurrounding the beginning of the urethra.

PROSTHA-

PROSTHAPHÆRESIS, προσθαφαιρησις, in aſtronomy, the difference between the true and mean motion, or true and mean place, of a planet, called alſo equation of the orbit, or of the center, and ſimply equation.

Proſthaphæreſis amounts to the difference between the mean and equated anomaly.

PROSTHESIS, in grammar, the prefixing ſome letter or ſyllable at the beginning of a word, as in *gnatus*, for *natus*, &c.

PROSTHESIS, among ſurgeons, is the ſupplying that which is deficient by the appoſition of new matter, as the filling up ulcers, wounds, &c. with new fleſh.

PROSTYLE, in antient architecture, a range of columns in the front of a temple.

PROTASIS, in the antient drama, the firſt part of a comic or tragic piece, wherein the ſeveral perſons are ſhewn, their characters intimated, and the ſubject of the piece propoſed and entered upon.

PROTECTION, the ſhelter, defence, authority, and aid employed by any one in behalf of another.

PROTECTOR, a perſon who undertakes to ſhelter and defend the weak, helpleſs, and diſtreſſed.

PROTECTOR is alſo ſometimes uſed for a regent of a kingdom, made choice of to govern it during the minority of a prince.

PROTEST, in law, is a call of witneſs, or an open affirmation that a perſon does, either not at all, or but conditionally, yield his conſent to any act, or to the proceeding of any judge in a court in which his juriſdiction is doubtful; or to anſwer upon his oath farther than he is bound by law.

PROTEST, in commerce, is a ſummons wrote by a notary public to a merchant, banker, or the like, to accept or diſcharge a bill of exchange drawn on him, after his having refuſed either to accept or pay it.

PROTESTANT, a name firſt given in Germany to thoſe who adhered to the doctrine of Luther; becauſe in 1529, they proteſted againſt a decree of the emperor Charles V. and the diet of Spires; declaring that they appealed to a general council. The name has alſo been given to thoſe of the ſentiments of Calvin, and is now become a common denomination for all thoſe of the reformed churches.

PROTHONOTARY, a term which properly ſignifies firſt notary, and which was anciently the title of the principal notaries of the emperors of Conſtantinople.

PROTHONOTARY with us is uſed for an officer in the court of King's Bench and common pleas; the former of which courts has one, and the latter three. The Prothonotary of the King's Bench records all civil actions ſued in that court, as the clerk of the crown-office does all criminal caſes.

PROTHYRIS, in the ancient architecture, is ſometimes uſed for a quoin or ſtone in the corner of a wall, and ſometimes for a croſs beam or rafter. Prothyris is alſo uſed by Vignola for a particular ſort of key of an arch; an inſtance of which is found in the Ionic order: it conſiſts of a roll of water-baſes between two reglets and two fillets, crowned with a Doric cymatium; its figure greatly reſembling that of modillion.

PROTHYRUM, in architecture, a porch at the outer door of a houſe.

PROTO-TYPE is the original or model after which a thing was formed, but chiefly uſed for the patterns of things to be engraved, caſt, &c.

PROTRACTION, in ſurveying, the ſame with plotting. See the article PLOTTING.

PROTRACTOR, in ſurgery, a kind of forceps, ſo called from extracting foreign bodies out of wounds.

PROTRACTOR is alſo the name of an inſtrument uſed for protracting or laying down on paper the angles of a field, or other figure.

The protractor is a ſmall ſemi-circle (plate CII. *fig.* 10.) of braſs, or other ſolid matter; the limb or circumference of which is nicely divided into 180 degrees; it ſerves not only to draw angles on paper, or any plane, but alſo to examine the extent of thoſe already laid down. For this laſt purpoſe let the ſmall point, A, in the center of the protractor, be placed above the angular point, and let the ſide AB coincide with one of the ſides that contain the angle propoſed; then the number of degrees cut off by the other ſide, computing on the protractor from B, will ſhew the quantity of the angle that was to be meaſured.

PROTUBERANCE, in anatomy, is any eminence, whether natural or preter-natural, that projects or advances out beyond the reſt.

PROVEND, or PROVENDER, originally ſignified a kind of veſſel containing the meaſure of corn daily given to a horſe, or other beaſt of labour, for his ſubſiſtence: but it is now uſed for all the food given to cattle.

PROVERB, according to Camden, is a conciſe, witty, and wiſe ſpeech, grounded upon experience, and for the moſt part containing ſome uſeful inſtruction.

Book of PROVERBS, a canonical book of the Old-Teſtament, containing a part of the proverbs of Solomon, the ſon of David, king of Iſrael. The firſt twenty-four chapters are acknowledged to be the genuine work of that prince; the next five chapters are a collection of ſeveral of his proverbs, made by order of king Hezekiah; and the two laſt ſeem to have been added, though belonging to different and unknown authors, Agur the ſon of Jakeh, and king Lemuel.

In this excellent book are contained rules for the conduct of all conditions of life; for kings, courtiers, maſters, ſervants, fathers, mothers, children, &c.

PROVIDENCE. the conduct and direction of the ſeveral parts of the univerſe, by a ſuperior intelligent Being.

The notion of a providence is founded on this ſuppoſition, that the Creator has not ſo fixed and aſcertained the laws of nature, nor ſo connected the chain of ſecond cauſes, as to leave the world to itſelf; but that he ſtill preſerves the reins in his own hands, and occaſionally interpoſes, alters, enforces, reſtrains, and ſuſpends thoſe laws by a particular interpoſition.

Some, with the Epicureans, deny a providence, as imagining it inconſiſtent with the happineſs of the divine nature.

Others again deny the exiſtence of a providence, on account of the ſeemingly unjuſt diſtribution of good and evil.

Simplicius argues thus for a providence: If God do not look to the affairs of the world, it is either becauſe he cannot or will not; but the firſt is abſurd, ſince to govern cannot be difficult, when to create was eaſy; and the latter is both abſurd and blaſphemous. See GOD.

The ſentiments of Cicero are likewiſe very preciſe and pertinent to this purpoſe: he thinks it impoſſible for one who duly conſiders the innumerable objects of the univerſe, and their invariable order and beauty, to entertain the leaſt doubt, but that there is ſome efficient cauſe who preſides over and directs the mighty fabric! Nay he lays it down as a fundamental principle of all ſocieties, that there is a divine providence, which directs all events, obſerves the actions of mankind, whether good or bad, diſcerns the very intention of the heart, and will certainly make a difference between good men and the wicked.

Nuns of PROVIDENCE, a community of young women at Paris, who make two vows, viz. of chaſtity and obedience. They are habited in black, and board young ladies who chooſe to be educated among them.

PROVINCE, in geography, a diviſion of a kingdom or ſtate, compriſing ſeveral cities, towns, &c. all under the ſame government, and uſually diſtinguiſhed by the extent either of the civil or eccleſiaſtical juriſdiction.

PROVINE, a branch of a vine laid in the ground to take root and propagate.

PROVISO, in law, a condition inſerted in a deed, upon the obſervance of which the validity of the deed depends.

PROVOCATIVE, in phyſic, a medicine which is ſuppoſed to ſtrengthen nature, and incites to venery.

PROVOST, *Præpoſitus*, an officer, whereof there are divers kinds, civil, military, &c.

PROVOST *of a city or town*, is the chief municipal magiſtrate in ſeveral trading cities, particularly Edinburgh, Paris, &c. being much the ſame with mayor in other places.

PROVOST *Marſhal of an Army*, is an officer appointed to ſeize and ſecure deſerters, and all other criminals.

PROXY, *Procurator*, a perſon who officiates as a deputy in the room of another.

Sal PRUNELLÆ, in chemiſtry. See the article NITRE.

PRUNES, in commerce, are plums dried in the ſunſhine, or in an oven.

PRUNIFEROUS TREES, thoſe with pretty large and fleſhy fruit, with a nucleus in the middle, and called by botaniſts a drupe.

PRUNING, in gardening and agriculture, is the lopping off the ſuperfluous branches of trees, in order to make them bear better fruit, grow higher, or appear more regular.

There is not any part of gardening, which is of more general uſe than that of pruning; and yet it is very rare to ſee fruit-trees ſkilfully managed: and almoſt every gardener will pretend to be a maſter of this buſineſs, though there are but few who rightly underſtand it; nor is it to be learned by rote, but requires a ſtrict obſervation of the different manners of growth of the ſeveral ſorts of fruit-trees; ſome requiring to be managed one way, and others muſt be treated in a quite different method, which is only to be known from carefully obſerving how each kind is naturally diſpoſed to produce its fruit: for ſome ſorts produce their fruit on the ſame year's wood, as vines; others produce their fruits, for the moſt part, upon the former year's wood, as peaches, nectarines, &c. and others upon curſons or ſpurs, which are produced upon wood of three, four, or five, to fifteen or twenty years old, as pears, plums, cherries, &c. therefore, in order to the right management of fruit-trees, there ſhould always be proviſion made to have a ſufficient quantity of bearing wood in every part of the trees, and, at the ſame time, there ſhould not be a ſuperfluity of uſeleſs branches, which would exhauſt the ſtrength of the trees, and cauſe them to decay in a few years.

The reaſons which have been laid down for pruning of fruit-trees, are as follow: firſt, to preſerve trees longer in a vigorous bearing ſtate; the ſecond is, to render the trees more beautiful to the eye; and, thirdly, to cauſe the fruit to be larger, and better taſted.

1. It preſerves a tree longer in an healthy bearing ſtate; for by pruning off all ſuperfluous branches, ſo that there are no more left upon the tree than are neceſſary, or than the roots can nouriſh properly, the root is not exhauſted in ſupplying uſeleſs branches, which muſt afterwards be cut out; whereby much of the ſap will be uſeleſsly expended.

2. By ſkilful pruning of a tree, it is rendered much more pleaſing to the eye: but here I would not be underſtood to be an advocate for a ſort of pruning which I have ſeen too much practiſed of late; viz. the drawing a regular line againſt the wall, according to the ſhape or figure they would reduce the tree to, and cutting all the branches, ſtrong or weak, exactly to the chalked line; the abſurdity of which practice will ſoon appear to every one who will be at the pains of obſerving the difference of thoſe branches ſhooting the ſucceeding ſpring. All therefore that I mean by rendering a tree beautiful, is, that the branches are all pruned according to their ſeveral ſtrengths, and are nailed at equal diſtances in proportion to the different ſizes of their leaves and fruit; and that no part of the wall, ſo far as the trees are advanced, be left unfurniſhed with bearing wood. A tree well managed, though it does not repreſent any regular figure, yet will appear very beautiful to the ſight, when it is thus dreſſed, and nailed to the wall.

3. It is of great advantage to the fruit; for the cutting away all uſeleſs branches, and ſhortening all the bearing ſhoots, according to the ſtrength of the tree, will render the tree more capable to nouriſh thoſe which are left remaining, ſo that the fruit will be much larger, and better taſted. And this is the advantage which thoſe trees againſt walls or eſpaliers have to ſuch as are ſtandards, and are permitted to grow as they are naturally inclined; for it is not their being trained either to a wall or eſpalier which renders their fruit ſo much better than ſtandards, but becauſe they have a leſs quantity of branches and fruit for their roots to nouriſh; and, conſequently, their fruit will be larger, and better taſted.

There are many perſons who ſuppoſe, that if their fruit-trees are but kept up to the wall or eſpalier, during the ſummer-ſeaſon, ſo as not to hang in very great diſorder, and, in winter, to get a gardener to prune them, it is ſufficient: but this is a very great miſtake; for the greateſt care ought to be employed about them in the ſpring, when the trees are in vigorous growth; which is the only proper ſeaſon to procure a quantity of good wood in the different parts of the tree, and to diſplace all uſeleſs branches, as ſoon as they are produced, whereby the vigour of the tree will be intirely diſtributed to ſuch branches only, as are deſigned to remain; which will render them ſtrong, and more capable to produce good fruit; whereas, if all the branches are permitted to remain, which are produced, ſome of the more vigorous will attract the greateſt ſhare of the ſap from the tree, whereby they will be too luxuriant for producing fruit, and the greateſt part of the other ſhoots will be ſtarved, and rendered ſo weak, as not to be able to produce any thing elſe but bloſſoms and leaves, as hath been before mentioned; ſo that it is impoſſible for a perſon, let him be ever ſo well ſkilled in fruit-trees, to reduce them into any tolerable order by winter pruning only, if they are wholly neglected in the ſpring.

There are others, who do not intirely neglect their trees during the ſummer ſeaſon, as thoſe before mentioned; but yet do little more good to them by what they call ſummer pruning; for theſe perſons neglect their trees at the proper ſeaſon, which is in April and May, when their ſhoots are produced, and only about Midſummer go over them, nailing in all their branches, except ſuch as are produced fore-right from the wall, which they cut out; and at the ſame time often ſhorten moſt of the other branches; all which is intirely wrong practice; for thoſe branches which are intended for bearing the ſucceeding year, ſhould not be ſhortened during the time of their growth, which will cauſe them to produce two lateral ſhoots from the eyes, below the place where they were ſtopped, which ſhoots will draw much of the ſtrength from the buds of the firſt ſhoot, whereby they are often flat, and do not produce their bloſſoms; and if thoſe two lateral ſhoots are not intirely cut away at the winter pruning, they will prove injurious to the tree, as the ſhoots which theſe produce will be what the French call water-ſhoots: and in ſuffering thoſe luxuriant ſhoots to remain upon the tree until Midſummer, before they are diſplaced, they will exhauſt a great ſhare of the nouriſhment from the other branches, as was before obſerved; and by ſhading the fruit all the ſpring-ſeaſon, when they are cut away, and the other branches faſtened to the wall, the fruit, by being ſo ſuddenly expoſed, will receive a very great check, which will cauſe their ſkins to grow tough, and thereby render them leſs delicate. This is to be chiefly underſtood of ſtone-fruit and grapes; but pears and apples, being much hardier, ſuffer not ſo much, though it is a great diſadvantage to thoſe alſo, to be thus managed.

It muſt alſo be remarked, that peaches, nectarines, apricots, cherries, and plums, are always in the greateſt vigour, when they are the leaſt maimed by the knife; for, where theſe trees have large amputations, they are very ſubject to gum and decay; ſo that it is certainly the moſt prudent method carefully to rub off all uſeleſs buds when they are firſt produced, and pinch others, where new ſhoots are wanted to ſupply the vacancies of the wall; by which management trees may be ſo ordered, as to want but little of the knife in winter pruning, which is the ſureſt way to preſerve theſe trees healthful, and is performed with leſs trouble than the common method.

The management of pears and apples is much the ſame with theſe trees in ſummer; but in winter they muſt be very differently pruned: for, as peaches and nectarines do, for the moſt part, produce their fruit upon the former year's wood, and therefore muſt have their branches ſhortened according to their ſtrength, in order to produce new ſhoots for the ſucceeding year; ſo pears, apples, plums, and cherries, on the contrary, producing their fruit upon curſons or ſpurs, which come out of the wood of five, ſix or ſeven years old, ſhould not be ſhortened, becauſe thereby thoſe buds which were naturally diſpoſed to form

theſe curſons or ſpurs, would produce wood-branches, whereby the trees would be filled with wood, but never produce much fruit; and as it often happens, that the bloſſom-buds are firſt produced at the extremity of the laſt year's ſhoot, ſo, by ſhortening the branches, the bloſſoms are cut way, which ſhould always be carefully avoided.

There are ſeveral authors who have written on the ſubject of pruning in ſuch a prolix manner, that it is impoſſible for a learner to underſtand their meaning: theſe have deſcribed the ſeveral ſorts of branches, which are produced on fruit-trees; as wood-branches, fruit-branches, irregular branches, falſe branches, and luxuriant branches; all which they aſſert, every perſon who pretends to pruning, ſhould diſtinguiſh well: whereas there is nothing more in all this but a parcel of words to amuſe the reader, without any real meaning; for all theſe are comprehended under the deſcription already given of luxuriant or uſeleſs branches, and ſuch as are termed uſeful for fruit-bearing branches: and, where due care is taken in the ſpring of the year, to diſplace theſe uſeleſs branches, as was before directed, there will be no ſuch thing as irregular, falſe, or luxuriant branches, at the winter pruning; therefore it is to no purpoſe to amuſe people with a cant of words, which, when fully underſtood, ſignify juſt nothing at all.

The following hints will be of great uſe in pruning ſtandard trees.

Firſt, you ſhould never ſhorten the branches of theſe trees, unleſs it be where they are very luxuriant, and grow irregular on one ſide of the tree, attracting a great part of the ſap of the tree, whereby the other parts are unfurniſhed with branches, or are rendered very weak; in which caſe the branch ſhould be ſhortened down as low as is neceſſary, in order to obtain more branches, to fill up the hollow of the tree: but this is only to be underſtood of pears and apples, which will produce ſhoots from wood of three, four, or more years old; whereas moſt ſorts of ſtone fruit will gum and decay, after ſuch amputations.

But from hence I would not have it underſtood, that I would direct the reducing of theſe trees into an exact ſpherical figure, ſince there is nothing more deteſtable than to ſee a tree, which ſhould be permitted to grow as it is naturally diſpoſed, with its branches produced at proportionable diſtances, according to the ſize of the fruit, by endeavouring to make it exactly regular at its head, ſo crouded with ſmall weak branches as to prevent the air from paſſing between them, which will render it incapable to produce fruit. All that I intend by this ſtopping of luxuriant branches, is only when one or two ſuch happen on a young tree, where they intirely draw all the ſap from their weaker branches, and ſtarve them: and then it is proper to uſe this method, which ſhould be done in time, before they have exhauſted the roots too much.

Whenever this happens to ſtone fruit, which ſuffer much more by cutting than the former ſorts, it ſhould be remedied by ſtopping or pinching thoſe fruits in the ſpring, before they have obtained too much vigour; which will cauſe them to puſh out ſide branches, whereby the ſap will be diverted from aſcending too faſt to the leading branch, as hath been directed for wall trees; but this muſt be done with caution, as before.

You muſt alſo cut out all dead or decaying branches, which cauſe their head to look very ragged; eſpecially at a time when the leaves are upon the tree, theſe being deſtitute of them, have but a deſpicable appearance; beſides, theſe will attract noxious particles from the air, which are injurious to the trees; therefore the ſooner they are cut out the better: in doing of this you ſhould obſerve to cut them cloſe down to the place where they were produced, otherwiſe that part of the branch left will decay, and prove equally hurtful to the tree; for it ſeldom happens, when a branch begins to decay, that it does not die quite down to the place where it was produced. and, if permitted to remain long uncut, does often infect ſome of the other parts of the tree. If the branches are large which you cut off, it will be very proper, after having ſmoothed the cut part exactly even with a knife, chiſſel, or hatchet, to put on a plaſter of grafting clay, which will prevent the wet from ſoaking into the tree at the wounded part.

All ſuch branches as run acroſs each other, ſhould alſo be cut out; for theſe not only occaſion a confuſion in the head of the tree, but by lying over each other, rub off their bark by their motion, and very often occaſion them to canker, to the great injury of the tree; and on old trees, eſpecially apples, there are often young vigorous ſhoots from the old branches near the trunk, which grow upright into the head of the trees: theſe therefore ſhould carefully be cut out every year, leſt, by being permitted to grow, they fill the tree too full of wood; which ſhould always be guarded againſt, ſince it is impoſſible for ſuch trees to produce ſo much, or ſo good fruit, as thoſe trees whoſe branches grow at a farther diſtance; whereby the ſun and air freely paſs between them, in every part of the tree. *Miller's Gard. Dict.*

PRUNUS, the plum-tree, in botany. See the article PLUM-TREE.

PRUSSIA, a province of Poland, ſituated on the coaſt of the Baltic ſea, and divided into Regal and Ducal Pruſſia, the firſt ſubject to Poland, and the laſt to the king of Pruſſia.

PRUSSIAN-BLUE, among painters, &c. is prepared by precipitating a ſolution of green vitriol and alum with a lixivium drawn from fixed alkaline ſalt that has been calcined with animal coals. Commonly about three parts of alkali and two of dried ox-blood are calcined ſo long as any flame appears, then thrown into boiling water, and the ſtrained decoction poured into a hot mixture of ſolutions of four parts of alum and one or leſs of vitriol. The liquor becomes inſtantly thick or curdly, and looks at firſt of a greyiſh colour, which changes to a brown, and in a little time to a bluiſh green. The matter being well ſtirred together, and mixed with a quantity of hard ſpring water, a green precipitate ſubſides: ſpirit of ſalt poured upon the edulcorated powder, diſſolves a part, and leaves the reſt blue.

Mr. Geoffroy is the beſt who has given a plauſible theory of this proceſs, or any rational means for improving it. He obſerves, that the Pruſſian blue is no other than the iron of the vitriol, revived by the inflammable matter of the alkaline lixivium, and perhaps brightened by an admixture of the white earth of the alum; the green colour proceeds from a part of the yellow ferrugineous calx or ochre unrevived, mixing with the blue; and that this ſpirit of ſalt diſſolves this ochre more readily than the blue part, though it will diſſolve that alſo by long ſtanding, or if uſed in too large quantity. From theſe principles he was led to increaſe the quantity of inflammable matter, that there might be enough to revive the whole of the ferrugineous ochre, and produce a blue colour at once without the uſe of the acid ſpirit: in this he perfectly ſucceeded, and found at the ſame time, that the colour might be rendered of any degree of deepneſs or lightneſs at pleaſure. If the alkali is calcined with twice its weight of dried blood, and the lixivium, obtained from it, poured into a ſolution of one part of vitriol to ſix of alum, the liquor acquires a very pale blue colour, and depoſites as pale a precipitate: on adding more and more of a freſh ſolution of vitriol the colour becomes deeper and deeper, almoſt to a blackneſs. He imagines with great probability, that the blue pigment thus prepared will prove more durable in the air, mingle more perfectly with other colours, and be leſs apt to injure the luſtre of ſuch things as are mixed or applied in its neighbourhood, than that made in the common manner; the tarniſh and other inconveniencies, to which common Pruſſian blue is ſubject, ſeeming to proceed from the acid ſpirit, which cannot be totally ſeparated by any ablution. He takes notice of an amuſing phœnomenon, which happens upon mixture. When the liquors are well ſtirred together, and the circular motion as ſoon as poſſible ſtopt; ſome drops of ſolution of vitriol, depurated by long ſettling, let fall on different parts of the ſurface, divide, ſpread, form curious repreſentations of flowers, trees, ſhrubs, flying inſects, &c. in great regularity and perfection: theſe continue ten or twelve minutes; and on ſtirring the liquor again, and dropping in ſome more of the ſolution of vitriol, are ſucceeded by a new picture.

Mr. Macquer has ingeniouſly applied the preparation of this pigment to the dying of wool and ſilk; and found means of fixing the blue fecula in their pores. By dipping cloth firſt in a diluted ſolution of vitriol and alum, then in the ley diluted, and afterwards in water acidulated with ſpirit of vitriol, it acquires a light blue colour; which becomes deeper and deeper on repeating the dippings alternately in the ſame order as before; and adding to the liquors each time a little more of the reſpective ſaline matters. This blue dye, he ſays, in beauty and luſtre exceeds that of indigo and woad as far as ſcarlet does the madder red; and penetrates the whole ſubſtance of fulleſt cloth, without weakening it. The colour is durable in the air, and ſtands boiling with alum water, but is diſcharged by ſope, and, without certain precautions, liable to be ſpecky or unequal. See the *Memoirs of the French Academy for the year* 1749.

PSALM, ψαλμος, a divine ſong or hymn; but chiefly appropriated to the hundred and fifty Pſalms of David, a canonical book of the Old Teſtament.

Moſt of the Pſalms have a particular title, ſignifying either the name of the author, the perſon who was to ſet it to muſic or ſing it, the inſtrument that was to be uſed, or the ſubject and occaſion of it. Some have imagined, that David was the ſole author of the Book of Pſalms; but the title of many of them prove the contrary, as Pſalm xix. which appears to have been written by Moſes. Many of the Pſalms are inſcribed with the names Korah, Jeduthun, &c. from the perſons who were to ſing them. Pſalm lxxii. and cxxvii. are under the name of Solomon; the former being compoſed by David for the uſe of his ſon, and the latter being probably compoſed by Solomon himſelf.

The authority and canonicalneſs of the book of Pſalms has always been acknowledged, both by Jews and Chriſtians. However, nothing can be a greater argument of its obſcurity than the great number of commentaries upon them.

PSALMODY, ψαλμοδια, the art or act of ſinging pſalms.

PSALTER, ψαλτηριον, the ſame with the book of Pſalms.

PSALTERY, ψαλτηριον, a muſical inſtrument, much in uſe among the ancient Hebrews, who called it nebel.

PSEUDO, from ψευδος, a Greek term uſed in the compoſition of many words, to denote falſe, or ſpurious; as the pſeudo-acacia, or baſtard acacia; pſeudo-fumaria, or baſtard-fumitory; pſeudo-ruta, or baſtard-rue, &c.

PSITTACUS, the PARROT, in ornithology. See the article PARROT.

PSOAS, in anatomy, the name of two muſcles, diſtinguiſhed by the epithets magnus and parvus. The pſoas magnus is one of the flexor muſcles of the thigh, and ariſes from the firſt, ſecond, third, and fourth vertebræ of the loins. The pſoas parvus is one of the flexor-muſcles of the loins, which ariſes by a ſlender tendon from the os pubis, where it is joined to the ilium; and is inſerted into the ſide of the upper vertebra of the loins; it is often wanting, and when found, its office is to aſſiſt the quadratus in elevating the oſſa innominata, eſpecially when we lie down.

PSORA, ψορα, in medicine, the ſame with the itch. See the article ITCH.

PSYCHOLOGY, ψυχολογια, that branch of anthropology which treats of the ſoul, its faculties, paſſions, &c.

PSYCHOMANCY, ψυχομαντεια, a kind of divination, performed by raiſing the ſouls of perſons deceaſed.

PSYCROMETER, an inſtrument for meaſuring the degrees of coldneſs or heat in the air, and more uſually called thermometer. See THERMOMETER.

PTERYGOIDE, ſomething reſembling a wing; from a reſemblance to which, four apophyſes or proceſſes of the os ſphenoides have been called pterygoide.

PTERYGOIDÆUS, in anatomy, the name of two muſcles of the lower jaw, one internal and the other external. The internal pterygoidæus muſcle has its origin in the cavity of the pterygoide proceſs, and its termination is in the interior and lower ſuperficies of the angle of the jaw. The external pterygoidæus ariſes from the exterior lamina of the ſame proceſs, and terminates a little above the inſertion of the other.

There are alſo ſeveral pairs of muſcles of the pharynx and uvula, as the pterygo-pharyngæus, and pterygo-ſtaphylinus, which have got their names from being connected by the ſame proceſs. The pterygo-ſtaphylinus ariſes from the upper part of the ſaid proceſs, and deſcending between its two lamellæ, turns back its tendon over the thin apophyſis of the interior lamella, as over a pulley, to the anterior part of the membrane of the palate, into which it is inſerted, and ſerves to draw the uvula downwards and forwards.

PTOLEMAIC, or PTOLEMÆAN *Syſtem of Aſtronomy*, is that invented by Claudius Ptolemæus, a celebrated aſtronomer and mathematician of Peluſium, in Egypt, who lived in the beginning of the ſecond century of the Chriſtian ærea.

This hypotheſis ſuppoſes the earth immoveably fixed in the center, not of the world only, but alſo of the univerſe; and that the ſun, the moon, the planets, and ſtars all move about it, from eaſt to weſt, once in twenty-four hours, in the order following, viz. the moon next to the earth, then Mercury, Venus, the Sun, Mars, Jupiter, Saturn, the fixed ſtars, the firſt and ſecond cryſtalline heavens, and above all the fiction of their primum mobile. See (plate CV. *fig.* 9.) See alſo MOON, &c.

This ſyſtem or hypotheſis was firſt invented, and adhered to, chiefly becauſe it ſeemed to correſpond with the ſenſible appearances of the celeſtial motions. They took it for granted, that the motions which thoſe bodies appeared to have, were ſuch as they truly and really performed: and not dreaming of any motion in the earth, nor being apprized of the diſtinction of abſolute and relative or apparent motion, they could not make a proper judgment of ſuch matters; but were under a neceſſity of being miſled by their ſenſes, for want of the aſſiſtances we now enjoy.

It is eaſy to obſerve, they had no notion of any other ſyſtem but our own, nor of any other world but the earth on which we live. They imagined that all the fixed ſtars were contained in one concave ſphere, and that the primum mobile was circumſcribed by the empyreal heaven, of a cubic form, which they ſuppoſed to be heaven, or the bliſsful abode of departed ſouls.

It would ſcarce have been worth while to have ſaid ſo much about ſo abſurd an hypotheſis, as this is now well known to be, were it not that there are ſtill numerous retainers thereto, who endeavour very zealouſly to defend the ſame, and that for two reaſons principally, viz. becauſe the earth is apparently fixed in the center of the world, and the ſun and ſtars ſeem to move about it daily; and alſo becauſe the Scripture aſſerts the ſtability of the earth, the motion of the ſun, &c. But that the diurnal motion of the earth occaſions all theſe appearances, we have abundantly proved under the articles DIURNAL and COPERNICAN.

PTYALISM, πτυαλισμος, in medicine, a ſalivation, or frequent and copious diſcharge of ſaliva.

PUBERTY, *Pubertas*, among civilians, &c. the age wherein a perſon is capable of procreation, or begetting children.

Boys arrive at puberty at fourteen years of age, and girls at twelve; eighteen years of age is accounted full puberty.

PUBES, among anatomiſts, &c. denotes the middle part of the hypogaſtric region of the abdomen, lying between the two inguina or groins. See the article ABDOMEN.

PUBLICAN, *Publicanas*, among the Romans, one who farmed the taxes and public revenues.

PUBLICATION, *Publicatio*, the act of making a thing known to the world; the ſame with promulgation.

PUCERON, *Podura*, in zoology, a genus of wingleſs inſects with fewer than ſix pair of legs. The body is ſhort and roundiſh; the tail is crooked and forked; the legs are three pairs, and ſerve only for walking; and the eyes are two, but each compoſed of eight leſſer ones.

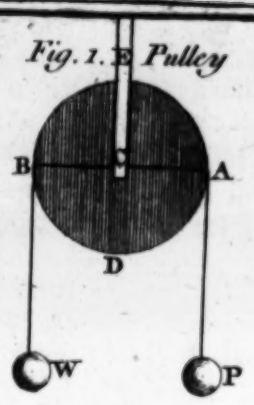
The pucerons are extremely numerous, living on the young branches of trees and plants; and often found in ſuch cluſters as wholly to cover them: they are uſually denominated from the trees and places where they are found;

5 JA 59

Plate CVI.

Facing Pulley.

Fig. 1. Pulley



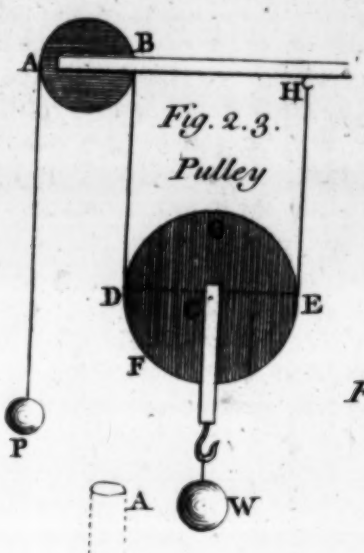


Fig. 2. 3. Pulley

Fig. 4.

Fig. 5.

Pulley

Fig. 6. Pulley

Fig. 7. Pulley

Fig. 8. Pulley

Fig. 12. Pump

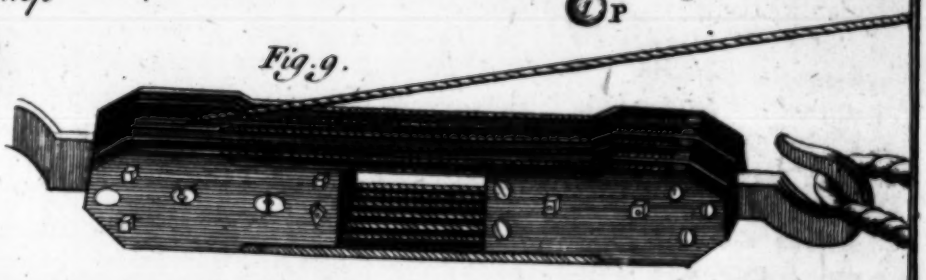


Fig. 9.

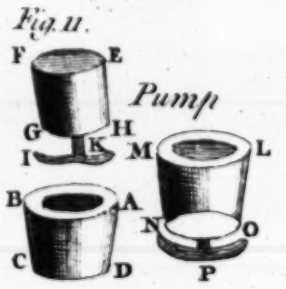


Fig. 11. Pump

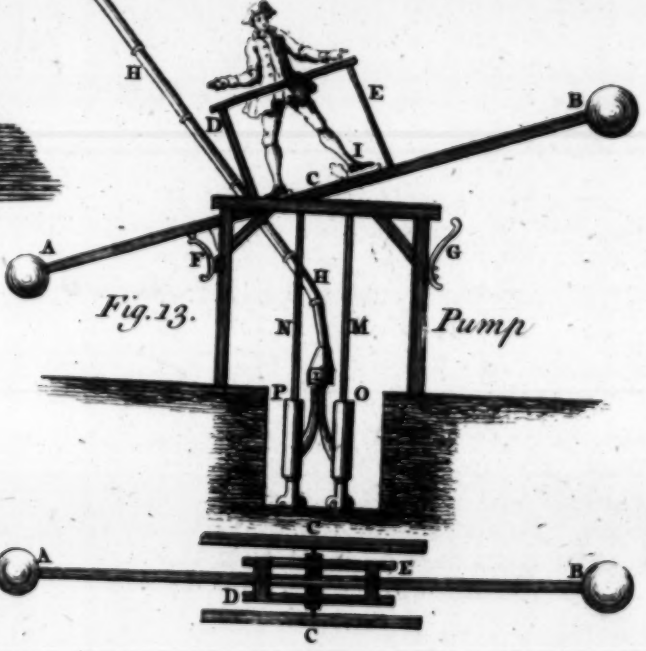


Fig. 13. Pump

Fig. 17. Pump

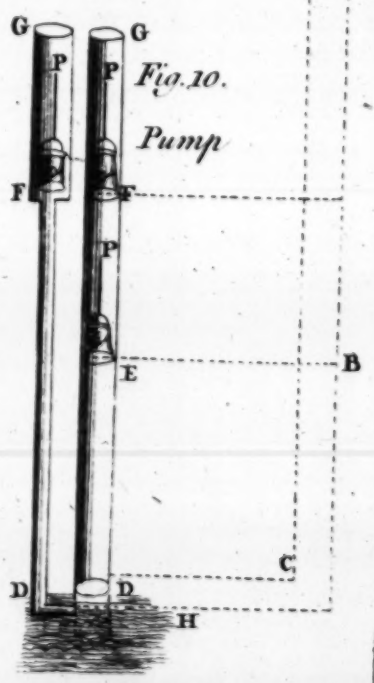


Fig. 10. Pump

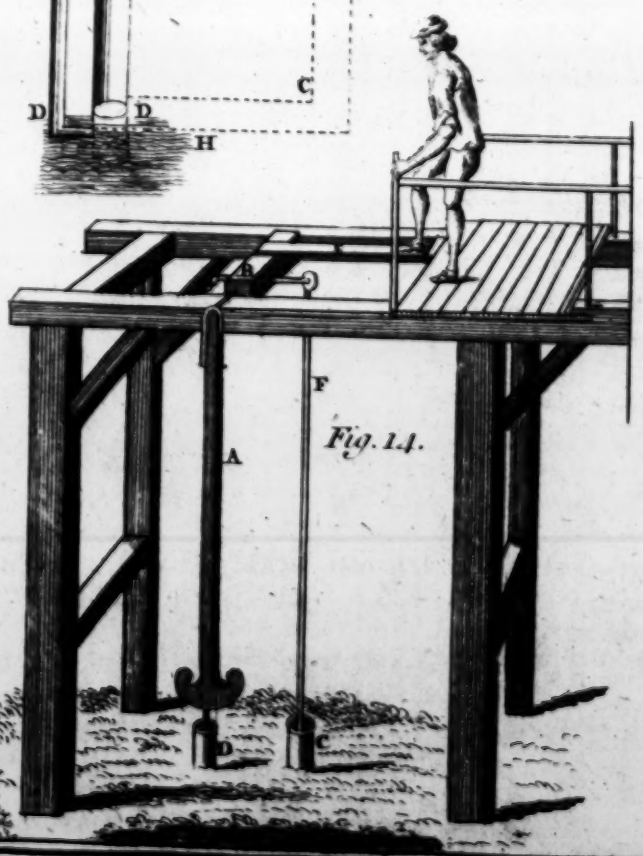


Fig. 14.

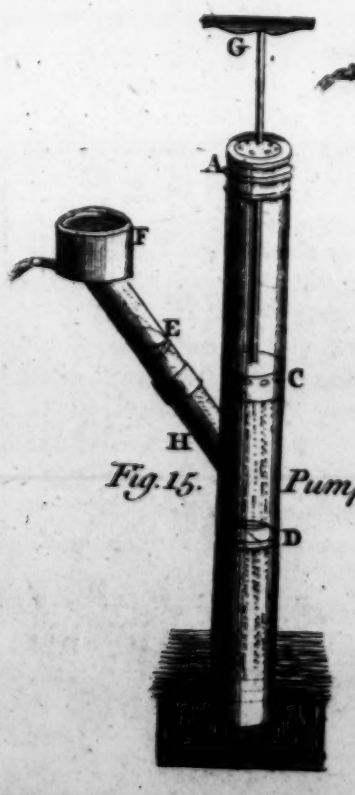


Fig. 15. Pump

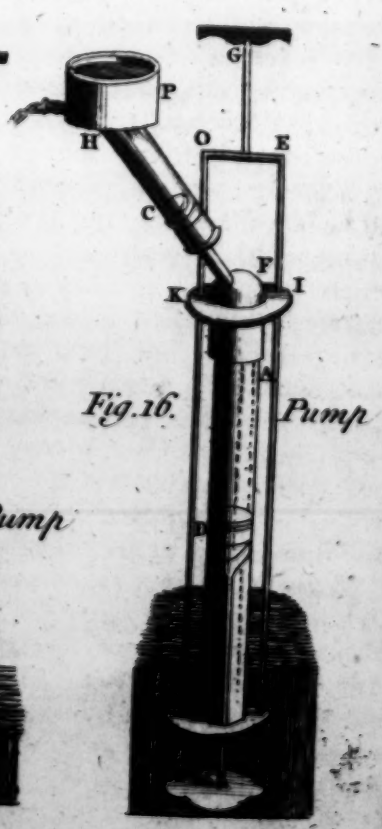


Fig. 16. Pump

found; there being ſcarce a vegetable, either in the fields or gardens, that has not a peculiar ſpecies of puceron to feed on its juices,

PUDENDA, the parts of generation in both ſexes. See the article GENERATION.

PUDDENING, a thick roll of rope faſtened about the maſt of a ſhip to prevent the yard from falling down when the rigging is ſhot away

PUERILITY, in diſcourſe, is defined by Longinus to be a thought, which, by being too far-fetched, becomes flat and inſipid.

Puerility, he adds, is the common fault of thoſe who affect to ſay nothing but what is brilliant and extraordinary.

PUGIL, *Pugillus*, in phyſic, &c. ſuch a quantity of flowers, ſeeds, or the like, as may be taken up between the thumb and two fore-fingers.

It is eſteemed to be the eighth part of the manipule or handful.

PUISNE, or PUNY, in law, one younger born.

PULLEY, in mechanics, one of the five mechanical powers, called by the Latins *trochlea*, and by the ſeamen a tackle.

If ADBE (plate CVI. *fig.* 1.) be a pully upon which hang the weights PW; then ſince the neareſt diſtances of the ſtrings A P and B W, from the center of motion C, are AC and BC, the pully will be reduced to the lever or ballance AB, with reſpect to its power; and from thence it appears that, ſince AC = BC, we ſhall always have P = W, for an equilibrium; and, therefore, no advantage in raiſing a weight, &c. can be had from a ſingle pulley.

In a combination of two pullies, AB and DFEG, (*fig.* 2.) the power is doubled; for the pulley DFEG is reducible to the lever ED, which muſt be conſidered as fixed in the point E to the immoveable ſtring HE; and the power acting at D is equal to P, and the weight W is ſuſtained from the center C of the pulley; but P : W :: CE : DE; therefore, ſince DE = 2 CE, it is W = 2P, or P = $\frac{1}{2}$W.

The force of the pullies may alſo be eaſily ſhewn by comparing the velocities of the power and weight; for it is evident, if the weight W (*fig.* 3.) be raiſed one inch, each ſtring HE, DB, will be ſhortened one inch, and conſequently the ſtring AP will be lengthened two inches; and ſo P will paſs through twice the ſpace that W does, in the ſame time: conſequently the tackle of pullies, in the form of *fig.* 4. will increaſe the power five times; and that of *fig.* 5. and 6 will increaſe it ſix times.

In the diſpoſition of pullies according to *fig.* 8. it is plain, ſince each pulley has a fixed rope, it muſt be conſidered as a lever of the ſecond ſort, and ſo will double the power of the fore-going pulley; and ſo four pullies will increaſe the power ſixteen times.

Tho' the laſt-mentioned form be of the greateſt force from the ſame number of pulleys; yet, if we conſider the ſimplicity, force, and conveniency of the tackle of pullies altogether, none is ſuperior to that of the form of *fig.* 7. where the uppermoſt pulley is fixed, and each has a rope annexed to the weight; its power is therefore thus eſtimated: when the weight W is raiſed one inch, the rope AB will be lengthened as much, and ſo the pulley C will deſcend one inch, by which means the rope CD will be lengthened two inches, and one by the riſing of the weight W; wherefore the pulley E will deſcend three inches; and thus the rope EP will be lengthened ſix inches by that means (viz. three on each ſide); alſo, the riſing of the weight will cauſe it to lengthen one inch more, ſo that the power P goes through ſeven inches, while the weight W riſes one: therefore, P : W :: 1 : 7. And thus you proceed for any other number.

The following curious and uſeful combination of pullies is given by the ingenious Mr. Smeaton in the XLVIIth Vol. of the *Philoſophical Tranſactions*.

The preſent method of arranging pullies in their blocks may be reduced to two. The firſt conſiſts in placing them one by the ſide of another, upon the ſame pin; the other in placing them directly under one another, upon ſeparate pins. But in each of theſe methods an inconvenience ariſes, if above three pullies are framed in one block. For, according to the firſt method, if above ſix pullies are placed by the ſide of one another, as the laſt line, by which the draught is made, or, as it is uſually called, the fall of the tackle, muſt neceſſarily be on the outſide pulley or ſhieve, the difference of their friction will give it ſo great a tendency to pull the block away, that as much will be loſt by the rubbing of the ſhieves againſt the block, on account of its obliquity, as will be got by increaſing the number of lines.

The ſecond method is free from this objection; but, as the length of the two blocks, taken together, muſt be equal to the ſum of the diameters of the ſix pullies, beſides the ſpaces between for the ropes, and the neceſſary appendages of the framing, were there more than three pullies in each block, they would run out into ſuch an inconvenient length, as to deduct very conſiderably from the height, to which the weight might otherwiſe have been raiſed; ſo that upon thoſe accounts, no very great purchaſe can be made by the common tackles of pullies alone.

In order therefore to encreaſe its power, ſometimes a ſecond tackle is fixed upon the fall of the firſt; but here it is obvious, that, whatever be the power of the ſecond tackle, the height to which the weight might otherwiſe have been raiſed by the firſt, will be leſs in the ſame proportion as the purchaſe is encreaſed by the ſecond.

Again, very frequently the fall of the firſt tackle is applied to an axis in peritrochio, which increaſes the purchaſe very commodiouſly without the inconveniences laſt mentioned; but then the machine is rendered cumberſome, and, conſequently, leſs fit for a moveable apparatus.

All thoſe impediments I have avoided, by combining the two methods, above deſcribed, in one. The pullies are here placed in each block in two tier; ſeveral being upon the ſame pin as in the firſt method, and every one having another under it, as in the ſecond; as alſo that, when the tackle is in uſe, the two tier, that are the remoteſt from one another, are ſo much larger in diameter than thoſe that are neareſt, as to allow the lines of the former to go over the lines of the latter without rubbing.

From this conſtruction ariſes a new method of reeving the line upon the ſhieves: for here, let the number of ſhieves be what it will, the fall of the tackle will always be upon the middle ſhieve, or on that next the middle, according as the number of pullies on each pin is odd or even.

To do this the line is fixed to ſome convenient part of the upper block, and brought round the middle ſhieve of the larger tier of the under block; from thence round one of the ſame ſort, next the center one of the upper block; and ſo on till the line comes to the outſide ſhieve, where the laſt line of the larger tier falls upon the firſt ſhieve of the ſmaller, and being reeved round thoſe, till it comes at the oppoſite ſide, the line from the laſt ſhieve of the ſmaller tier again riſes to the firſt of the larger, where it is conducted round, till it ends on the middle ſhieve of the upper block on the larger tier, as will appear more plain, by inſpection of plate CVI. *fig.* 9.

In this method all the lines are clear of one another, and the blocks are kept parallel. The model which I had the honour to ſhew the Society, and from which I made the draught, is a compoſition of twenty ſhieves, five on each pin. With this model, which may be eaſily carried in the pocket, I have raiſed 600 weight. But with a tackle of this ſort, properly executed in large, one man will eaſily raiſe a ton, and a greater number in proportion.

I have tried ſeveral numbers of ſhieves as far as 36; but 20 ſeems to be the largeſt number, that will anſwer well in practice.

A very commodious tackle of twelve might be executed in wood, in the ſame manner that common blocks are made.

PULMONARIA, ſage of Jeruſalem, in botany, a genus of plants, with a monopetalous flower, divided into five obtuſe and erecto-patent ſegments at the limbs: there is no pericarpium, the ſeeds, which are four, being contained in the calyx unaltered.

The leaves of ſage of Jeruſalem are accounted pec-

total and cardiac, and therefore good in all diſorders of the lungs.

PULMONARY *Veſſels*, in anatomy, are arteries and veins, which carry the blood from the heart to the lungs, and back again from the lungs to the heart.

PULMONARY *Conſumption*. See the article CONSUMPTION and PHTHISIS.

PULP, in pharmacy, the fleſhy and ſucculent part of fruits, extracted by infuſion or boiling, and paſſed through a ſieve.

Some phyſicians uſe the term pulp for the fatteſt, fulleſt, and moſt ſolid part of the fleſh of animals.

PULPIT, *pulpitum*, an elevated place in a church, from which ſermons are delivered: the French give the ſame name to a reading-deſk.

PULSE, *pulſus*, in the animal œconomy, denotes the beating or throbbing of the heart and arteries. See the articles HEART and ARTERY.

No doctrine has been involved in more difficulties than that of pulſes; ſince, in giving a phyſiological account of them, phyſicians have eſpouſed quite oppoſite ſentiments; whilſt ſome doubt whether the pulſe is owing to the ſyſtole or diaſtole; as alſo, whether the motion of the heart, and arteries, is one and the ſame, for a moment of time. See SYSTOLE and DIASTOLE.

With regard to motion, the pulſes are reckoned only four, great and little, quick and ſlow. When quickneſs and greatneſs are joined together, it becomes violent; and when it is little and ſlow, it is called a weak pulſe. They are alſo ſaid to be frequent and rare, equal and unequal; but theſe are not the eſſential affections of motion. Frequency and quickneſs are often confounded with each other. A pulſe is ſaid to be hard or ſoft, with regard to the artery, according as it is tenſe, renitent, and hard, or flaccid, ſoft, and lax; for the diſpoſitions of the arteries contribute greatly to the change of the pulſe; wherefore it ſometimes happens, that the pulſe in both arms is not alike, which is very common in a hemiplexy. Add to theſe a convulſive pulſe, which does not proceed from the blood, but from the ſtate of the artery, and is known by a tremulous ſubſultory motion, and the artery ſeems to be drawn upwards: this in acute fevers, is the ſign of death; and is ſaid to be the pulſe in dying perſons, which is likewiſe generally unequal and intermitting. A great pulſe ſhews a more copious afflux of the blood to the heart, and from thence into the arteries; a little pulſe, the contrary. See the article CIRCULATION.

The pulſes of perſons differ according to the largeneſs of the heart and veſſels, the quantity and temperies of the blood, the elaſtic force of the canals; as alſo with regard to the ſex, age, ſeaſon, air, motion, food, ſleep, watchings, and paſſions of the mind. The pulſe is larger and more quick in men than in women; in the bilious and ſanguineo-bilious, than in the phlegmatic and melancholic. Thoſe who are lean, with tenſe fibres, and larger veſſels, have a greater and a ſtronger pulſe than thoſe that are obeſe, with lax fibres and ſmall veſſels; whence they are more healthy, robuſt, and apt for labour. In children, the pulſe is quick and ſoft; in adults, greater and more violent. In the old, it is commonly great, hard, and ſlow. Labour, motion, and exerciſe of the body, encreaſe the circulation of the blood, the excretions, and particularly reſpiration; reſt renders the circulation ſlow and weak; intenſe ſpeaking increaſes the circulation, and conſequently renders the pulſe large and quick. In watching, the pulſe is more evident; in ſleep more ſlow and languid. After drinking hot things, ſuch as coffee and tea, or hot bath-waters, as well as after meals, the pulſe vibrates more quick. But nothing produces a greater change in the pulſe than affections of the mind: in terror it is unequal, ſmall, and contracted; in joy, frequent and great; in anger, quick and hard; in ſadneſs, ſlow, ſmall, deep, and weak; and in intenſe ſtudy, languid and weak. With regard to the air, when after the predominancy of a weſt or ſouth-wind, it becomes north or eaſt, the pulſe is ſtronger and larger; as alſo when the quickſilver riſes in the barometer. But when the atmoſphere is denſe, humid, rainy, with a long ſouth wind; as alſo where the life is ſedentary, the ſleep long, and the ſeaſon autumnal, the pulſe is languid and ſmall, and the perſpiration decreaſed. In May it is great, and ſometimes violent; in the middle of ſummer, quick but weak; in the autumn, ſlow, ſoft, and weak; in the winter, hard and great. A draſtic purge and an emetic render the pulſe hard, quick and weak, with loſs of ſtrength; chalybeates, and the bark, render it great and robuſt, and the complexion lively; volatiles amplify and increaſe the pulſe; acids and nitrous remedies refrigerate the body, and appeaſe the pulſe; opiates and the like render it ſmall and weak, and decreaſe the elaſticity of the ſolids; whereas things abounding with a friendly ſulphur increaſe the pulſe; but poiſons render it ſmall, contracted, and hard. When the quantity of the blood is too great, bleeding raiſes the pulſe.

The ſeveral indications of the pulſe in different diſorders, may be ſeen under the reſpective names of theſe diſeaſes.

PULSE is alſo uſed for the ſtroke with which any medium is affected by the motion of light, ſound, &c. through it.

Sir Iſaac Newton demonſtrates, that the velocities of the pulſes in an elaſtic fluid medium (whoſe elaſticity is proportionable to its denſity) are in a ratio compounded of half the ratio of the elaſtic force directly, and half the ratio of the denſity inverſely; ſo that in a medium whoſe elaſticity is equal to its denſity, all pulſes will be equally ſwift.

PULSE, *Legumen*, in botany, a term applied to all thoſe grains or ſeeds which are gathered with the hand, in contradiſtinction to corn, &c. which are reaped, or mowed: or it is the ſeed of the leguminous kind of plants, as beans, vetches, &c. but is by ſome uſed for artichokes, aſparagus, &c.

PULSION, the act of driving, or impelling a thing forwards.

PULVERIZATION, *Pulverizatio*, the art of pulverizing, or reducing a dry body into a fine powder; which is performed in friable bodies, by pounding or beating them in a mortar, &c. but to pulverize malleable ones, other methods muſt be taken. To pulverize lead, or tin, the method is this: rub a round wooden box all over the inſide with chalk; pour a little of the melted metal nimbly into the box; when, ſhutting the lid, and ſhaking the box briſkly, the metal will be reduced to powder. See the article GRANULATION.

PULVINATED, in the ancient architecture, a term applied to a frieze which ſwells or bulges out in the manner of a pillow.

PULVIS *Fulminans*, among chymiſts, a powder, ſo called from its ſmart and loud exploſion, when it begins to melt, after being placed upon an iron-plate over a gentle fire. It is prepared thus: Take three ounces of purified nitre, and one ounce of brimſtone, and grind them well together in a mortar; then putting a ſmall quantity, as about half a dram, over the fire, in the manner already mentioned, it will make a great exploſion. The more philoſophical way of accounting for this effect of the pulvis fulminans is, according to Dr. Shaw, by ſuppoſing that the acid ſpirits of the nitre and ſulphur, being looſened by the heat, ruſh towards one another, and towards the ſalt of tartar, with ſo great a violence, as, by the ſhock, at once to turn the whole into vapour and ſmoke.

PUMICE, in natural hiſtory, a ſlag or cinder of ſome foſſil, originally bearing another form, and only reduced to this ſtate by the action of the fire, though generally ranked by authors among the native ſtones. It is a lax and ſpongy matter, frequently of an obſcure, ſtriated texture, in many parts, and always very cavernous and full of holes; it is hard and harſh to the touch, but much lighter than any other body that comes under the claſs of ſtones. It is found in maſſes of different ſizes, and of a perfectly irregular ſhape, from the bigneſs of a pigeon's egg to that of a buſhel. We have it from many parts of the world, but particularly about the burning mountains, Ætna, Veſuvius, and Hecla, by whoſe eruptions it is thrown up in vaſt abundance; and being by its lightneſs ſupported in the air, is carried into ſeas at ſome diſtance, by the winds, and thence to diſtant ſhores. The great uſe of the pumice among the ancients, ſeems to have been as a dentifrice, and at preſent it is retained in the ſhops on the ſame account.

PUMP, in hydraulics, a machine, formed on the model of a ſyringe, for raiſing of water.

The theory of pump-work depends, in a great meaſure, upon the properties of the inverted ſyphon: thus, let A B C D E F G (plate CVI. *fig.* 10) repreſent an inverted ſyphon, A B C D a column of air, and D G the lower part of a pump, immerſed in the water of the well H I; let P be the piſton of the pump at E, in its loweſt ſituation, and at F in its higheſt. Now as both theſe parts communicate with the water, one by preſſing on it, the other by opening into it, they may be looked upon as communicating with one another. Wherefore A B C D, the column of air, would, by its weight or preſſure, force up a column of water into the pipe D G, to the height of thirty-two feet, were the air exhauſted from the ſaid pipe, and continued to that height; ſince the weight of a column of air is equal to that of ſuch a column of water, of the ſame baſe. If, therefore, the piſton P be thus thruſt down to E, meeting the water there, and from thence it be raiſed to F with an uniform motion, the water will riſe from E to follow the piſton with a variable motion; the leaſt of which is as $\sqrt{AC} - \sqrt{DE}$, and the greateſt as $\sqrt{AC - DE} = \sqrt{AB}$.

If in lifting up the piſton, the velocity of the water be leſs than that of the piſton, it will not be able to follow it, but will leave a ſpace between them, which will increaſe more and more, as the velocity of the water becomes leſs than that of the piſton. The conſequence of this will be, that a part of the ſtroke of the piſton will be loſt; and not only that, but the piſton, when the water leaves it, will riſe very hard, as having a weight of water upon it, and the air of greater denſity above than below; whence the equilibrium, which ought to be in pumps, is deſtroyed, and the balance againſt the workman. Now, as this can happen even where the diameter of the ſucking-pipe is equal to that of the pump-barrel, much ſooner will it happen when the ſucking-pipe is leſs than the barrel, becauſe the water, riſing through a leſs paſſage, will be longer in filling the pump-barrel, and therefore muſt quit the piſton, and leave the greater void ſpace between.

On the contrary, if the leaſt velocity of the water riſing in the pipe, be greater than that of the piſton, there will be no void ſpace; and the pump-barrel may be made in proportion, as much wider than the pipe, as the velocity of the water is greater than that of the piſton. Now that this may be the caſe, we ſhall ſhew, by calculation, what diameters the barrel and pipe ought to have, compared with the velocity of the water and piſton. Let A repreſent the leaſt altitude of the atmoſphere A C = 31 feet of water; B = D F the higheſt elevation of the piſton over the ſurface of the water H I, which let be 16 feet. And let the greateſt velocity of the piſton, which can well be given to a pump, be that of four feet in a ſecond = v; and V = the leaſt velocity of the water that riſes in the pipe; D = the diameter of the barrel; and d = the diameter of the pipe.

Now here we have $\sqrt{A} - \sqrt{B} = V$ = the leaſt velocity of water; and the fall, which will produce that velocity, is the ſquare of that expreſſion, viz. $A + B - 2\sqrt{AB}$, that is, $31 + 16 - 2\sqrt{31 + 10} = 2$ feet 6 inches, the height of the fall required. Whereas, by the common way of taking the ſquare of $\sqrt{A - B}$, viz. $A + B$ for the height, we have 15 feet for the fall, which extraordinary error muſt be of very bad conſequence in practice.

Here the velocity $\sqrt{A} - \sqrt{B} = \sqrt{31} - \sqrt{16} = 5{,}6 - 4 = 1{,}6$ per ſecond. The velocity of the water, at the bottom of the pipe D, is as $\sqrt{A} = 5{,}6$; that alſo muſt be the velocity of the piſton at D, that the water may follow it; whence the piſton moving with the ſame velocity at F, where the velocity is but 1, 6, we have 5, 6 − 1, 6 = 4 feet of void ſpace; therefore 4 parts in 5, 6 of ſuch a ſtroke would be loſt or ineffectual. We may here obſerve, by the way, that ſince the velocity of the water at D is 5, 6, and the greateſt velocity which can be given to the piſton, without damaging the machinery, is but 4; therefore a piſton, working at the lower end of the pipe or barrel, will always have water more than enough to prevent any void ſpace or loſs of labour.

But, ſince we find ſo great a void in the pipe at F, of the ſame diameter with the piſton, it is evident, if we contract all the part below F into a ſmall pipe, as FD, and let the part F G remain as it was for the barrel for the piſton to play in, as at FG, that then the water will riſe into the barrel FG with a greater velocity, than before, in proportion as the pipe is leſs; conſequently, if the bore of the pipe FD be to that of the barrel FG, as the velocity of the piſton P, or the water in the barrel, is to the velocity of the water in the pipe, there will always be a ſufficiency of water to prevent a vacuum in the barrel. Which rule in ſymbols is thus expreſſed, $D\,D : d\,d : V : v$; whence $D^2 v = d^2 V$ for a general canon; any three of which quantities being given, the fourth may be found. Thus, for example: ſuppoſe D, v and V were given to find d, we have $d = \frac{D\sqrt{v}}{\sqrt{V}}$. Let the diameter of the barrel D = 6 inches; and ſuppoſe the piſton gives 20 ſtrokes in a minute, each a two feet ſtroke, ſpending as much time in its aſcent as deſcent; then will the motion of the piſton be 80 feet per minute, or $1\frac{1}{3}$ per ſecond; whence v equals $1\frac{1}{3}$. Laſtly, to obtain the value of V, we muſt fix on the length of the pipe FD, which let be 16 feet; then the higheſt elevation of the piſton will be 18 feet, if it comes to the bottom of the barrel, as it ought to do; wherefore, an height of water of 18 feet in the pump GD, acts againſt the weight or height of 31 feet in the leg A C. Now the velocity V of the water in the pipe FD being uniform, or conſtantly the ſame, we muſt find what difference of uniform velocities will be generated by falls from 31 and 18 feet heights. Thus $\sqrt{16\frac{1}{9}} : 32 :: \sqrt{31} : 43$ nearly; and $\sqrt{16\frac{1}{4}} : 32 :: \sqrt{18} : 32\frac{1}{4}$; whence the difference of theſe uniform velocities will be $43 - 32\frac{1}{4} = 10\frac{1}{4} = 10$ feet three inches per ſecond; therefore $V = 10\frac{1}{4}$. Wherefore $\frac{D\sqrt{v}}{\sqrt{V}} = d = 2\frac{1}{10}$ inches of the diameter of the pipe FD.

The reaſon why we make no uſe of the expreſſion $\sqrt{AC} - \sqrt{DF}$ in this caſe, is becauſe this gives only the difference of the inſtantaneous velocities, or the leaſt velocity with which the water at F can begin its motion upwards; whereas we here want to find what the conſtant and uniform motion of the water will be, or how much it will ſupply every ſecond uniformly, which is done by the method above. For ſince a fall of $16\frac{1}{9}$ gives an uniform velocity of 32 feet per ſecond, a fall of 31 feet will give 43; thus a fall of 18 feet will give $32\frac{1}{4}$, and their difference muſt be that of the water at F.

If we know the velocity of the piſton v, the diameter of the barrel D, and the diameter of the pipe d, we ſhall find the velocity of the water in the pipe $V = \frac{vDD}{dd}$; or thus in words, multiply the ſquare of the diameter of the barrel by the velocity of the piſton; divide the product by the ſquare of the diameter of the pipe, the quotient will be the velocity ſought from the water in the pipe. This velocity, when found, muſt be taken from 43, the remainder 43 − V will be the uniform velocity produced by a fall from the higheſt ſituation of the piſton to the loweſt ſurface of the water in the well, and which is found by ſaying, as $32 : \sqrt{16\frac{1}{9}} :: 43 - V : \sqrt{DF}$; whence D F, the higheſt elevation of the piſton, will be known.

When we know D, V and d, we find v the velocity of the piſton by this theorem, $\frac{V\,dd}{DD} = v$; that is, in words, multiply the ſquare of the diameter of the pipe by the velocity of the water in it, and divide the product by the ſquare of the diameter of the barrel, the quotient is the velocity of the piſton required.

Having given the velocity of the water in the pipe V, the diameter of the pipe d, the velocity of the piſton v, to find the diameter of the barrel D, we have this theorem, $D = \sqrt{\frac{V\,dd}{v}}$; that is, multiply the ſquare of the diameter of the pipe by the velocity of its water, and divide that product by the velocity of the piſton; the ſquare root of the quotient is the diameter of the barrel ſought.

We ſhall now proceed to the deſcription of two or three of the moſt uſeful pumps, but firſt give an account

fo

of that ſort of valves which are exceeding good, and ought to be uſed in pumps, and all kinds of water-engines, where valves are neceſſary.

Let A B C D (*fig.* 11.) be the bucket of a piſton, or any other part where a valve is required; in the middle there is a circular but tapering hole from top to bottom, in which is fitted the tapering or conical piece E F G H, with a piece I K to be ſcrewed in and out of the bottom part H G. It is to be ſcrewed out, when the ſaid ſolid E G is put into its place or hole in A C; and afterwards ſcrewed in, when the whole together appears as in the figure L M N O P. The piece E G now becomes a valve, or capable of permitting the water to aſcend, and to prevent its deſcent.

That the water paſſing againſt the bottom of the valve will raiſe it upwards, is evident from the conical form thereof, and its lying in the hole only by its own weight; the length of the key at K being ſufficient to permit ſuch a riſe of the valve, as will admit a ſpace between it and the hole for the water to paſs as freely as required; and, that the valve may not be thrown quite out of the hole, the croſs-piece I is added, of a greater length than the diameter of the loweſt part of the valve.

If the valve E G and its ſocket A C be of braſs, and fitted, by grinding them with emery firſt and putty afterwards, with a drill bow into each other, they will not only be water-tight, but even air-tight; and that too, if but ſlightly touched with the emery or putty; for if they are ground to a poliſh, the attraction of coheſion will take place, and prevent the valve from riſing ſo freely as it ought to do; yea, ſometimes thoſe ſurfaces have been found to cohere ſo ſtrongly, that the force of the riſing water could not overcome it: but all this would be prevented, and every thing ſucceed to one's wiſh, if they were made as above directed, as has been found by long experience, and trying every way.

Kinds and Structure of PUMPS. Pumps are diſtinguiſhed into ſeveral kinds, according to the different manners of their acting; as the common ſucking pump, forcing pump, lifting pump, &c.

1. The ſtructure and action of the common ſucking pump, as it is called, has been ſo far deſcribed in the above theory of pumps, that little remains to be ſaid on it. However, it may not be improper to give a figure or two of this kind of pump, in order to ſhew its ſtructure, and the contrivances uſed in working it. *Fig.* 12. repreſents a ſimple ſu king pump, in which A is the ciſtern; A B, the barrel or pipe, ſtanding in the water E F; G D, the piſton and bucket, with its bucket and valve D; and C, the valve open for the aſcent of the water. *Fig.* 13. is a very ſimple and uſeful contrivance for working two pumps by means of the ballance A B, having large iron balls at each end, placed in equilibre on the two ſpindles C, as repreſented in the figure; on the right and left are two boards I, nailed to two croſs-pieces faſtened to the axis of the machine. On theſe two boards, the perſon who is to work the pumps, ſtands, and ſupports himſelf by four poſts, E, D, erected perpendicularly, and having croſs-pieces on the top. At the diſtance of ten inches on each ſide of the axis, are faſtened the piſtons M N, which go to the ſuckers. The man, by leaning alternately on his right and left foot, puts the ballance in motion, by which means the pumps O, P, are worked, and the water thrown into the pipe H, and carried to a height proportional to the diameter of the valves, and the action of the ballance. It will be neceſſary to place on each ſide an iron ſpring, as F, G, in order to return the ballance, and prevent its motion from being too great. *Fig.* 14. is another machine for working two pumps, where A repreſents a large weight faſtened to the axis, to regulate the motion of the machine. On each ſide of the axis B, is a piſton which goes to the ſuckers of the two pumps C, D. The machine is put in motion by the man's treading on the board E, and, conſequently, the two pumps deliver water alternately. All which is ſo plain from the figure, that it needs no farther deſcription.

2. The forcing pump, of the common ſort, is a machine thus conſtructed: A B (*fig.* 15.) is the barrel ſtanding in the well or mine at B; G C is the piſton; and C a ſolid piece without any hole or valve, becauſe no water is to paſs through it, as in the other This piece ſhould be well leathered, to fit the barrel very nicely, that in its motion neither air nor water ſhould paſs between. At a diſtance below, a valve, with its diaphragm, is fixed to the barrel, as at D. Between this and the loweſt ſituation of the piſton C, there goes off a pipe at H, in which there is fixed a diaphragm and valve as at E. Now the piſton, being drawn up from C towards A attenuates the air above D, by which means the water ruſhes into the ſpace C D; then, when the piſton is forced down, as the water cannot repaſs at D, it is forced to aſcend into the pipe at H, and through its valve E into the ciſtern F, which may be ſituated at any diſtance above the pump, from whence the water will run off by the ſpout.

3. The lifting pump is only a forcing pump of another ſtructure, repreſented in *fig.* 16. where A B is a barrel, fixed in the frame K I L M; which alſo is fixed immoveable, with the lower part in the water to be exhauſted. G E Q H O is a frame with two ſtrong iron rods, moveable through holes in the upper and lower parts of the pump I K and L M; in the bottom of this frame is fixed an inverted piſton B D, with its bucket and valve upon the top at D. Upon the top of the barrel, there goes off a part K H, either fixed to the barrel, or moveable by a ball and ſocket, (as here repreſented at F) but in either caſe ſo very nice and tight, that no water or air can poſſibly get into the barrel, which would ſpoil the effect of the pump. In this part, at C, is fixed a valve opening upwards. Now when the piſton-frame is thruſt down into the water, the piſton D deſcends, and the water below will ruſh up through the valve D, and get above the piſton; where, upon the frame's being lifted up, the piſton will force the water through the valve C up into the ciſtern P, there to run off by the ſpout. Note, this ſort of pump is ſet ſo far in the water, that the piſton may play below the ſurface of it.

For the deſcription of a piſton that works without friction, ſee DUELLE's *Piſton.*

General Obſervations on PUMP-WORK. From what has been ſaid under the articles FLUID, ATMOSPHERE, and GRAVITY, we preſume the reaſon will appear ſufficiently evident, why no ſingle pump, though perfectly tight, can raiſe water by a piſton playing at a greater diſtance than 32 feet; nor can this be remedied by ſeveral valves in the pipe below the piſton, as ſome have pretended: for let A B (plate CVI. *fig.* 17.) be the barrel of a pump, G F the piſton, B E a pipe going from the barrel to the water at E, 60 feet below it; and let B, C, D, E, be 4 valves placed in the pipe at 20 feet diſtance from each other. Now when the piſton is drawn up from B to F, a vacuum will be made between, but the valve B will not riſe by the water below it; for the water in the part B C cannot riſe itſelf, much leſs can that in the part C D below it, as being preſſed with the weight of the column above, and its own weight downwards, therefore no part of the watry column B F can move of itſelf, or by itſelf. Now no power can be applied any where but at E to move the whole column; nor can the whole be moved without raiſing all the valves at once; therefore the power able to raiſe the valve at E, and conſequently the valve at B, muſt be able to overcome the preſſure of a column of water 60 feet high: but the air can ſuſtain a column only of 32 feet high; therefore the air cannot raiſe the valve E, nor any of the reſt; and conſequently, the water cannot riſe in the barrel A B of a ſingle pump, if longer than 32 feet.

Air PUMP. See the article AIR *Pump.*

Chain PUMP, a machine chiefly uſed on board large ſhips. It conſiſts of two rollers, one fixed at the top, and the other at the bottom of the machine. Round theſe two rollers an endleſs chain, furniſhed with burs, or ſmall leather buckets, is fixed; and on one ſide is a tube or barrel exactly fitted to the burs, extending from the deck or place where the water is delivered, to the lower roller in the well. Both theſe rollers are ribbed to prevent the chain from ſlipping, and the upper one has a double winch fixed to it. When this roller is turned round, the chain is drawn thro' the tube or barrel, and conſequently cauſes the water to aſcend with the buckets to the top of the tube, where it is diſcharged.

PUMP-BRAKE. See the article BRAKE.

PUN, or PUNN, a conceit arising from the uſe of two words that agree in ſound, but differ in the ſenſe.

PUNCH, an inſtrument of iron or ſteel, uſed in ſeveral arts, for the piercing or ſtamping holes in plates or metals, &c. being ſo contrived as not only to perforate, but to cut out and take away the piece.

PUNCHEON, PUNCHIN, or PUNCHION, a little block or piece of ſteel, on one end whereof is ſome figure, letter, or mark, engraven either in creux or relievo, impreſſions whereof are taken on metal, or ſome other matter, by ſtriking it with a hammer on the end not engraved. There are various kinds of theſe puncheons uſed in the mechanical arts; ſuch for inſtance are thoſe of the goldſmiths, cutlers, pewterers, &c.

The puncheon, in coining, is a piece of iron ſteeled, whereon the engraver has cut in relievo the ſeveral figures, arms, effigy, inſcription, &c. that are to be in the matrices, wherewith the ſpecies are to be marked. Minters diſtinguiſh three kinds of puncheons, according to the three kinds of matrices to be made; that of the effigy, that of the croſs or arms, and that of the legend, or inſcription. The firſt includes the whole portrait in relievo; the ſecond are ſmall, each only containing a piece of the croſs or arms, for inſtance, a fleur-de-lys, an harp, a coronet, &c. by the aſſemblage of all which the intire matrice is formed. The puncheons of the legend only contain each one letter, and ſerve equally for the legend on the effigy ſide and the croſs ſide. See the article COINING.

PUNCHEON is alſo uſed for ſeveral iron tools of various ſizes and figures uſed by the engravers in creux on metals. Seal-gravers particularly uſe a great number for the ſeveral pieces of arms, &c. to be engraven, and many ſtamp the whole ſeal from a ſingle puncheon.

PUNCHEON is alſo a common name for all thoſe iron inſtruments uſed by ſtone-cutters, ſculptors, blackſmiths, &c. for the cutting, inciding, or piercing their ſeveral matters.

PUNCHEON, in carpentry, is a piece of timber placed upright between two poſts, whoſe bearing is too great, ſerving, together with them, to ſuſtain ſome large weights.

PUNCHEON is alſo uſed for the arbor or principal part of a machine, whereon it turns vertically, as that of a crane, &c.

PUNCHEON is alſo a meaſure for liquids, containing an hogſhead and one third, or eighty-four gallons.

PUNTA LACRYMALIA. See the article LACRYMALIA.

PUNCTATED HYPERBOLA, an hyperbola whoſe oval conjugate is infinitely ſmall, i. e. a point.

PUNCTUATION, in grammar, the art of pointing, or of dividing a diſcourſe into periods by points expreſſing the pauſes to be made in the reading thereof. See the article POINT.

PUNCTUM, in geometry, &c. See the article POINT.

PUNCTUM SALIENS, in anatomy, the firſt rudiments of the heart in the formation of the fœtus, where a throbbing motion is perceived.

PUNCTURE, in ſurgery, any wound made by a ſharp-pointed inſtrument.

PUNICA, the pomegranate-tree. See the article POMEGRANATE-TREE.

PUNISHMENT, in law, the penalty which a perſon incurs on the breach or tranſgreſſion of any law.

PUPIL, *pupillus*, in the civil law, a boy or girl not yet arrived at the age of puberty. i. e. the boy under fourteen years, and the girl under twelve.

PUPIL is alſo uſed in univerſities, &c. for a youth under the education or diſcipline of any perſon.

PUPIL, *pupilla*, in anatomy, a little aperture in the middle of the uvea and iris of the eye, through which the rays of light paſs to the cryſtalline, in order to be painted on the retina, and cauſe viſion.

PURCHASE, in law, the buying or acquiring of lands, &c. with money, by deed or agreement, and not by deſcent or right of inheritance.

PURE, ſomething free from any admixture of foreign or heterogeneous matters: thus we ſay pure fire, &c. See the article FIRE, &c.

PURE HYPERBOLA, in conics, is an hyperbola without any oval, nodes, ſpike, or conjugate point.

PURFLEW, a term in heraldry, expreſſing ermins, peans, or any of the furs, when they compoſe a bordure round a coat of arms: thus they ſay, He beareth gules a bordure, purflew, vairy: meaning that the bordure is vairy.

PURGATIVE, or PURGING MEDICINES, a medicament which evacuates the impurities of the body by ſtool, called alſo cathartics.

PURGATORY, a place in which the juſt, who depart out of this life, are ſuppoſed to expiate certain offences which do not merit eternal damnation.

Broughton has endeavoured to prove, that this notion has been held by Pagans, Jews, and Mahometans, as well as by Chriſtians.

PURIFICATION, in matters of religion, a ceremony which conſiſts in cleanſing any thing from a ſuppoſed pollution or defilement.

PURIFICATION *of the Bleſſed Virgin*, a feſtival of the chriſtian church, obſerved on the ſecond of February, in memory of the purification of Chriſt in the temple, and his mother's ſubmitting to the Jewiſh law of purification, after the birth of a male child.

PURIFICATION, in chemiſtry, the act of purifying or refining natural bodies by ſeparating the fæces and impurities from them.

PURIM, or *the Feaſt of Lots*, a ſolemn feſtival of the Jews, inſtituted in memory of the deliverance they received from Haman's wicked attempt to deſtroy them, by means of Mordecai and Eſther.

PURITAN, a name formerly given in deriſion to the diſſenters from the church of England, on account of their profeſſing to follow the pure word of God, in oppoſition to all traditions and human conſtitutions.

PURLINS, in building, thoſe pieces of timber that lie acroſs the rafters on the inſide, to keep them from ſinking in the middle of their length.

PURLUE, or PURLIEU, ſignifies all that ground near any foreſt, which being made foreſt by king Henry II. Richard I. and king John, was afterwards by perambulations and grants of Henry III. ſevered again from the ſame, and made purlieu; that is to ſay, pure and free from the laws of the foreſt.

PURLUE-MAN, or PURLIEU-MAN, a perſon who has ground within the purlieu, and is qualified to hunt within the ſame, though under certain reſtrictions.

PURPLE, a colour compoſed of a mixture of red and blue.

A beautiful tranſparent purple for painting, may be made by boiling four ounces of raſped Braſil-wood in a pint of ſtale beer, and half an ounce of logwood, till the liquor is heightened to the colour you deſire, which may be known by dipping a piece of paper in it. If you find it too red, add a quarter of an ounce more of logwood, which will render it ſtill deeper, and by this method you may bring it to any degree of purple, by putting in either more or leſs logwood to the former compoſition, and fixing it with alum. This will produce ſuch a clear purple as no mixture of reds and blues will produce. Madam Mariana of Amſterdam, famous for painting in miniature, and for her excellent manner of illuminating prints, ſays, that the beſt purple that can be made, may be compoſed between the carmine and indigo; to ſtrengthen which, on the red ſide, you may add lake, between the lighter and darker part: and ſo lake when it is uſed in the ſame way, on the foregoing purple, produces a very fine effect.

PURPLE FEVER, the ſame with miliary fever. See the article FEVER.

PURPURA, in natural hiſtory, a genus of ſimple ſhells, having no hinge, formed of one continuous piece, and covered from the top to the bottom with ſpines, tubercles, and umbos: the mouth is ſmall, and approaches to a round figure: the clavicle is ſhort, but the other extremity is uſually protended to a conſiderable length.

PURPURE, POURPRE, or PURPLE, in heraldry, according to ſome, is one of the five colours of armories, compounded of gules and azure, bordering on violet, and according to others, of a great deal of red and a little black. But it was excluded by the antient heralds as only an imperfect colour. In the coats of noblemen it is

called amethyſt; and in thoſe of princes, mercury. It is repreſented in engraving, by diagonal lines drawn from the ſiniſter chief to the dexter baſe point.

PURREL, a liſt ordained by act of parliament to be made at the end of kerſeys, to prevent deceit in diminiſhing their length.

PURSIVENESS, among farriers, is a diſorder in horſes, otherwiſe called broken wind, in which the horſe makes a hiſſing whiſtling ſound in his throat, and has a greater heaving in the flanks than in common colds.

PUS, in medicine, a white or yellowiſh putrid matter, formed of corrupted blood, and contained in a wound or ulcer.

PUSTULE, a pimple, or ſmall eruption on the ſkin full of pus.

PUTLOGS, or PUTLOCKS, in building, are ſhort pieces of timber about ſeven feet long, uſed in building ſcaffolds. They lie at right angles to the wall with one of their ends reſting upon it, and the other upon the poles which lie parallel to the ſide of the wall of the building.

PUTREFACTION, a kind of ſlow corruption produced by heat and ſome moiſt fluid, particularly the air and water; which, penetrating the pores, diſſolves and ſets at liberty ſome of the more ſubtile parts, particularly the ſalts and oils, and thus looſens the compages, and changes the texture of bodies.

PUTRID, ſomething rotten, or putrefied.

PUTTY, the ſame with ſpodium. See SPODIUM.

PUTTY, in its popular ſenſe, is a kind of paſte compounded of whiting and linſeed oil, beaten together to the conſiſtence of a thick dough.

It is uſed by glaziers for the faſtening in the ſquares of glaſs in ſaſh-windows, and by painters for ſtopping up the crevices and clefts in timber and wainſcots, &c.

PUTTY ſometimes alſo denotes the powder of calcined tin, uſed in poliſhing and giving the laſt gloſs to works of iron and ſteel.

PYCNOSTYLE, in the antient architecture, is a building where the columns ſtand very cloſe to each other; only one diameter and a half of the column being allowed for the intercolumniations.

According to Mr. Evelyn, the pycnoſtyle chiefly belonged to the Compoſite order, and was uſed in the moſt magnificent buildings; as at preſent in the periſtyle at St. Peter's at Rome, which conſiſts of near three hundred columns; and in ſuch as yet remain of the antients, among the late diſcovered ruins of Palmyra.

PYGME, the ſame with cubit. See the article CUBIT.

PYGMY, a perſon not exceeding a cubit in height.

PYLORUS, in anatomy, the right or lower orifice of the ſtomach, which is connected with and opens into the inteſtines. See the article STOMACH and INTESTINES.

PYRAMID, *πυραμις*, in geometry, a ſolid ſtanding on a triangular, ſquare, or polygonal baſis, and terminating in a point at the top; or, according to Euclid, it is a ſolid figure, conſiſting of ſeveral triangles, whoſe baſes are all in the ſame plane, and have one common vertex.

Hence the ſuperficies of a given pyramid is eaſily found by meaſuring theſe triangles ſeparately; for their ſum added to the area of the baſe, is the ſurface of the pyramid required.

It is no leſs eaſy to find the ſolid content of a given pyramid; for the area of the baſe being found, let it be multiplied by the third part of the height of the pyramid, or the third part of the baſe by the height, and the product will give the ſolid content, as is demonſtrated by Euclid, lib. 12 prop. 7.

If the ſolid content of a fruſtum of a pyramid is required, firſt let the ſolid content of the whole pyramid be found; from which ſubſtract the ſolid content of the part that is wanting, and the ſolid content of the fruſtum, or broken pyramid will remain. See FRUSTUM.

Every pyramid is equal to one third of its circumſcribing priſm, or that has the ſame baſe and height.

All pyramids are in a ratio compounded of their baſes and altitudes; ſo that, if their baſes be equal, they are in proportion to their altitudes; and *vice verſa*.

Equal pyramids reciprocate their baſes and altitudes; that is, the altitude of one is to that of the other, as the baſe of the one is to that of the other.

PYRAMID, in architecture, a ſolid maſſive building, which from a ſquare, triangular, or other baſe, riſes diminiſhing to a vertex or point.

Pyramids are ſometimes uſed to preſerve the memory of ſingular events; and ſometimes to tranſmit to poſterity the glory and magnificence of princes. But as they are eſteemed a ſymbol of immortality, they are moſt commonly uſed as funeral monuments. Such is that of Ceſtius at Rome, and thoſe other celebrated ones of Egypt, as famous for the enormity of their ſize, as their antiquity. Theſe are ſituated on the weſt ſide of the Nile almoſt oppoſite to Grand Cairo; the baſe of the largeſt covers more than ten acres of ground, and is, according to ſome, near ſeven hundred feet high, though others make it ſix hundred, and ſome but little more than five hundred. The pyramid is ſaid to have been, among the Egyptians, a ſymbol of human life; the beginning of which is repreſented by the baſe, and the end, by the apex; on which account it was, that they uſed to erect them over ſepulchres.

PYRAMIDAL, ſomething relating to a pyramid.

PYRAMIDALIA CORPORA, in anatomy, the two protuberances of the medulla oblongata. The ſpermatic veſſels are alſo by ſome authors thus termed.

PYRAMIDALIS, in anatomy, a ſmall muſcle in the abdomen lying in the lower part of the rectus. It has its name from its figure, and its origin from the margin of the os pubis, with a broad fleſhy head, whence it grows gradually narrower, till it ends in a ſmall round tendon in the linea alba, ſometimes almoſt at the navel. This muſcle is ſometimes ſingle, ſometimes it has its fellow, and in ſome ſubjects they are both wanting.

PYRAMIDALIS is alſo the name of one of the dilatores, or muſcles which ſerve to turn up the noſe. This muſcle riſes at the foot of the noſe, and is uſually continuous with the frontalis. It deſcends along the ſide of the noſe, where it is by degrees a little expanded. It is inſerted into the alæ of the noſe, and often ſends down its fibres as far as to the upper-lip.

PYRAMIDOID, the ſame with the parabolic ſpindle.

PYRENOIDES PROCESSUS, in anatomy, a proceſs of the ſecond vertebra of the neck, called alſo odontoides, and dentiformis.

PYRETICS, medicines good againſt fevers. See FEVER and FEBRIFUGE.

PYRIFORMIS, in anatomy, a muſcle of the thigh, receiving its name from its figure, which reſembles that of a pear. It riſes thick from the lower part of the os ſacrum, where it is joined to the ileum; from thence it runs tranſverſely towards the joint of the hip, and terminates in a ſhort tendon, which is inſerted in the middle of the internal labium of the upper edge of the great trochanter, by two or three branches.

PYRITES, in natural hiſtory, a claſs of compound inflammable metallic bodies found in detached maſſes, but of no determinately angular figure. See the article COPPERAS.

PYROMANCY, *πυρομαντεια*, a kind of divination by means of fire. The ancients imagined they could foretel future events, by inſpecting fire and flame; and to this end, they conſidered its direction, which way it turned: ſometimes they added other matters to the fire, ſuch as a veſſel full of urine, having its neck bound about with wool, watching narrowly on which ſide it burſt, and thence taking their augury: ſometimes they threw pitch on it; and, if it took fire immediately, they eſteemed it a good augury.

PYROTECHNY, *πυροτεχνια*, the art of fire, or a ſcience which teaches the management and application of fire, in ſeveral operations. Pyrotechny is of two kinds, military and chemical: military pyrotechny is the doctrine of artificial fire-works and fire-arms, teaching the ſtructure and uſe of thoſe uſed in war, the attacking of fortifications, &c. as gun-powder, cannons, bombs, granadoes, carcaſſes, mines, fuſees, &c. and thoſe made for amuſement ſake, as rockets, ſerpents, &c.

PYROTICS, *πυρωτικα*, in medicine, cauſtics, or remedies, either actually or potentially hot; and which accordingly

accordingly will burn the flesh and raise an eschar. See CAUSTICS

PYRRHICHIUS, in the Greek and Latin poetry, a foot consisting of two syllables, both short, as *deus*.

PYRRHONIANS, PYRRHONEANS, or PYRRHONISTS, a sect of ancient philosophers, so called from Pyrrho, a native of Elis, in Peloponnesus. The opinions of these philosophers, who were also called Sceptics, terminated in the incomprehensibility of all things, in which they found reason both for affirming and denying: accordingly they seemed, during their whole lives, to be in search of truth, without ever acknowledging that they had found it: hence the art of disputing upon all things, without ever going farther than suspending our judgment, is called pyrrhonism.

Pyrrho maintained, that life and death were equally indifferent; and he is charged with teaching, that honour and infamy, the justice and injustice of actions, depended solely on human laws and customs; and, in a word, that there is nothing in itself honest or dishonest, just or unjust: an abominable doctrine, that opens the way to all manner of crimes.

PYTHAGOREANS, a sect of ancient philosophers, so denominated from their being the followers of Pythagoras of Samos, who lived in the reign of Tarquin, the last king of the Romans, in the year of Rome 220; or, according to Livy, in the reign of Servius Tullius, in the year of the world 3472.

Pythagoras, from his extraordinary desire of knowledge, travelled in order to enrich his mind with the learning of the several countries through which he passed. He was the first that took the name of philosopher, that is, a lover of wisdom, which implied, that he did not ascribe the possession of wisdom to himself, but only the desire of possessing it.

His maxims of morality were admirable: for he was for having the study of philosophy solely tend to elevate man to a resemblance of the Deity. He believed that God is a soul diffused through all nature, and that from him human souls are derived; that they are immortal, and that men need only take pains to purge themselves of their vices, in order to be united to the Deity. He made unity the principle of all things; and believed, that between God and man there are various orders of spiritual beings, who are the ministers of the Supreme Being. He condemned all images of the Deity, and would have him worshipped with as few ceremonies as possible. His disciples brought all their goods into a common stock, contemned the pleasures of sense, abstained from swearing, eat nothing that had life, and believed in the doctrine of a metempsychosis. See the article METEMPSYCHOSIS.

Pythagoras made his scholars undergo a severe noviciate of silence for at least two years; and it is said, that where he discerned too great an itch for talking, he extended it to five: his disciples were therefore divided into two classes, of which the first were simple hearers, and the last such as were allowed to propose their difficulties, and learn the reasons of all that was taught them. The Pythagoreans, it is said, on their rising from bed, roused the mind with the sound of the lyre, in order to make them more fit for the actions of the day; and at night resumed the lyre, in order to prepare themselves for sleep, by calming all their tumultuous thoughts. The figurative manner in which he gave his instructions, was borrowed from the Hebrews, Egyptians, and other orientals. Some think he derived his philosophy from the books of Moses, and that he conversed with Ezekiel and Daniel at Babylon; but this is mere conjecture.

Some authors say, that he left nothing in writing; but Laërtius and others attribute several treatises to him. His golden verses, attributed by some to one of his disciples, are allowed to be an exact copy of the sentiments of that Divine Philosopher, from whose school proceeded the greatest philosophers and legislators.

PYTHIA, in antiquity, the priestess of Apollo at Delphi, by whom he delivered oracles: she was thus called from the god himself, who was denominated Apollo Pythios, from his slaying the serpent Python.

This priestess was to be a pure virgin: she sat on the lid of a brazen vessel mounted on a tripod or three-legged stool; and thence, after a violent enthusiasm, delivered her oracles in a few ambiguous and obscure verses, or in a short sentence in prose. See ORACLE.

PYTHIAN GAMES, in antiquity, solemn games celebrated near Delphi, in honour of Apollo, in remembrance of his having killed the serpent Python.

These were held every two years, about the month Elaphebolion, which answered to our February. The celebration of these games was attended with the Pythian song, in which was celebrated the fight of Apollo and the serpent. The victors were crowned with branches of laurel; though, at the first institution, the crown was of beech-leaves.

PYXIDIUM, CUP-MOSS, in botany, a genus of mosses, consisting of a firm, tough, and flexile matter, formed into the shape of hollowed cups, or drinking glasses, with longer or shorter stems.

PYXIS, in anatomy, the acetabulum, or cavity of the hip-bone.

END OF THE SECOND VOLUME.

5 JA 59